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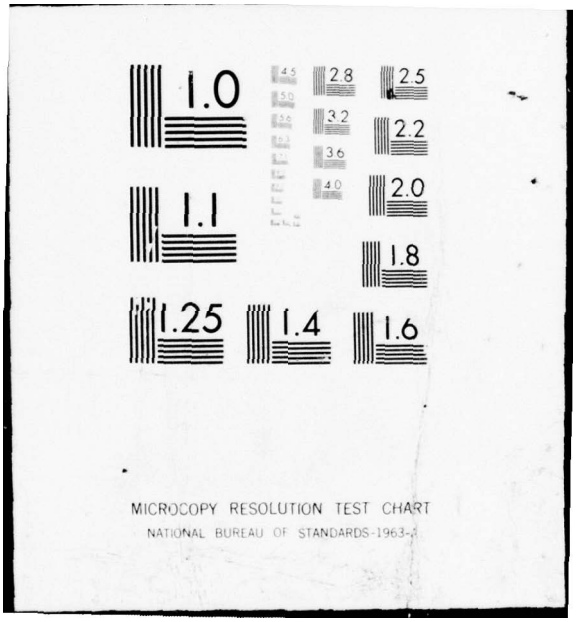
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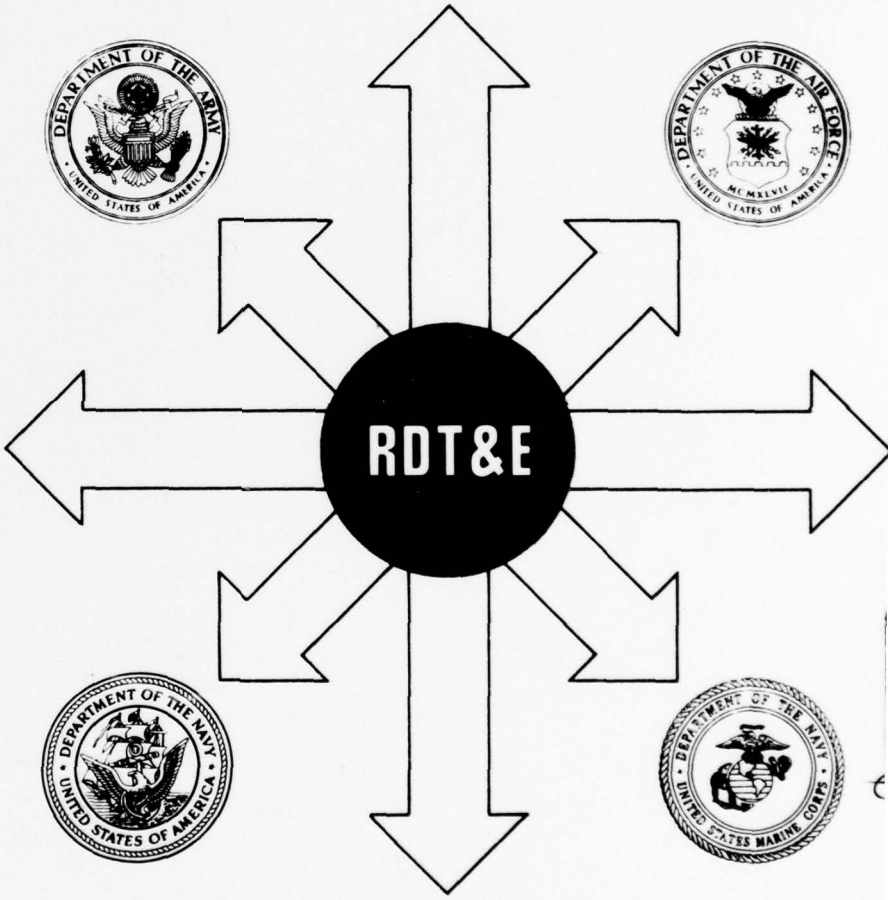

NAVY PERSONNEL RESEARCH AND DEVELOPMENT C
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NPRDC SPECIAL REPORT 78-3 JANUARY 1978

PROCEEDINGS OF THE 1977 NATIONAL SYMPOSIUM OF THE MILITARY SERVICES ON UTILIZATION OF PEOPLE-RELATED RESEARCH, DEVELOPMENT, TEST AND EVALUATION (RDT&E)

Reviewed by
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The 1977 symposium provided a forum for active discussion of the problems of research utilization in the military services, with an emphasis on formulating recommendations for improved utilization strategies. The program agenda encompassed a review of current research utilization activities in the Air Force, Army, and Navy; viewpoints of some key DoD decision-makers about RU; perspectives of potential users of military research from the operational community; and a review of RU activities in other federal agencies and private industry.

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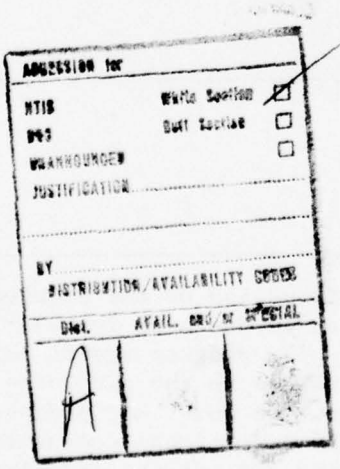
The symposium provided the first major opportunity for a diverse group representing a broad spectrum of interests to discuss this important topic with reference to military research and development.



FOREWORD

The 1977 National Symposium of the Military Services on Utilization of People-Related Research, Development, Test, and Evaluation (RDT&E) was held in San Diego, California on 14-17 June 1977. It was sponsored and conducted by the Navy Personnel Research and Development Center (NAVPERSRANDCEN), San Diego, with the support of the Human Interaction Research Institute (HIRI), Los Angeles, under Contract No. N00123-76-C-0174. The general chairman was Dr. Franklin F. Sands, NAVPERSRANDCEN; and the faculty chairman, Dr. Edward M. Glaser, HIRI. There were 120 participants, including representatives from the Department of Defense, other government and private agencies, and universities (see Appendix A).

The purpose of the symposium was to assess the problems and needs of human resources RDT&E, principally within the military establishment, and to formulate recommendations for improved utilization of the RDT&E. Since most of the participants were very familiar with issues of research utilization, the program agenda and work plan (Appendices B and C) were designed to permit a high degree of participation by attendees. This was done by providing not only prepared presentations but also the opportunity for conferees to meet in small groups to address substantive issues and to reconvene in plenary sessions to integrate problems, needs, and recommendations. This process was greatly facilitated by symposium faculty members (Appendix D).

The symposium was organized into the following nine sessions:

1. Invited Addresses: Major addresses by key DoD policymakers.

2. Military Service Group Meetings: Held to identify barriers to utilization and recommend possible solutions.

3. Reflections from the Operational Community: Central issues in utilization as seen by the operational community.

4. State-of-the-Art in Research Utilization Within Other Federal Agencies: Experiences of nonmilitary agencies in dealing with research utilization.

5. Overall Research Utilization Perspective: Summary of recurrent themes from first portion of symposium.

6. Technology Transfer Panel Discussion: Comments on transfer of technology from federal laboratories to state/city governments.

7. Case Problem Analysis: Discussions of prepared case problems in utilization (summaries included in Appendix E).

8. Selected Concept Papers: Presentation of two papers that highlight utilization issues.

9. Policy Recommendations for Improved Research Utilization: Small group meetings to develop recommendations for improved RU.

The proceedings provided by this report include (1) an edited transcript of the presentations, small group reports in plenary session, and open discussion--organized by the above nine sessions, (2) summaries (on blue paper) of the nine sessions, (3) a synthesis (on green paper) integrating the nine summaries and (4) the appendices. Appendix F provides a summary of symposium evaluation comments provided by participants.

Special appreciation is extended to the following invited speakers (Session 1) who provided a provocative thrust and challenge to symposium deliberations:

1. RADM Joseph Metcalf, III, USN, Assistant Chief of Naval Personnel for Financial Management and Management Information.

2. Dr. Bernard Rostker, Principal Deputy Assistant Secretary of the Navy for Manpower and Reserve Affairs.

3. COL Henry L. Taylor, USAF, Office of the Director, Defense Research and Engineering.

Appreciation is also extended to:

1. Dr. Edward Glaser of HIRI and to members of the Symposium Steering Committee and Symposium Faculty (listed in Appendix D), for their assistance in planning and conducting the symposium.

2. Ms. Linda Culligan and Dr. Paul Greenberg of HIRI, for their assistance in preparing the symposium proceedings.

3. The following NAVPERSRANDCEN personnel, for their contributions in planning and execution of logistics in support of the symposium:
Mrs. Loretta T. Teague, Mr. Robert F. Turney, LCDR David C. Emerson, Mr. Walter M. Spencer, Mr. Robert Harrigan, and ET1 Gerald G. Boykin, USN.

J. J. CLARKIN
Commanding Officer

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INVITED ADDRESSES

SUMMARY

The task of the symposium participants--to assess the problems of utilization of human resources RDT&E in the military environment and to formulate policy recommendations for improving utilization--was outlined in the welcoming remarks by Dr. Frank Sands, the symposium general chairman, and CAPT James Clarkin, USN, Commanding Officer of the host organization. Dr. Sands emphasized the growing pressure at the federal level to increase the rate of R&D product use. CAPT Clarkin urged that members of the R&D community pay particular attention to utilization barriers in their own community, and be willing to compromise as they work with the sponsors and users to achieve greater utilization.

The charge and challenge to the conferees posed by Dr. Sands and CAPT Clarkin was fleshed out in substantial detail in major addresses by three key DoD policymakers. The keynote speaker, RADM Joseph Metcalf III, USN, Assistant Chief of Naval Personnel for Financial Management and Management Information, concluded that the essence of the utilization problem is failure to consistently and effectively plan for implementation. He cited three fundamental reasons for this: resistance to change, conflict of interest between the research and user communities, and the difficulty in establishing meaningful criteria for measuring the success of human resources research and utilization activities. He pointed to the need for better methods for managing R&D planning, including the explicit assignment of responsibility for implementation planning in order to improve accountability for utilization.

COL H. L. Taylor, USAF, Office of the Director, Defense Research and Engineering, offered a perspective on RDT&E utilization from the vantage point of DDR&E. COL Taylor reviewed a series of major historical factors that have intensified the pressure for improved utilization of people-related research within the military services. The factors include:

- *Growing interest by the Congress in the relevance of research, including the Mansfield Amendment, which stated that all defense R&D must have a direct and apparent relationship to the DoD mission.*
- *The Ginzberg Management Report.*
- *The House Appropriation Committee report on the FY 76 budget request, recommending a 50 percent reduction in five critical program areas of human resources R&D.*
- *The 1976 Defense Science Board Task Force on Training Technology.*
- *The April 1977 GAO report, which made a series of recommendations to DoD for improvement in managing the utilization of human resources R&D.*

COL Taylor concluded that without better and more visible utilization of research results, support for R&D in the human resources area will dry up, and this will have a critical impact on combat readiness.

The banquet speaker was Dr. Bernard Rostker, Principal Deputy Assistant Secretary of the Navy for Manpower and Reserve Affairs. Dr. Rostker asserted that human resources R&D should be structured to address policy issues and operational problems, and that much of the work fails to do so and is neither relevant nor useful. He further contended that communication is poor between researchers and users and between researchers and policymakers, that there is not enough follow-through from research to application, and that this is largely the responsibility of the R&D community. He concluded that the planning, programming and budgeting of R&D should be realigned so as to put control in the hands of policymakers.

INVITED ADDRESSES

SYMPOSIUM INTRODUCTION

Dr. Franklin F. Sands
Head, Applications Support Office
Navy Personnel R&D Center

I would like to welcome you here with the hope that this research utilization symposium proves to be interesting and successful, and some useful items can be taken away from this meeting. It is our goal that the integrated summaries which we will be developing later on in the week will have a positive impact on current and future research utilization policy.

As you probably know, federal support for R&D has grown to the level of about 22 billion dollars per year. Of this amount, the Department of Defense accounts for approximately 12 billion, of which about 2.5 billion is allocated to the Army, about 4.2 billion to the Air Force, about 4.3 billion to the Navy and Marine Corps, and about 0.8 billion to other defense agencies. The growth in R&D support in the Department of Defense has been predicated on the assumption that R&D has a very significant impact on the operational capability of military forces. That assumption, however, has been coming under increasing scrutiny by policymakers in the federal establishment, and there is a growing pressure to increase the incidence of research product use. The same pressures are apparent in other agencies as well. For example, beginning in FY 1977, the Research Applied to National Needs (RANN) Division of the National Science Foundation has been directed by the Congress to establish procedures for reporting on the utilization of research results. These kinds of pressures have provided a good deal of the impetus for a national conference in which people who are grappling with the problem of research utilization can share experiences, needs, frustrations and successes, and can together formulate tangible policy recommendations for improving the utilization of R&D products.

The challenge is indeed at hand. We are aware of the fine work underway in each of the military services and in other federal agencies. The steering committee is very optimistic, and we want you to know we intend to do all we can to establish effective channels and to build new partnerships that would increase the benefit to be derived from the RDT&E enterprise now and in the future.

With that, I'd like to introduce to you the Commanding Officer of the Naval Personnel Research and Development Center here in San Diego, Captain Jim Clarkin.

WELCOMING REMARKS AND INTRODUCTION OF KEYNOTE SPEAKER

CAPT James J. Clarkin, USN
Commanding Officer
Navy Personnel R&D Center

I had planned on greeting you with "Good morning, ladies and gentlemen," but I note with some concern that there is only one lady present in the room, and I'm wondering if in some obscure fashion this might be related to the problems of utilization of personnel R&D. I do welcome you sincerely, both personally and on behalf of the Navy Personnel R&D Center, and I wish you every success in your work during the next several days.

It is quite proper that your symposium includes not only representation from each of the military services and the Department of Defense, but also involves participants from other agencies, from academia, and from private research activities. Under the best circumstances, an even broader participation would be desirable, for it is not only the utilization of people-related research and development by the military services but also the behavioral and managerial sciences that are under intensive scrutiny and questioning today.

In fact, as you are well aware, our society and its elected and appointed officials are looking skeptically at the entire spectrum of technology. During the past two decades, a great deal of attention and concern has been focussed on the continually increasing degree of specialization. Much of the concern has been with the narrowness of perspective that is often attendant to, or a byproduct of, specialization. You are all familiar with the projections that if we continue at our present pace, by the year x we will have more scientists than people and will be producing more technical papers and reports than can be stored on the earth's surface. The fact remains that we have continued and will continue to specialize. One cost of specialization is the need to concern ourselves with problems of interdependence. In that spirit, we need to give increasing attention to our dependence upon one another within the R&D community and to our interdependence with the sponsoring and using components of the larger community of which we are a part. The cost of this interdependence is measured in terms of time, effort and intelligent compromise and adjustment. We will have to accept these costs.

In welcoming you and wishing you well in your deliberations, I would like to express my hope that you will aspire to make the symposium a truly productive effort. Most of you are already aware of earlier delineations of problems which hinder the utilization of R&D efforts. The Ginnesburg report, and more recently the laboratory

utilization studies, are cases in which many of the utilization problems were quite well defined. If your symposium is to be productive, as I hope it will be, it must go beyond the listing of problems or constraints to utilization. To be productive, you must tackle the more difficult task of defining the steps necessary to remove, or at least reduce in degree, existing constraints to the utilization of people-related R&D. To do this, I believe you must look at the constraints in your own community--the R&D community--as well as those to be found in the external world of sponsors and users. If both internal and external constraints are recognized, then the prescriptions for removing or lessening them will have far greater value.

One of the more difficult tasks in achieving greater utilization of R&D products may be in making intelligent compromises, and in making adaptations or changes in our individual and collective behavior within the R&D community. Having recognized that, I will proceed to a change in my own behavior and address the more important task I've come to perform here, which is to introduce my good friend, Admiral Joe Metcalf.

KEYNOTE SPEAKER

RADM Joseph Metcalf III, USN
Assistant Chief of Naval Personnel
and Management Information

Thanks, Jim. Since Captain Clarkin has already given my speech, I may as well sit down right now. Seriously, I think that Jim has given you an excellent picture of what the challenge is all about.

I would like to compliment Captain Clarkin and NPRDC for being brave enough to host this symposium. The subject you propose to address is very difficult. There is hardly a problem I can think of that is more pressing, more urgent, and more fundamental to the business in which you are professionals. As Captain Clarkin mentioned, the area of R&D utilization is of great concern to me. When I sit down with my R&D colleagues, we usually get off on the subject of how to deal with this problem of utilization. It is tremendously difficult and always frustrating.

I would like to characterize my remarks as bridge building, a term I borrowed from Mr. Malehorn's provocative paper, because what we are really doing in research utilization is building a bridge between the conduct of research and its implementation. Bridge building involves spanning gaps, but the gaps in themselves are

not the important thing. We know the nature of the gaps in the R&D business--failure to communicate, and lack of understanding, among other things. The more important task before you is to define the ends of the bridge, the abutments, because in my judgment that is where both the problems and the solutions lie.

In the R&D business, there are three islands to bridge and join: (1) the consumers, who utilize the products of R&D; (2) the highly talented, dedicated individuals who conduct research; and (3) the managers of research, who provide the lubricant (and sometimes the lack of lubricant) between the consumer and the researcher. It is this third group, the research managers, who in my view are probably the key to the problem of utilization. They pay the bills, serve as coordinators, and have a very important review function. In short, the critical element in the equation of bridge building is the professional in R&D management.

If I were to survey the audience today, I believe I would probably find that the researchers and the managers of research far outnumber the users, whom I represent. This is a chronic problem. In fact, I'm afraid there may even be a diminishing community of interested users. If we can't get more consumers actively involved in solving the utilization problem I think the task that you people have set for yourselves is going to be very, very difficult. In other words, I would suggest that the initial problem is how to get more of us users actively involved in the busines of R&D and its proper utilization. One end of the bridge seems to be lost in the fog.

To illustrate why we find this attitude of apparent indifference by users, I would like to borrow a quotation (from Forbes magazine) which relates to the options market. "Potential investors (in the options market) would do well to remember that options have generally proved to be better business for brokers than they have for investors." Many consumers of R&D would rephrase that quotation in the following way: "Potential users of R&D would do well to remember that research has generally proved to be better business for researchers and research managers than for the consumer." Now, this perception is one of the gaps that I think you must address in your bridge building.

It is a perception held by many of us; and whether we like it or not, it is a fundamental block in the proper commissioning and utilization of much R&D and in particular, of human resources research.

This feeling that research very often is done for the sake of research is just a symptom of the utilization malaise, it is not the heart of the problem. I believe the basic disease is that neither the consumer, the manager, nor the human resources researcher consistently or effectively plans for implementation. Thus, your prime task at this symposium will be to explore ways to inject the discipline of planning into the process of testing and implementing promising R&D end products. The key to the bridge-building business is to plan the bridges.

I would like to explore three problem areas that I feel contribute to the lack of planning for utilization: (1) resistance to change, (2) conflict of interest between the producers, the managers, and the consumers of R&D, and (3) the difficulty in developing reasonable criteria of success.

First, let me comment on resistance to change. I am not going to offer illustrations; we each have our own horrible examples. I would like to observe, however, that we all tend to look at ourselves as absolute paragons of flexibility. Thus, when the subject is resistance to change, you will generally find that fingers are pointed in all directions but inward. As you go about your labors in this symposium, I suggest that you take a healthy look at yourselves and the institutions you represent, and see if you can knock out any cobwebs. Something is going to have to change in the way we do business or we are not going to be successful. You might as well not be here if you do not produce a program of recommended change in the way we plan R&D utilization.

The second area, conflict of interest between R&D managers, producers, and consumers is perhaps the best understood. Left to your own devices, I suspect you would concentrate your efforts here. In my view, however, it is not the key area. There are conflicts of interest. For example, the researcher tends to focus his attention on methodology, whereas the consumer is more interested in operational responsiveness. The researcher (particularly if engaged in basic research) generally is not interested in implementation planning, and perhaps does not even know how to do it. At the same time, the manager of research sits in the middle and is concerned with balancing programs, putting things in the proper categories (6.1, 6.2, etc.), showing that the books are in order, defending programs before Congress, and making sure they all make sense. Unfortunately, these interests are very often in fundamental conflict.

Let me go back for a moment to the problem of resistance to change, which is founded in conflict of interest. In many instances the consumer is afraid of the extended impact of R&D, of changes that we or our bureaucracies are not willing to accept. Automation is a case in point; here the implementation of a single change may imply revolution in the way we do business. We as consumers are very often unsure about the implications of given changes, and thus we're afraid to take them on. At least in part, the consumer's reluctance is based on the fact that he feels that he is more sensitive to the political impact of human resources R&D than is the researcher, because he has to deal with Congress, for example, and has to take the flak when something goes wrong.

Now, let's take a look at one particularly troublesome problem of conflict of interest: the clash of the time differential. With respect to a given R&D activity, users are generally in the picture for very short periods of time. In contrast, the R&D community

is typically involved for much longer periods of time. It always requires more time to develop a solution than to pose a problem. Thus, very often the consumer who poses the problem and asks for the research to be done is gone when the solution arrives.

Further, the researcher may have little interest in a problem that requires the application of yesterday's technology. Also, researchers contend that consumers of R&D often want some kind of magic pill to provide a quick fix and, thus, open themselves to old snake oil remedies. This expectation nurtures many of the so-called "beltway bandits" that surround Washington. We get for our money what we ask for--a scientific gloss on any subject to support whatever conclusion the consumer demands. The magic pill syndrome is often characterized by the consumer asking a question for which there is no reasonable or immediate answer. We tend to turn to R&D for the solution to the Gordian Knot. When we receive less than a satisfactory answer to an impossible problem we carve one more notch on the stick with which we flagellate the research community. The problem is that many of the consumers of R&D do not understand the fact that if the answers they seek were simple, they wouldn't be going to the research community to get them.

Another aspect of the conflict of interest is that the consumer generally prefers minimum risk while the researcher thrives on risk. In fact, risk is what research is all about. Studies of the behavior of managers in industry have shown that they do not try to maximize profit, because that generally entails maximum risk. The max profit notion is rhetorical fantasy. Managers maximize stability rather than risk upsetting the organization. This is also true in the community of military consumers of which I am a member, and in my experience, is also present to a high degree amongst the middlemen--the research managers. We often talk of change, but we seldom behave in a way that promotes it.

Perhaps the most fundamental conflict between producers and consumers lies in the issue, "Are we studying the right problem?" Last week (following a presentation by Dr. Hackman of Yale on a study of job motivation), the Chief of Naval Personnel lamented about this to a group of researchers and senior managers. From Admiral Watkin's view, it was a splendid piece of work, but was sub-optimization. What was really needed, he said was research on the process of change associated with an all-volunteer force. Dr. Hackman was focusing on a way to increase motivation; Admiral Watkins was looking at the bigger problem. He said, "Here we have a situation where our forces are predominantly volunteers. They should be happier, but they are less happy. Desertion rates are up, and reenlistment rates are not substantially different than they were during the days of the draft." Dr. Hackman made the observation that we have mountains of data that indicate that the rate of attrition of the nonhigh school graduate is twice that of his high school graduate peer. The solution suggested by intuition

and the research community seems to be to recruit high school graduates. Admiral Watkins pointed out that a better solution might be to attempt to change the propensity of nonhigh school graduates to attrite, since not enough high school graduates choose to volunteer. The basic issue is the relevance of the research. I suspect that Dr. Rostker will deal with this in some detail tonight.

I surmise that many of the answers to the questions that Admiral Watkins proposed to Dr. Hackman and to those of us who were present are available on the shelves somewhere in your research communities. The problem is both one of getting access to this information and of using it.

The third problem area contributing to the lack of planning for utilization of R&D is the difficulty in developing reasonable criteria for success--so that we can assign accountability. I recognize that after 25 years in the military the term accountability probably has a very different connotation to me than to you--one that is hard, stark, black and white. That connotation undoubtedly cannot be applied to the business of research, nor would it ensure the utility of research. So the problem is, how do we measure the utility of research, and who is accountable for starting research that is poorly defined with reference to the problem at hand.

Perhaps one test of accountability is survival. And if survival isn't a satisfactory criterion, perhaps we should look at success--if only we could measure it. The idea I'm trying to get at is that it is very difficult to formulate criteria (relevance, utility, viability, etc.) for identifying and promoting good research.

In my experience, worthwhile "people research" has multiple dimensions and uncertainties. Because bureaucratic organizations do not like multiple measures, we try to collapse them into some sort of simpler index or "bottom line" denoting good or bad. Mark Twain observed that there is a simple solution for every complex problem and it is always wrong. And I think that observation is particularly apt in the business of people research, especially with reference to implementation. But that does not mean there is any less need for accountability.

I would suggest, then, that an implementation plan is probably as good a surrogate of accountability as we are going to find. In other words, if we have a well thought out plan, we can judge how well we carry out that plan.

Perhaps the most reasonable criterion of success is whether the research was or is usable. Far too much research on human behavior, organizational theory, and leadership explains history very well, but too often does not adequately explain it in terms of factors that management can control or use. The interesting question, often left unanswered, is "what can the consumer do with the

research result, given that he accepts what the researcher says as true?" Even where the variables are controllable by management, the researcher usually provides no estimate of what the impact of future management decisions and change will be. The consumer is left to answer the question of what it will cost to effect the change suggested by the researcher, and what the most likely outcome will be. Again, if we were required to anticipate the answers to some of these questions we might be able to bridge the gap between the consumer and the user. For example, it has been shown that pay grade is related to first-term retention. If I, as a manager, made everyone an E-5, would they reenlist? Considering cost, what are the diminishing returns for such a suggestion? In short, too little R&D has criteria applied by which either the researcher, the research manager, or the consumer can estimate the risk associated with the implementation of the research.

We have covered three points: resistance to change, conflict of interest, and the lack of criteria. I think that these points adequately identify the malaise that we have before us. The problem is summarized nicely in Dr. Drucker's paper, in which he says that too often we have experienced the frustration of trying to promote utilization of R&D products when virtually no money has been allocated for that purpose, few personnel can be legitimately assigned to implementation activities, and there is little or no responsibility in user commands for seeing that the product gets used. Products have been known to get into the correct systems, nonetheless, but generally through ad hoc arrangements spurred by someone's conscience and with funding from God knows where. In short, no up-front planning.

It is clear to me that we cannot continue on this road. I suggest the following points for your consideration in this conference. I would say that point one is to develop a means to plan an organized way of requiring that the potential use of a given piece of research, even 6.1 research, is made explicit. Point two is to do some more planning; point three is to plan some more. Fundamentally, we must get into the business of developing R&D utilization plans. Through planning we must educate users and consumers so that they will have a better understanding of the power of R&D, of its limitations, and of what can be expected of R&D, particularly in specified time frames. Going one step further, I suggest that it is the principal responsibility of the R&D manager to articulate and carry out this planning. It also is the responsibility of the individual research project staff to participate in the planning.

I think we need to develop better methods to categorize R&D, particularly human resources research. For example, the program categories of 6.1 and 6.2, etc., were designed to produce "rat screws" (i.e., hardware) and are generally inappropriate to the human resources area.

We also need to revise the way R&D programs are evaluated. Presently, these programs are generally examined in much more detail by the

manager of R&D than by the consumer. For example, at a recent program review conducted at NPRDC, which was very professionally done from the perspective of the R&D manager, not a single consumer was present. Something must change in this area. Perhaps we need to set up a bureaucratic procedure that assigns an obligation to the consumer, as part of his accountability, to evaluate the R&D program.

We also need to reduce the fragmentation of R&D management. There are many research programs in which there appear to be more managers than researchers.

I would suggest that the idea of resource programming and research implementation go hand in hand. If you are going to put a program into effect these days, you must allocate resources three years in advance. Clearly, this means that in order to put research into effect, you must plan well in advance and anticipate the funds that will be required if the research is successful enough to warrant utilization.

Formal assignment of responsibility for the planning and implementation of an R&D product must be made explicit. I am generally sympathetic to the viewpoint of the researcher, who produces the product and feels that he is not responsible for selling it. In fact, I think that some researchers would be better kept in the back room, while others should be trooped out into public view. Good scientists are often poor at articulating the concepts of utilization. They often have a different set of values and goals, which I pointed out earlier in discussing conflict of interest. The scientist exploring the unknown may not be interested in programming and implementing the results of his research. I am not sure that he should be, but someone has to be responsible for understanding what is required not only to get the research accomplished but to follow it through. In my judgment, the real responsibility for this aspect of R&D lies with the consumers and the R&D management professionals.

In conclusion, I would like to reemphasize that I believe planning is the most essential element in this business of building bridges between consumers, producers and managers in order to promote better utilization of R&D. I wish you the best of luck in your explorations into this swamp of human resources R&D utilization. It's a tough, murky problem. If it were not, you would not be here. As Captain Clarkin said, it probably is one of the most urgent tasks confronting us today. Your challenge is to map a strategy for change, one which will be more likely than the present modus operandi to bring about timely utilization of promising R&D results.

As I have already stated, if we are going to improve R&D utilization, we must improve accountability for utilization, and with today's austere funding climate, the reward for a particular R&D project may very well be its survival. However, this is not the real objective. Remember that the successful utilization of an effective new development

by the operational community may mean the difference between victory and defeat. The basic task that you have is to get the research horse connected up with the operational wagon. It is not going to be easy.

Now I would like to introduce Colonel Hank Taylor who, in some measure, I've been flagellating here today. But he is one of the most competent people in this business.

RDT&E UTILIZATION: A PERSPECTIVE FROM THE OFFICE OF DDR&E

COL H. L. Taylor, USAF
Military Assistant for Training and Personnel Technology
Office of the Secretary of Defense

I am pleased to have the opportunity to speak at this important symposium. My topic is RDT&E utilization: a perspective from the Office of DDR&E. I'd like at the outset to thank Dr. Sands for allowing me 30 minutes to cover this topic, because if I had had a shorter time, with the reading of the title of the symposium and the title of my presentation I think I would have been out of business before I even got started.

I think Admiral Metcalf put his finger on many of the problems that our community faces, and I want to emphasize "our" community, because utilization requires a joint effort between the researcher and the user. I think he not only pointed to the deficiencies in the way we interact with each other but that he also probably flailed himself as much as he flailed any of the R&D users. I think we need to focus on this problem of the interfaces between the user and the researcher and the R&D manager.

As both an advocate and critical reviewer of the Department of Defense Research and Technology programs in people-related research, it is probably the understatement of the year to say that I am interested in utilization. We have to be concerned with research utilization, because, as Admiral Metcalf so clearly indicated, from an R&D management standpoint it typically indicates whether your program will continue to survive or not. On a broader perspective, R&D utilization has the potential of impacting on combat readiness and on national security.

Certain external factors that impinge on the area of utilization of people-related research should be reviewed and considered in your deliberations. This area has probably had more review per dollar

than any other R&D program around, both within the military services, the Department of Defense, and the Congress. It is an area that is not clearly articulated through any chain of command in terms of the potential impact. We don't market our research very well. We don't provide clear understandings to the people who are trying to manage the R&D or to apply the results. Perhaps you can come up with suggestions for overcoming these deficits.

Over the past decade we've put a great deal of emphasis on utilization within the Department of Defense. For those of you that have been in R&D management or associated with R&D for the last decade, you will remember that in the late 60's and early 70's the Congress showed an intense interest in relevancy of research. I submit to you that the behavioral and social sciences R&D, with its emphasis during this time period on foreign affairs research, was one of the principal programs that created this Congressional concern about relevancy, a concern that spread to all of DoD's research and development. You are probably familiar with the Mansfield Amendment to an early 1970 appropriations bill, which stated that all defense research and development must have a direct and apparent relationship to the DoD mission. What constitutes a direct relationship is not easy to define, but the emphasis was to the overall DoD mission, either in the development of hardware, weapon systems or subsystems, or in the maintenance of combat readiness through better training, better personnel management, or better manpower management.

The stipulation that the research must have an <u>apparent</u> relationship to the DoD mission was even less specific. I was at the Air Force Systems Command at that time, when a review of all the R&D programs in the Air Force was conducted as a result of the Mansfield Amendment. We struggled with the problem of how one could determine whether a particular research effort had a direct and apparent relationship to the DoD mission and we finally decided that the best criterion that we could come up with was to let the night janitor read the project, and if he could see the apparent relationship then we were probably on safe ground.

In a more serious vein, there was a very critical and very serious review of all defense research and development during that time. In the Systems Command, we sorted all projects into three categories based on the review of the project write-up. One contained those projects where the relationship was both direct and apparent. Another category contained those projects in which there appeared to be a relationship but it was not clearly articulated in DD-1498, the project write-up. (Each of those in this second category had to be rewritten or the project would not be continued.) The third group contained those projects in which the relationship was neither direct nor apparent. These were cancelled. Each of the military services went through this exercise for all R&D. The result was a considerable restructuring of the programs from the standpoint

of both relevancy and emphasis. I think this was the start of the emphasis that we are seeing today in the Congress.

Shortly after this period, behavioral and social sciences R&D dipped to a low funding point of somewhere around $37 million in technology-related items. This was about the time of the Ginnesburg Management Report, which recommended an increase in RDT&E in this area, along with better management of it. If we look at the trends in funding, we see that RDT&E in this area has increased every year since that time. In fact, it has increased far out of proportion to the rest of RDT&E funding. However, it is still a struggle both to defend the programs and to get them implemented if they are supported and completed.

The next major historical point was the House Appropriations Committee's review and report on the 1976 fiscal budget request. The Committee recommended a 50 percent reduction (from $40 million to $20 million) in five critical program areas within what we then called human resources R&D. The recommendation came near the end of the first quarter of the fiscal year. If implemented, it would have had a very significant effect on the R&D community. In light of all of the personnel actions that would have been required to meet the reduced budget, we simply would not have had enough money left even to close some of our laboratories, much less keep them open. There were also some very critical contractual efforts that would have had to be terminated before their completion.

The rationale for this reduction by the House Appropriations Committee was their concern over the extent of utilization of research in this area. We were successful in getting a portion of these cuts restored; the Senate restored half of the $20 million reduction and the House acceded to the Senate's position. You might say that people-related R&D was spared, but the Congress really got our attention. Since that time, there has been a concerted effort within the R&D management community and within certain segments of the user community to make the utilization of people-related R&D clear. There also have been internal programs designed to look at utilization, which I'll talk about later.

In response to the action of the Congress, we restructured the human resources R&D program so that we could better see its various parts. We tried to make the program responsive to the Congressional concerns and still maintain a viable effort to address critical DoD needs.

In November 1975, following the final authorization of the FY 76 budget, the chairman of the House Appropriations Committee requested that the General Accounting Office make a detailed review of these programs so that a more thorough analysis of the FY 77 defense budget request could be completed. This review started immediately and continued for almost a year and a half. It culminated in the GAO report published April 22, 1977, entitled "Human Resources Research and Development Results Can Be Better Managed." I would like

to take a few minutes to give you some of the highlights of this report, which can be obtained from the General Accounting Office. I will give enough details so that you can consider this report in your deliberations, since I think it is a very important milestone.

The GAO conducted this evaluation over a period of about 18 months. They developed an audit trail of human resources research, using the technical report as a basic source to audit. They visited eight organizations within the Department of Defense and identified 374 reports that had results which the research community deemed ready for immediate use. By the GAO definition this included all research intended to support changes in regulations, orders, doctrines, policies or manuals; research intended to support changes in programs of instruction or training programs; and research intended to support changes in equipment.

To complete the audit trail, the GAO contacted users both by survey and personal interviews to determine which R&D results were used and which were not used. They found that, by their criteria, 56 percent of the results had been used, 38 percent had not been used, and 6 percent were being considered for possible use. The emphasis here (and in our opinion, overemphasis) was clearly on immediate use. We also feel that the definition of use is quite restrictive. However, some of the reasons they found for nonuse are very instructive. First, many of the users believed that the reported results were intended for information only. Second, the supposed users (that is, people who were identified by the R&D community as potential users of the research) had not seen the reports or were unaware of the reported results. Third, the results were questioned or were believed to be unusable by the research community.

There were other categories in which the results were clearly used in decision-making but which were considered unused by the GAO. In our estimation these situations constituted a legitimate use of defense research since the results did have impact on decision-making. However, counting them doesn't substantially change the percentages. (It would put the none-use category down to about 25 percent rather than 38 percent.)

What we need to focus on are those instances where the user cannot determine from the research report that it is intended to do more than simply increase his state of knowledge, or where he doesn't even receive the report. Some of these things can be handled by management action, but I think it's clear that there is ample opportunity to effect change within the management of human resources R&D.

As a result of this study, the GAO made four recommendations to DoD which are intended to improve utilization management. The first one was that criteria need to be developed to identify research and

development results with immediate use potential. They concluded that without such criteria, results cannot be identified and tracked, and related implementation problems cannot be identified.

We have reviewed this recommendation and, in general, support the GAO's conclusion. Criteria are needed to identify research efforts that have potential use, and to identify intended users and the ways in which the results may be used. We have not responded to this recommendation yet, but we have drafted a response. Although I am probably speaking out of school, I would at least like to give you an idea of what the Department of Defense is considering in terms of a response, because I think this is very important and pertinent to your actions here.

As you recall, the GAO used three criteria for judging the use potential of a given research project (i.e., research intended to support (1) change in education or training, (2) change in equipment, or (3) change in regulations, orders, policy, doctrine or manuals). The GAO recommended that DoD use these three definitions of use as a basis for developing criteria to determine immediate use potential. We accept this but think that the criteria are too narrow, and we are looking at additional criteria that should be used to identify research with immediate use potential. Our intention at the present time is to require that each published technical report in the human resources area provide a statement concerning the intended user or user community and the suggested use of any product or findings. This will include those research reports that essentially feed other R&D efforts, since the R&D community is a consumer of its own RDT&E. In short, we are looking at it from a very broad perspective, and intend to include those projects in which the research is designed to advance the state of knowledge and to provide additional information rather than change equipment, programs, or policy. We believe that the responsibility for this lies with R&D management.

The second conclusion in the GAO report was that communication between researchers and users must be improved. This is a motherhood statement, but I think it is also valid. It is evident that better communication will serve to identify problems and provide more timely solutions. This goes back to Admiral Metcalf's conclusion that better planning in all phases of defense RDT&E is one of the things that we need to focus on. Obviously, we have deficiencies in our communications process. I think we all are aware of some of the problems.

In my opinion, we are actively working to develop both formal and informal solutions to these very difficult problems. One idea is to institute a periodic utilization report; the Navy is actively pursuing this effort. The Air Force and Army both have changed their regulations regarding human resources research in the last year or two in a way that specifically identifies the need for user involvement in the R&D process, from the requirements stage all the way to the transition of R&D to the user, and also identifies the points for interface during the R&D process.

We have tried several other things over the years. One is having field detachments directly collocated with users. In many cases, this helps the communications process both on the requirements end and on the utilization end. There are examples of this in all three military departments. Another strategy is holding conferences, such as this one that NPRDC is hosting, to try to come to grips with the communications problem. Another technique that is being tried by some of the military departments is designating representatives at intermediate command levels to serve as intermediaries between the research and user communities. Although we are doing a lot in the area of user/researcher communication, I would submit to you that it needs further work.

The remaining two GAO recommendations essentially involve mechanical kinds of processes. One is to establish a monitoring and feedback system for tracking utilization, and the other is to develop a management mechanism for resolution of issues between the researcher and the user. We will be addressing these issues within the Department of Defense.

One other effort that directly impacts the job you have to do here is the 1976 Defense Science Board Task Force on Training Technology. There are three or four important conclusions from their report that I would like to submit to you.

The first and foremost is again one that was mentioned by Admiral Metcalf--the need for cost-benefit and performance-effectiveness analysis relating to the use of R&D results. Cost-effectiveness has become a "buzz word," but my impression in reviewing the programs of the military departments is that it is being taken seriously. It costs money to do a good cost-benefit analysis; nevertheless, you see more and more R&D programs including it at the outset as one of their tasks toward the utilization of research. I think this is clearly a step in the right direction.

As Captain Clarkin indicated, the Laboratory Utilization Report also identified problems of interface and utilization. They included recommendations like collocation and better communication, which I've already touched on. The Laboratory Utilization Report did find that the human resources laboratories offered a unique technical input into military planning and decision-making. It is our job here at the utilization conference to see what steps can be taken to make that input more effective and more widely used.

Utilization pervades all aspects of R&D management. I think it is essential to have a good investment strategy that indicates you are working on important problems. Our technology-base request for human resources research to Congress this year was over $100 million, up from $37 million in the early 1970's. That is tremendous growth.

At all levels, both in the management and utilization of R&D, we must make sure that we have a proper and well-thought-out investment strategy for the utilization of these resources, so that we get a maximum return on the dollars invested. These are high leverage dollars. They address problems that are critical to the Department of Defense, problems that relate not only to the high cost of manpower training, but also to the actual combat readiness of our forces. Decisions are going to be made about training, personnel and manpower. If we don't have the information available to assist in making those decisions, they will be made without the input of the R&D community.

I would like to emphasize the importance of having users involved in all phases of R&D. Users should assist the research community in developing more quantified statements of the problems that they are attempting to attack in their research and development efforts. Clearly, this is easier to do in connection with an advanced technology demonstration project than it is for a basic research project, but I think we need to think in quantitative terms, to remove as much of the vagueness from our requirements as we possibly can. Users need to be effectively involved not only in the generation of requirements but also in the RDT&E planning process.

The transition of research results to actual implementation again requires long lead-time in terms of planning, budgeting and allocating the particular kinds of resources that are needed. Without appropriate cost-benefit analysis, it is very difficult to convince a manager, a user, or a consumer to implement a system that is going to cost him several million dollars when he has one that is working right now. If we are going to change and improve the system, we have to show the consumer how it will benefit him. And he has to be willing to trade off near-term investment cost for long-term savings. This is probably one of the toughest problems we face because the system is built to work against doing that. Congressional review cycles and investment in DoD focus on the near-term investment cost and not the overall life-cycle cost. I hope you will be able to come to grips with this problem during your deliberations here.

Another aspect of the R&D process is one in which the conflict of interest between the researcher and the user is probably greatest. That is effective user involvement during the ongoing research. The researcher doesn't want the user telling him what to do, and the user doesn't want a product that is of no use to him. So there has to be a mutual interaction. I can't define in any precise terms what this interaction should be, but I think there needs to be compromise on both sides.

During your deliberations, I strongly urge and encourage you to look at the whole R&D process, not just the utilization end. If you start there, you are dead before you start. You need to start at the planning stages in looking at quantitative requirements. You need to look at user involvement during all stages of the research effort.

In perspective, I believe we can reasonably say that DDR&E supports the need for R&D in the human resources area, as well as the need for better and more visible utilization of the research results. Without better utilization the money well is going to dry up, and we believe that this would have a significant and critical negative impact on our combat readiness. Once again, I applaud this utilization conference and the issues that have been laid out before you. Let's hope that we can come up with some concrete conclusions and recommendations. I wish you luck as you proceed, and I look forward to both a near-term and a longer-term follow-up of this very ambitious effort.

DR. SANDS: On behalf of Captain Clarkin and others, I'd like to thank Admiral Metcalf and Colonel Taylor for their thorough and insightful discussion of problems and issues that are currently before us as we look at research utilization in a hard and, I hope, meaningful way. Now we'd like to open the session for discussion.

DISCUSSION

DR. SINAIKO: Do you have any examples of particularly good utilization?

COL TAYLOR: I think there are examples around. We routinely try to look at payoff; unfortuantely, many times we look at payoff in terms of the development effort itself rather than the actual implementation of the work in operational commands. At any rate, one good example of utilization is the Army program, REALTRAIN. This is a program that is intended to put realistic training into field maneuvers for the Army. It consists of a feedback mechanism that uses very simple equipment but is based on results that have come out of the research community over the years in terms of knowledge of results, feedback, and repetition of training. Essentially, each combat soldier is assigned a two-digit number, which is displayed on his helmet, and each offensive soldier is given a scope on his rifle. The technique involves the offensive soldier identifying the number and calling it out to a controller who takes the person spotted out of the field exercise. Once the exercise is completed, there is a discussion and review of the training effort, and the exercise is then repeated. Thus, you have feedback, discussion of proper and improper tactics, and repetition of the drill. The Army is developing sophisticated hardware in the form of lasers attached to the guns and an identification system that would consist essentially of retro-reflectors, so that the system will become more automated. This is currently being implemented. REALTRAIN grew out of the exploratory development program and it has continued to receive R&D support during the implementation.

There are several essential elements in REALTRAIN that make good utilization possible. For one, it deals with a very clear-cut

operational problem--the problem of how to provide safe and realistic training for troops in the field in order to reduce initial conflict casualties in the event of war. The Army presently has either live firing at stationary targets or more interactive field exercises that involve firing blanks, with the controller deciding who's dead and making judgments about combat effectiveness. No real assessment is made of the casualties involved in the conflict, so that the learning becomes very stilted. It is questionable whether or not there is any effective learning in this at all. Motivation of the troops is very low.

So, REALTRAIN looks at a real problem; it has user involvement in all phases; and the R&D community is involved in test and evaluation and in the continual improvement and update of the program.

DR. HAMERUS: Involvement of users in research calls for the ability to identify or define users in a way that is decision-related. What is the likelihood of an honest effort to address the utilization problem through reorganization of the research and development activity in the military relative to the linkages within the user agencies? That is, users at a command level need a certain kind of involvement in the R&D process but at lower decision points users need different involvement. What is the likelihood of the military being able to consider reorganization of the research and development structure to provide closer affiliation with the user structure, so that decisions in the R&D process are more closely tied to the user control point rather than the research control point? In that way, the user would determine when the research commences and who contributes to the planning decision process and the implementation process. Accountability would be easier to pinpoint through that kind of structure rather than there being two or more independent agencies that negotiate with one another about whether they get involved or not.

ADM METCALF: Let me see if I can get at what you're saying. The way it came across to me is that you are asking (in part), "What is the probability of getting the senior user, who I represent, involved in the R&D process?" I assure you that if senior users get involved, you will get junior users involved. That happens to be the way things work in our marvelous oligarchy. You've hit the right point; I think that guys like me need to have some degree of involvement in research.

Then I think you raised the interesting problem of who you talk to at the lower level decision points about such things as exploratory development. That is a very definite and very difficult problem. All I am suggesting, simplistically I guess, is that we devise a procedure so that when we are designing research we have to take that question into account and seek to answer it explicitly. In some cases, the answer to that question may be unknown. Right now, particularly when we are talking about funding a given piece of

research, we don't know how it is going to be implemented. Thus, whether we realize it or not, we answer the question by making a nondecision, but we don't make it an explicit nondecision. I think we need to be more careful in our planning and make it more of a structured process, so that we are explicit about such things as the research plan, what it is going to cost, what the expected outcomes are, and the risk of failure. It appears that lots of researchers are unwilling to expose the fact that there is a risk of failure. They don't want to tell me that I've only got a 25 percent chance of success, because it's their bread and butter and they feel that quite often the consumer will say, "Hell, I'm not going to take that 25 percent chance," and so they are unwilling to articulate that risk. But I think that somewhere along the line, we've got to educate our consumers to the fact that research is risk, and that by their getting into the process, they can reduce the risk. I don't know whether that answers your question or not.

DR. HAMERUS: Well, it speaks to it. Just one more little piece on that. From your point of view, what would be the reasonable likelihood that you or others at your level of authority might be assigned a certain degree of responsibility of this kind, that is, to officially "connect" with this kind of research involvement?

ADM METCALF: Yes, I think that is probably the answer. That is why I said that I ought to be required to sign off on R&D projects. But if you're going to get the consumer like myself to sign off, the other side of the coin is that we've got to know what we are signing off on. And that information too often is not there. What I'm suggesting is that we explore a means of giving me, the consumer, a better understanding of what is expected out of the research; what its side effects may be, what risks might be involved, what the probability is that it can be utilized, and what dollars must be allocated in order to undertake implementation. There is research in the Navy right now on the problem of improving our recruiting system. It's taking place right here at NPRDC, and it looks very exciting. The problem is that it is going to take a lot of dollars to implement if it comes to fruition, and at the present time there isn't a nickel in the program for implementation.

QUESTION: What you are saying is that, to be complete, a research plan requires an implementation plan.

ADM METCALF: Exactly.

DR. UHLANER: I am Jay Uhlaner of the Army Research Institute. Admiral Metcalf, I think you touched on my question but I'd appreciate further elaboration. You correctly mentioned that one of the problems in utilization is the conflict of time in the mind of the researcher and consumer. Related to this is the problem of changing policy positions as different individuals come into the policy-making roles. For example, under one set of policies the

utilization of women in large numbers might possibly be an objective; under another Admiral or General it might be reversed.

ADM METCALF: That is an absolute fact, not a conjecture.

DR. UHLANER: How do you see the research community adjusting itself to those major policy changes if the consumer is going to determine the needs as you suggest? Do you suggest that programs be reviewed as new policy-makers come in and be cancelled if they are inconsistent with the new policy-maker's objectives? I think this is related to your comment, if I understood you correctly, that there is no need for 6.1 and 6.2 efforts in this area.

ADM METCALF: No, no, no. I was misunderstood; I think there is a very definite need for 6.1 and 6.2 programs. What I was saying with my comment on 6.1 and 6.2 (and I was really referring all the way through 6.5) is that bureaucratically it is designed for hardware research. I find it difficult to structure human research programs using that framework. I think you absolutely must have 6.1 and 6.2. It is a most difficult area to define, but I think that if you can figure out some way to design an implementation plan for 6.1 and 6.2 that may answer your other question. A lot of research with regard to utilization of women, for example, is policy driven. Thus, some types of research on this matter may not be addressing the underlying consideration. That is a risk. In large measure, the research community is a service organization. You're like the supply officer or the logistician in the Army, Air Force or Navy who has gone out and bought all kinds of propellers for his airplanes; and the next year we go to jets and we don't need propellers anymore. You are undertaking research into certain aspects of male chauvinism, which is dissolving. It may be that we won't need those solutions anymore. This is a risk in project selection.

Now, should we review all R&D projects every time we get a new policy change? You know, I think in some ways, that is the role of the R&D manager; it is a very important thing to consider. In large measure, the R&D manager has isolated the researcher from the whims and changes of the policy-maker and properly so. (Sometimes, however, I think he is overisolated.) But that is one of the manager's functions; he serves as a very useful bumper. The research manager usually has a long term in his job. He is used to policy or leadership changes. Thus, if he sees that a given research project is likely to have some productive outcome--if it is solving the needs of a plan which we set out before current policy changes, but which will have reasonable potential for utilization, he should say whether it should continue or not. I'm not sure I could turn off research that is going on right now even if I wanted to as a consumer. And I'm not so sure that that is altogether bad.

DR. UHLANER: Right. It seems to me that one part in the total trade-off in this equation that hasn't been mentioned this morning is some

concern with the quality of the researcher that you can attract to the program. There must be some continuity of incentive other than just concern about personal survival. I think the survival of R&D as a creative field needs to be based more on the brilliance, the creativity, the capability and the outstanding work of the research community than is possible if it is driven by the day-to-day consumer requirements. It seems to me that we have to find a way of balancing off one with the other. If one, such as the immediate demands of the consumer, drives out or significantly reduces the likelihood of attracting excellent scientists who might be interested in the field, we have a counterproductive system. I'm looking at it from a total systems point of view. I haven't heard any concern with the quality of effort and how it might relate to this whole interrelationship with the consumer.

ADM METCALF: I would submit that you have an excellent point. It happens to be a point that is made over and over again, namely, that controls on research, such as requirements for accountability and relevance, may make life somewhat nervous for researchers. I do not feel sympathetic with research just for the sake of research, which is what I think you're talking about. In other words, I'm on the other end of the spectrum of what you have just described. Very often, getting highly creative, productive people is a tough problem. But we should not let the problem of getting good people overshadow the obligation for planning, accountability and relevance.

Thus, what I hear you saying is at one end of the spectrum and I have just described the other. Now, somewhere along the line, we've got to have a meeting of minds on this legitimate question. Probably it is going to be compromise.

DR. UHLANER: I'd like to return to the example that Colonel Taylor cited as an excellent illustration of R&D utilization that came out of our Institute, namely REALTRAIN. The emphasis in the beginning of that program was technology based, not at all specified by the user. The user was informed informally about our research effort. In fact, the general officers who witnessed it at one of the so-called "shootoffs" said, "Gee that's enough exploratory development; let's get it into the system right now." So, I think that although my words emphasized the other thing, it may be pointing toward the very objective we all want to get to, namely, developing good products for the user.

ADM METCALF: Let's look back for a second. You thought that you had a good program going and you carried it out from exploratory development funds. Does that mean that at the start of such a program you couldn't sit down with somebody in the appropriate bureaucracy and get their sponsorship?

DR. UHLANER: It probably would have been rejected.

ADM METCALF: Are you saying that if you invite joint planning and review of an exploratory development project by a potential sponsor/user, the risk of rejection is too high?

DR. UHLANER: No, I think it is because the kinds of risks that are perceived by a potential user before actual demonstration and tryout seem to him to be very high risks. It is only after demonstration that the user can get a better feel for whether or not the risks are within the limits of what he can accept. So I think you have to deal with, and I think the working sessions will have to deal with, the very important concept which you elucidated, namely, risk taking. Can you think of some examples of high-risk projects that appealed to you, that is, where high risk was taken and you were glad it was? The low-risk projects will correlate with mediocre and mundane advancement, by and large. But it is the high-risk ones that tend to be more innovative, and are likely to have more impact. It's the same principle as the stock market. If you are going to take a long-shot risk, you're likely to lose a lot more or gain a lot more. It is the safe stock that will give you maybe a small appreciation or a small loss. You have the same thing in the research business. Can you think of some high-risk ones where you as a consumer, ahead of the game, said, "Gee, let's go."

ADM METCALF: I'm working of a high-risk problem right now; I'm trying to reorganize the Bureau of Naval Personnel. (Captain Clarkin thinks he did, but I've got news for him.) The risk problem is a very difficult one. All I'm suggesting is that if we base everything on the assumption that the user is going to reject high risk, we've got a real problem. But if you recall, I also said we've got to educate the user. In my own case, if I know what the risk is, or at least have some quantification of it, I'll accept that. Possibly my attitude is unusual, since I've been in R&D for some time, so I'm used to the concept of risk taking when investing in research. That is a problem, but it doesn't mean that we can't discipline ourselves. Maybe the answer is to make the plan and not show it to anybody. Then when a useful product or procedure turns up, by golly, you've got a good idea here and we users say to the R&D managers, "Well, how are we going to implement this thing?" The researcher then breaks out his plan and says, "Hey, listen, this is how we thought it would go before we started." You know, maybe it only goes as far as the R&D manager; we don't know. That is why I say that the R&D manager has a very key role in this whole equation.

DR. UHLANER: You know, I'm glad you gave that answer, suggesting that we need a very high level of R&D managers.

CAPT CLARKIN: The problem you cite, Jay, is a very real one. I think it goes back to the several armed camps that the Admiral addressed in his presentation--the camps of the users, researchers, and the research managers. I think each of these camps views the

others pejoratively, and I think one effort that will contribute to a solution is greatly increased interaction among all of those camps. I think the operational world generally views the researchers and their world as being populated by fools and charlatans, and the researchers generally view the operational world as being self-aggrandizers who temporarily occupy positions where they can get a punch check on their card. How the research managers view both of these camps, I'm not going to address for fear of being sued. The operational world is concerned with fire-fighting, damage control issues, today's problems; the researchers are concerned generally with the application of the technologies that are emerging or presently existing. I believe that with increased interaction, the operational world can responsively exercise the degree of autonomy that is implicit in what you've stated.

I further believe that the chief executives in the operational world can be enlisted to support the R&D community as a function of the degree of success that they experience from that process, and as a function of that, they can arrive at what I've characterized as a willing suspension of disbelief in what it is that the R&D people were doing. I can recall specific examples where that willing suspension of disbelief, or perhaps unawareness, has produced products that were urgently needed at the time and that were present at the time they were needed. One of them that I've cited before originated from the ONR community where Likert's work was funded in the latter 40's, eagerly sought after by industry and widely applied. It was 27 years later before the Navy ever became aware of what the product consisted of and then aggressively implemented it in its human resources management centers. The other work, that I think many in this room participated in, is the development of computer-assisted instruction in the 50's. Had that been submitted for control by the operational people (who at that time were luxuriating in vast amounts of money, as well as a never-ending supply of people to populate their classrooms and to present the instructions), they would have rejected it out of hand. But because there was a degree of autonomy in the R&D community, they were able to pursue that innovation and have it available at the time when the people and money problems were much more dire than they were at the time the development was initiated.

INTRODUCTION OF BANQUET SPEAKER

Dr. James J. Regan
Technical Director
Navy Personnel R&D Center

Those of you who received your meals later than the rest of us, please eat faster and more quietly. We have a problem when

establishing a schedule. Dr. Frank Sands, whom I'm sure you'll agree has done a heroic job in arranging for this symposium, may have gone a bit overboard in setting a schedule for this evening's proceedings, but we have one. I'm assuming that you've forgotten to bring this little booklet because if you didn't forget to bring it, there is almost no reason for my being up here.

My real function is to provide a few remarks during the time you are finishing your roast beef or whatever you got. If you asked for fish and you didn't have the grey card you probably didn't get it. As a matter of fact, if you had the grey card, you probably didn't get it either. But next year we are going to give you some options.

We are on something of a schedule, and I'll try to maintain it. You may not be familiar with the schedule because it is written in a curious set of numerics which I'm not going to attempt to translate, and since you don't have the book it won't make any difference anyway. I had been asked by several of you, however, during phase 1 of this three-phased operation, whether we were going to have an invocation. It probably has become clear to you by this time that we're not going to have one. Dr. Sands did, I must confess, want an invocation, something that would make our "spirits soar," I believe were his terms. Since we had quite a few spirits during phase 1, I thought we were all soaring already, so I wasn't too concerned about it. But he persisted and suggested that perhaps a passage from the gospel according to the Harvard Business School by Jim Clarkin would be in order. But since it's so sectarian and there are so many nonbelievers, I didn't think that would be appropriate either. I have a number of eminently forgetable invocations, which incidentally I've forgotten, so I'm not going to give you one. Therefore, we're not going to have an invocation.

What we are going to have, however, very fortunately, are some remarks by Dr. Rostker. And I guess among other things I'm not going to do this evening is read a list of his accomplishments and background, for several reasons, one of which is that you have them in your program, which you probably don't have with you either. But in the morning, if you can remember, you can look at the program and you can learn about his background. I should say that he is an economist and that he's the Principal Deputy Assistant Secretary of the Navy for Manpower, which is a title almost as long as the title of the symposium. So when we put them all together, we couldn't have a little program as it turned out.

I think it's important to say again (because we have so many intra-meetings in this meeting, nested inside nests, we might have forgotten why we're here in the first place) that our purpose is not to reiterate for the nth time why utilization is a problem and why those things that are utilized are not credited to us and those things that are not

utilized are blamed on us--but rather to arrive at some sort of set of specific recommendations of a policy nature which could change this world about which we've talked so much for so long.

I think a step in that direction will be some comments we're going to hear in a few moments from Dr. Rostker. Dr. Rosker is a prime member of the new Administration team, who I think are activists and very technically qualified young and innovative people that we'll be hearing a great deal more from. Ordinarily, I believe people say that our featured speaker needs no introduction and then proceed to give a long one. I'm willing to admit that, at least at this moment, but not in the future, he does need an introduction and I'm not going to give him one. I'm going to ask him to come up here and say what he's going to say.

BANQUET ADDRESS

Dr. Bernard D. Rostker
Principal Deputy
Office of the Assistant Secretary of the Navy
for Manpower and Reserve Affairs

That's a very hard act to follow, I'm afraid. Originally these remarks of mine were to be the keynote speech, but we had a little problem in Washington and I didn't quite get off on time, and I thank Joe Metcalf for sitting in this morning--we sort of played switchies. In fact, I actually have some prepared remarks which probably were more appropriate as a keynote address than an after dinner address, but so be it.

Let me give you my perception about people-related R&D programs and their management. In my opinion, research is only as effective as its contribution to the solution of problems. I believe it can be summed up by saying that research should be relevant and it should be problem oriented. My assessment of the personnel R&D business is that a great deal of the work done today is neither relevant nor very useful. I see few lines of communication between the researchers and the decision-makers. I see little communication in either direction between the researcher and ultimate customer. I do not see enough follow-through from research to application and, like it or not, I think the person most responsible for this situation is the researcher and the research community. What I'd like to do this evening is explore with you some of my thoughts on the problem and suggest a few things that I think we all can do to correct the situation, and tell you some of the things I intend to do from where I sit.

It's often said that the Department of Defense spends about 12 billion dollars on R&D efforts. We also tend to note that something like one-tenth of one percent is spent in personnel-related research. And it's often argued that this is evidence for the fact that we should increase the size of the personnel R&D programs. However, at this point in time I'm more concerned with what we are getting for the money we are spending rather than arguing for an increase in the size of the program. And I would submit to you that we are getting less than fifty cents on the dollar, maybe less than the twelve cents on the dollar that we talked about earlier. What really concerns me here is not that we produce research that is relevant and that for reasons beyond our control it's not applied. What concerns me is that so much of the research going on is irrelevant and even before the research is carried through, it's a fait accompli that it could never be applied and it's really not directed toward any practical problems. I'm not at all suggesting that we want to have a dollar return for a dollar spent in the R&D area. A certain amount of theoretical, uninhibited, and independent research is necessary; but I really hope I don't have to remind you of the intense competition that exists today for the defense dollar. I would submit that the time is upon us to face this issue squarely. The key word, I think, is relevance. Your efforts must be structured much more to the solution of major policy questions and operational problems than to the requirements of your discipline and the acceptance of your peers. We must be responsive to the needs of customers, we must learn how to communicate our results to people who can carry them through and make decisions; in this respect we are currently not doing a very good job. The most important contributions that we can make to achieve utilization is to focus our work on the problems at hand, to carry out the work in a comprehensive manner which draws together the many disciplines that are represented here.

In direct terms, utilization will result only if we work the problem, if our work is not overly theoretical, and if our approach is not fragmented. While we certainly need proper methodologies, refined models, and sound theory, they are not substitutes to a dedication to working the Defense Department's problems today. The factors that contribute or constrain the cost effectiveness of our personnel research efforts are widespread. It is not all our fault that our research is not carried through, yet the R&D community can do much to improve the present situation. Let me be more explicit. I believe we are constrained today by the very nature of the R&D structure that we are working under. The definitions of 6.1 through 6.5 money, the hardware orientation of the terminology, the operational guidelines and the practical application of those guidelines are not particularly conducive to the practical application of R&D in a problem solving mode.

Now let me digress from my prepared remarks and make a side comment. I've spent the last eight years at the Rand Corporation doing R&D for the Air Force. But we've had a unique environment. We have not been subject to the 6.1, 6.2, 6.3 type categorization; we've worked

directly for the decision-maker. We've been able to take problems and carry them through from their basic definition to the development of whatever unique tools are necessary to get the required answers through the application. Coming into this business from this end, I've found it really disturbing. The types of discussions that we heard about today, "is this 6.1 money or is this 6.2 money?" "I can't get 6.3 money," and "should the research be required to go from 6.1 to 6.2?" I have a lot of trouble with that. I believe a structure should facilitate solving a problem, and I would submit to you that the present structure that we have in the R&D community may be very appropriate for the hardware world but is not facilitating the development and the carrying out of articulated R&D programs. I would also suggest that the present structure gives the researcher a convenient place to hide while he does his own thing. From the researchers' point of view this is really understandable. I know many have grown accustomed to conducting their research in their own environment, in their own areas of expertise, free of outside interference and time pressures. Unfortunately, researchers have little incentive to solve practical problems; furthermore, results are delivered to the services usually in piecemeal fashion in the apparent hope that decision makers can determine how best to integrate the results. Then, as if to ensure nonimplementation, researchers often put their results in technical reports or professional journals. My message this evening is that this is a way of operation that we can no longer afford.

A contributing factor to the present situation that we find in the R&D community is the traditional way that people plan, program and budget. My main concern here is that it is the researchers who are involved in the planning, programming and budgeting of R&D funds and these are in fact the wrong people. Working up my remarks tonight, I became increasingly concerned about the domination of researchers in the R&D planning process. As far as the Navy is concerned, I believe that the people who should be most involved in the development of the research program are the customers of the research. I come to this conclusion knowing full well that these people have often not provided the guidance or support that is needed to the R&D community, but this is a risk that I submit is worth taking. If we cannot develop a research program, if we cannot have the research program supported by the ultimate consumers of those programs, then I would submit we have a difficult time making that research relevant and then carrying the research through to its ultimate conclusion and application.

For those of you who have not seen it, I would invite your attention to the so called Ginzberg Report of 1971. The report found, among other things: (1) a lack of communication between policy and decision-makers and researchers, (2) too much control of research by the hardware community, (3) too much research coming from the bottom up, rather than the top down, (4) too little involvement and control by those who are responsible for the program, but not necessarily

responsive to the needs of the client, and (5) too much concentration on research in the hands of particular groups, and the Ginnesburg report singled out psychologists, and too little use of the wide variety of disciplines.

In general, I agree with these findings. I have found that little has changed in the six years since this report was issued. While the need for manpower research has never been more pressing, the support that human resources researchers received in the Congress has never been less. On April 7th of this year, the House Armed Services Committee devoted about five pages to the need for personnel research. The House Committee highlighted the following areas: they saw a need for a better technique in forecasting force requirements; they argued for more research to come to grips with the declining manpower pool; they argued for more research to develop optimal physical and mental standards; research on the increased utilization of women; and research on the substitution of civilians for military. It is interesting to note that in the same report the House also slashed many of our R&D programs. In the Navy, the Training and Human Engineering Technology program was reduced by seven million dollars (from nine to two million dollars). The Human Factors Engineering Program was reduced from three million dollars plus to zero, and the Human Effectiveness Program was reduced from about five million dollars to about two million dollars. The message that the House was presenting was clear. While many of the research efforts were in areas of interest to the committee, they felt that the present R&D community was not doing the job and was not tackling the problems.

Well, where do I stand on these issues? I intend to work toward putting our research program and funding in the hands of those who set the lines of communication between the decision-makers and the researchers. I intend to see that at least in the Navy, we reorient our R&D efforts more toward solving problems. My message is really clear, I'd like you to join in these efforts. I doubt that all of you or even many of you here will be enthusiastic about these recommendations, but I would submit to you ladies and gentlemen, that the future of personnel research in the Defense Department is at stake. I hope you will ponder these thoughts carefully in the course of this symposium. If you do not, I strongly believe that personnel R&D will cease to be a viable and justifiable part of the Defense budget. If this occurs, the services, and certainly DoD, will be the losers. But I think, more importantly or equally importantly, you all will be the losers.

I thank you very much for the opportunity to speak here tonight and I'd be happy to answer any questions.

DISCUSSION

CDR DAVIS: You referenced the Ginzberg Report of 1971 and you made a comment that there was too much research coming from the bottom up instead of from the top down. And yet I interpreted the thrust of your remarks as getting the user involved. Maybe I don't understand your perception of user, as opposed to mine, which has the user some place at the top.

DR. ROSTKER: Well, I think there are two parts to that. One is that there's still a great deal of research that is being done for research's sake, that is generated by the research community and is perpetuated by the research community. We get into very comfortable modes, and I think it's only natural that researchers on your staff continue to do the things they know best, which is the thing they did last year, but that's unacceptable. That's one point in terms of the bottom up.

The second point is, I don't accept the premise that the customer is at the bottom of the heap. I think that's one of the real problems. There is a tremendous amount of research that's necessary in a policy sense that can really have an impact on the Defense Department, that can have an impact on the Navy. And the customer for that research is not a naval lieutenant someplace. The customer can well be an admiral who is trying to come to grips with pretty large policy questions in the areas I'm concerned about--manpower, personnel and training. I just don't see why the consumer has to be a lower-level person within an organization. I got a sense of that as the Air Force representative was talking today and said that the customer might be a captain in the Air Training Command. I spent most of my professional life in Air Force manpower, and I understand that remark. I understand those requirements, and I understand the kind of research that is done in response to that. I would also submit that the Air Training Command has some very, very major management problems, that the Air Force has some management problems in training strategies, and that those problems are basically not being looked at. I would be concerned that the kinds of skills that are represented in some of the R&D organizations are not very conducive to looking at some of the broader questions of systems management, efficiency, tradeoff. There are plenty of customers who are at high policy levels who need help badly. And I don't think we are giving it to them.

DR. UHLANER: I think it would be very helpful to me if you could think of some examples anywhere, whether in industry or in other government agencies, where a research program is entirely dictated by the consumer. I'm not challenging it--I'm just trying to think it through. You need a model, but as I wrack my brain I'm having difficulty thinking of one area where the consumer alone lays out the research program. Take the patient in the hospital--does he lay out the research program? Or take any industrial setting--does the

driver dictate what kind of automobiles will be built? I'm not saying it shouldn't be tried, but I'm trying to understand it.

DR. ROSTKER: Let me answer your question from my own background, and of course, that's why I make these remarks. The organization that directed the research we did at RAND was an Air Force Advisory group chaired by the Deputy Chief of Staff (DCS) for R&D and made up of the Assistant Deputy Chiefs of Staff of each of the functional organizations on the Air Staff. That research program, as good or as bad as it was, was done in response to the research needs of the DCS's on the Air Staff. I ran a program that was responsive to the DCS Personnel. A certain amount of the program, by agreement, was kind of free in what I wanted to do, but most of the program was in support of real hard requirements and problems. Those problems were not short term. We consistently avoided, at some political expense, the six-month turnaround and even the year turnaround. And we were able to argue effectively, when necessary, that there were needs for new methodologies, new material, new theories, and new ways of applying existing techniques that were groundbreaking. But we did it in the context of an operational problem for which there was an operational solution down the road. And I think it was very effective. I think it was effective in the logistics area and in the strategic area. We did basic research in areas that might be called operations research. We did some groundbreaking in statistics, but we did it in connection with an operational problem because there was a real need, not because we hired a theoretical statistician to go out and do his thing and fund him on that basis. And that's what I'm really shooting at. That's frankly what my model is.

DR. UHLANER: That, then, was a joint planning effort.

DR. ROSTKER: Yes, it was a joint effort.

DR. UHLANER: That I can understand.

DR. ROSTKER: The guidance we worked under was that the program would be jointly determined by RAND management and the Air Force Advisory group.

COMMENT FROM THE AUDIENCE: I'm having some difficulty. I agree with you completely about the need for the researcher to get into the operational problem area. The thing that is perplexing me is why the emphasis is on high-level policy making and decision making. You apparently are suggesting that we should be focusing our attention on what Congress says on the basis of some evaluation by the House Appropriations Committee of the total spectrum of research that's going on under manpower R&D, which I cannot believe is a well-informed set of considerations. So I'm asking whether you are really saying that there is a set of priorities we should be responding to that are at the very high-level policy-making decision levels. If

help was needed in those areas, I'm sure that almost everybody in this room would be deiighted to plunge in, to the extent that we felt it was possible to do something worthwhile. On the other hand, there's a tremendous amount of research going on at the lieutenant and captain levels, with really significant day-to-day operational problems, which is going to make a real difference, in my estimation, at to how ready the Department of Defense people are to perform their mission.

DR. ROSTKER: I understand. Let me answer at two levels. First, I think if you deal in terms of the budget, in terms of the critical decisions that are going to make a difference to the defense program over the next ten or fifteen years, there are researchable problems at the high level for which we do not have answers and which desperately need good research. Congress is not wrong in their perceptions, and the people who are in the decision-making positions in the Defense Department and the Services--on your own central staffs, on the OPNAV Staff, the Air Staff, the Army Staff--are wrestling with exactly these problems. I'm sure there are good research questions at the captain level. The question is whether or not in a tight budget situation we can afford to answer the captain's problems, whether we can afford to make the changes at the bottom when in fact we have tremendous budgetary pressures at the top and we have a need for research at the top.

There is also a perception problem. With the unmet needs of the Congress, with the unmet needs of the top decision-makers, when they start looking around for candidates for budget cuts, the captain's not standing there saying, "That's really good." And frankly, the press that the human resources R&D community gets from the average Navy officer, Army officer, Air Force officer is not good either. The reputation that the community has is a reputation of doing their own thing, being impervious to the needs of the Defense Department--I'm sorry if that's the case, but group after group, study after study, Congressional action after Congressional action is pointing in that direction. And solving Captain Smith's problems at a training center is not going to bale out this community in terms of increasing problems with the budget. The Navy took a six billion dollar cut in the POM program, and that's going to get translated right up and down the line. And frankly, the person that's going to make those determinations is going to make them based on, "What have you done for me lately?" And if you're working Captain Jones' problems down at the training center, the answer, to the decision maker, is "Not very much."

DR. HAVELOCK: I wonder why you accept at face value what the Congress says about all these programs. I've been trying to listen around and see what people are doing and what kind of research they are supporting, and I don't hear them supporting the kind of research you're talking about. I wonder why you take the view as essentially an activist for the Congress on this issue.

DR. ROSTKER: Because I happen to agree with the Congress, for one.

DR. HAVELOCK: What's your data base for agreeing with the Congress on this issue? Give us a few examples of the research that is being supported.

DR. ROSTKER: It's a matter of priority. You started asking, "Who's supporting other research?" I would submit that there is other research being supported. For instance, last year the Office of the Assistant Secretary of Defense for Manpower and Reserve Affairs went to the Congress to create a two million dollar Manpower Institute because they were not getting the kinds of research to these kinds of questions that they felt were necessary. Incidentally, they went in and asked for O&M funds.

DR. HAVELOCK: Is that wrong, or what?

DR. ROSTKER: No, I don't think that's wrong. I think it's indicative of the fact that these are researchable questions and that they were not able to get the kinds of answers they needed from the existing research community.

COMMENT FROM THE AUDIENCE: I think part of the frustration here is the issue of who is Congress, and that's one we encounter continually in all our public policy efforts. On the one hand, we deal with that part of Congress which is concerned with defense, and they are saying, "We want to do something about women and we want to do something about attitudinal development." But they won't support research on those problems. On the other hand, there's the part of Congress that's concerned with HEW, the U. S. Office of Education, the National Science Foundation, etc., which represents a different point of view. And I think one of the problems everybody is having is which aisle of Congress, at what time, are we listening to in terms of developing public policy. And it seems to me, Mr. Secretary, that as a new administration coming in and as a new effort, part of your responsibility is going to be to help the Carter administration articulate where we are in terms of human resource development and where we want to go. We can probably live with whatever priorities are assigned. But it's the Catch 22 of deciding who Congress is, and where their public policy is more appropriate than the public policy of the executive side of government, that causes great frustration. And I think that your efforts to articulate that are going to be important.

COMMENT FROM THE AUDIENCE: As far as we're concerned, Congress works by committees, so Congress is the committee with which we have to deal. More specifically, it is the subcommittees of those committees with which we have to deal, and then a little bit more specifically, it is the influential members of those subcommittees who are viewing us in whatever way they are viewing us and the influential staff members working for those influential members. That's the Congress as far as we're concerned. I don't know if you agree with me.

DR. ROSTKER: Let me kind of reiterate where I'm coming from. I'm saying that I think that the R&D product of this community should be relevant and problem-oriented. To the extent that it is--and can be packaged in a way that makes it meaningful to a decision-maker, makes it meaningful to the people who have to carry out policy and wrestle with difficult problems--I, and I think others in the new administration, am very willing to support the R&D community. To the extent that we are doing pure basic research, and to the extent that what should be applied research is not being applied (because the researchers are not carrying through since follow through is not to their liking), I will not support it. And I'll work actively against it.

LCDR MAIRS: I think we've had a very distinct message today, first from Captain Clarkin, followed by Admiral Metcalf, and now from you. The message is clear that the R&D community is not responding and that further attempts to elucidate reasons--by blaming the Congress, or blaming some sort of national spectrum that does not appreciate good research--is not really going to help us get on with the task we started out with today. I think we ought to stop that and start developing the answers to the three problems that Captain Clarkin, Admiral Metcalf, and you have identified.

CAPT CLARKIN: May I append a comment to Lee Mairs' statement. And I think Al Himes will recall Admiral Watkin's presentation. On each of the issues you mentioned, Admiral Watkins cited Navy research as making the contribution that prepared the Navy to deal with Congress and to deal with the issues that were most pressing. That was the source of the contribution that resolved the problem or at least ameliorated the problem with Congress.

DR. ROSTKER: Yes, sir.

COMMENT FROM THE AUDIENCE: With the exception of the 6.1 efforts, I am not aware of a single program that is not related to a Navy problem, and so I find myself uncomfortable with hearing you talk about research that we're conducting that is not related to Navy operational problems.

DR. ROSTKER: Part of it is a matter of the way it is presented and the way it is carried through. I had the pleasure of having a number of briefings from Jim Clarkin earlier last month. Most of them were first rate, but I remember one in which a researcher spent about 15 minutes talking about a theoretical model of work and occupations and everything, and it was absolutely nonoperational until he got to the hard things of what he had actually done. And that was exciting to me, as a person wrestling with a problem. Now I would submit that if that type of research could have been packaged, presented and made relevant, and if the researcher had been able to talk in my terms, then there wouldn't have been a doubt in my mind. A lot of what you think is irrelevant is in fact relevant. The question

is, how is it sold, how is it packaged, how is it presented, and what is the follow through? And if we don't do those things, then it's as good as never being done in the first place.

DR. REGAN: As formidable as Dr. Rostker is, there are 25 college students standing outside this door, and I guess I'm probably even more terrified of them. I regret very much that Dr. Rostker will not be able to join us for the next several days, because I thought we might be able to reschedule the program to accommodate what is a critical discussion, it seems to me, for a variety of reasons. But short of that, perhaps we can work out some forum for continuing discussion, which I really do apologize for having to truncate at this time. As you recall, we had planned to have Dr. Rostker's presentation this morning, and I felt I could deal somewhat more easily with Admiral Metcalf this evening. But I didn't realize that it was going to turn out this way. I think you'll all agree that we have heard a provocative set of remarks--that's in the form of a euphemism. But nobody would classify it as entertainment, I guess. We're going to have some now by a group named the National Review Troupe, Mesa College students. They've performed at the Veterans Administration, the Kiwanis Club, the USO, Children's Hospital, City College, and the Psychiatry Department of the University Hospital. At that location they confined themselves to upbeat and happy songs, and they told me that that's what they're going to do tonight, so you can draw your own conclusion. And they're going to come on now whether we want it or not.

MILITARY SERVICE GROUP MEETING: PLENARY SESSION

SUMMARY

In this portion of the symposium participants from each branch of the service met in separate small groups (joined by faculty members and others) to identify barriers to utilization of human resources RDT&E and possible strategies for improving utilization. The groups then reported their deliberations in plenary session.

Dr. Edward Glaser, the faculty chairman, in orienting the conferees to the task of the small groups, suggested that they consider a series of issues regarding utilization that were raised at a recent symposium on the management of federal R&D. At that symposium, it was suggested that R&D project plans should be required to address such questions as: Who are the potential users? How might they be reached? With what incentives to use the product? How might technical assistance aid the adoption process? What are the applications and policy implications of the projected findings or product? How will they be communicated to policymakers?

In the plenary session following the small group deliberations the chairman of the Air Force Group, Dr. Herbert Clark, Air Force Human Resources Laboratory (HRL), reported a number of procedures adopted by HRL to promote better utilization. These included:

- *Collocation of researchers and customers.*
- *Implementation of Air Force Regulation 80-51, which formalized the process by which customers stated R&D requirements.*
- *Initiation of "Trace"--a brief, timely summary of the results of an R&D project.*
- *Establishment of an applications office with responsibility for tracking R&D and facilitating customer involvement.*
- *Introduction of the work unit review cycle.*

The Army group, chaired by Dr. Arthur Drucker, Army Research Institute, addressed the question of how to get sustained sponsor involvement--without losing control. Their suggestions included:

- *Reach agreement in the initial research plan as to when the application phase will be, and who will do what at that time.*
- *Remind the sponsor of his obligation under Army Regulation 70-8 to report on the utilization of end products.*
- *Make the customer a believer in the research through periodic formal and informal reviews.*
- *Get the military to sell the research to the military.*
- *Make use of the Technical Advisory Service.*

There were two Navy groups. One, chaired by Dr. Robert Smith, Office of the Chief of Naval Operations, considered some specific recommendations of the Defense Science Board Task Force on Training Technology that were addressed to utilization. This group noted:

- *The need of the R&D producer for specific guidance as to product requirements.*
- *The need for cognizance of the resource programming cycle.*
- *The need for more direct ways of communicating the fleet's problems to the R&D setting and R&D results to the fleet.*
- *The possibility of special billets within the fleet to assist in implementation.*
- *The need for joint planning for utilization by R&D users, sponsors and producers.*
- *The need for producers and operators to have greater familiarity with each others communities.*

The second Navy group, chaired by Dr. Glenn Bryan, Office of Naval Research, reported a number of suggestions for improving the utilization of people-related R&D, including:

- *The need for cross education of researchers and users, including an intensive process of getting acquainted and the need for requirements to be stated in language that researchers can understand and reports to be tailored to specific users.*
- *The need for early and reiterated cost-benefit analysis of R&D products, where appropriate.*
- *The need for formal mechanisms for involving users with researchers in all stages of the research.*
- *Need for recognition that the customer for some (basic) research is another (mission-oriented) researcher.*

The moderator of the plenary session, Dr. Jay Uhlaner, Army Research Institute, contributed several observations:

- *No single utilization strategy will do the job. For example, different solutions may be required in different program categories (6.1, 6.2, etc.) and for different users.*
- *Utilization is part of program development, and consequently solutions must take cognizance of the life-cycle management of the total program development.*
- *There is need for more "horsepower" at various levels of the applications engineering effort.*
- *There is need for procedures by which a community of users can prioritize their requirements so the research community can carry out a balanced program.*
- *DDR&E should be apprised regarding reasonable expectations for payoff in the various program categories.*
- *Strategies are needed for exploiting the specialized competence of each player (e.g., operator, researcher, research manager) rather than assigning all tasks to everyone.*

MILITARY SERVICE GROUP MEETING: PLENARY SESSION

GROUP INTERACTION GUIDANCE

Dr. Edward M. Glaser
President
Human Interaction Research Institute

In planning this conference, we gave a good deal of thought to its length since one doesn't lightly ask people to take off 3 1/2 days to attend a meeting. The reason that we did it this way is reflected in the opening remarks made by this morning's speakers. Research utilization is a difficult and complex problem, beset by many obstacles and it will take time to reduce, let alone resolve them.

Last week in Washington, there was a two-day symposium on the management of federal R&D. Glenn Bryan was there, as was I. Glenn made an important point that has not been mentioned this morning. He stated that before you get to the stage of investing a good deal of time, energy and money in promoting the utilization of any R&D outcome, you should cross-validate it and determine if it truly works under operational conditions.

Now, considering the fact that research by its nature is something of a risky business and there is no guarantee that every hole you drill, so to speak, will produce a gusher, there is something that follows from that in relation to the GAO report. As I recall the GAO figures, they indicate that while quite a few of the projects have not been used, according to their criteria, 56 percent have been used. The fact that a majority of the projects did, according to their investigation, find application seems to me a rather commendatory finding. That doesn't change the fact that they found 38 percent that have not been used. That figure can be reduced significantly by some of the activities that Admiral Metcalf and Colonel Taylor suggested this morning in terms of early relationship with the user.

At the symposium last week, one of the points made that might be relevant for your consideration at this conference was that utilization would be facilitated if more R&D funding sources required applicants to think about the following sorts of questions in preparing research proposals:

1. Who is going to care about what has been found out or developed?

2. What categories of institutions, groups, or persons would constitute the audiences, beneficiaries and potential users

of the findings if they turn out to be valuable and ready for dissemination?

3. How might these potential users be reached?

4. What incentives or procedures might be employed to interest them in wanting to try the innovation?

5. If an offer of technical assistance is desirable to facilitate the transfer or adoption process, how might that be provided?

6. How do anticipated findings of the project relate to service delivery and support systems, given program efforts, teaching, training or staffing efforts, other R&D activities?

7. Might the findings from this project have policy or legislative implications? If so, for whom? At what levels? What sorts of implications?

8. And what is the plan for bringing the findings to the attention of various relevant categories of policy or political decision-makers?

When you break into small groups this afternoon, you might find it relevant to consider questions like those just enumerated in addition to the ones that have been included in the boxed-off material on pages 10 and 11 of your conference agenda.

The rationale for breaking into small groups is twofold. One is that at a conference where a major part of the time is spent listening to talks, however interesting and stimulating, audience participation is limited. You are very knowledgeable individuals who have many experiences and perceptions to share with each other. Small groups promote the active participation which we need. The other is that the Army, Navy, Air Force and Marine Corps have unique problems in addition to their common problems, and thus, each service needs time to identify its own problems and its own proposed strategies for coping with them.

AIR FORCE

Dr. Herbert J. Clark
Chief of Plans and Programs
Air Force Human Resources Laboratory

We had a rather interesting discussion about the different procedures that the Air Force has adopted to encourage better utilization of R&D.

It may be useful for me to discuss some of these. I am speaking primarily of the human resources program of the Human Resources Laboratory rather than the Air Force as a whole.

The Human Resources Laboratory (HRL) was established in 1968. There was concern at that time that R&D products in the human resources area were not being implemented adequately. So one of the first decisions was that the researchers should be collocated with the user. Instead of continuing to conduct our R&D and flying training and technical training at Patterson Air Force Base, we established two divisions, one at Phoenix and one at Lowry Air Force Base for flying and technical training, respectively.

Collocation proved to have many advantages. Our divisions can work directly with the customer; we can use Air Force trainees as research subjects; and we can communicate much better with the customer.

There are also disadvantages as far as HRL headquarters is concerned. The distance creates management problems; there is a tendency for the division to establish an extremely strong relationship with the customer, and sometimes become more responsive to the customer than to headquarters.

Another procedure that we implemented in the laboratory to ensure good communication and contact with the customer was Air Force Regulation 80-51. Basically, this requires the customer to submit a formal request to the laboratory when he wants assistance in R&D in personnel selection and classification or flying or technical training technology. The request does not come directly to the laboratory; it goes to the Air Staff and the Systems Command and, at the same time, we make a technical evaluation of that request. If it is within our resources and capability to conduct the R&D, we will carry it out. The end result is a formal relationship with the customer. There are some pros and cons to this, and I would like to come back to them in a moment.

In working with the customers, we have had numerous complaints that the results of R&D projects are not received soon enough and are poorly communicated. So we have established something called a "Trace," which is a quick summary in layman's terms of the results of the study. Sometimes this is distributed several months before the technical report is published, and deals quite well with the problem of providing the customer with something formal. It is also distributed to other interested parties both inside and outside of the Air Force.

In addition, we have established a separate applications office (I think the Army and Navy already have a number of these) which has the responsibility of tracking the R&D to guarantee that the customer understands it and knows what steps to take to implement it, if this is appropriate, and to do cost analysis both at the beginning and end of a research project.

We have also introduced a work unit review cycle, which requires that all work units in the laboratory be reviewed at least twice a year and that at the time each work unit is established the benefit to the customer must be identified, and an estimate of return on investment must be made.

We have three R's in the laboratory for establishing priorities and implementing research programs: a requirement which can either be from a customer or in-house, the available resources to support this requirement, and the expected results. If the anticipated results are reasonable both in the eyes of the laboratory and the customer, we will undertake the project. However, we are insisting more and more that the customer understand and support what we are doing. Otherwise, we have found that he may be disappointed with the results and refuse to implement them.

In the group we discussed the pros and cons of having a formal procedure for ensuring implementation of research products. At HRL we have tried to avoid the formality and depend on the goodwill of both the customer and the laboratory, but it has not worked out very well. The group felt that it is necessary to have a formal regulation which requires a written agreement between the laboratory and the customer with reference to each research project. This raises some issues, however. For example:

1. Since the customer submits requirements throughout the year, and we respond to them, what happens if we run out of money?

2. Should these requirements be funded individually or should we take the money out of one big pot? If the money comes out of one big pot, we may find out that at the end of the fiscal year we are out of money and can't satisfy the requirements.

3. A limitation in the regulation is that all of the requirement for communication seems to be on the laboratory; e.g., to provide project results to the customer. Now the regulation is being revised to require that the customer, upon receipt of the results, give feedback to the laboratory through our higher headquarters, indicating whether they are satisfied or dissatisfied. I think this was brought about by the GAO study and we hope that in the future we will be in a better position to know what proportion of our R&D has been implemented.

4. We discussed the question of what criteria are appropriate for determining whether or not a product has been implemented, but we didn't reach any firm conclusion on that. I think that is an extremely difficult question to answer and probably requires a symposium in itself.

In terms of recommendations for the symposium, we envision that what we are talking about today is simply food for thought, and that as

time goes on, we'll be able to develop some specific recommendations. Perhaps out of this symposium can come recommendations that, after appropriate service staffing, could be forwarded to DDR&E; for example, for their consideration. It would be appropriate to have this meeting produce a concrete product that can be utilized rather than simply a reiteration of issues that I'm sure we all have discussed in the past and will continue to discuss in the future.

What I have tried to pass on to you today is simply some of the procedures that the Air Force uses for carrying on its business of implementing its R&D products, and some of the perils involved in the techniques that we have developed.

DISCUSSION

QUESTION: Do you feel satisfied with your current procedures for achieving involvement with users?

DR. CLARK: I would say that I am quite satisfied with the procedures. In the past we would often get an informal request from a customer, who might be a captain in the Air Training Command, for a particular research activity, and nobody has ever heard of the requirement. As it stands now, our formal requirement comes from the Systems Command and is paralleled by a requirement in the Air Training Command. They now have a research review board. Before they send a requirement to our laboratory, they staff it so that Air Training Command is sending the request. There is a formal record of this; if the captain leaves, it doesn't matter. And we can go back to them and brief them periodically; they know what the status is. And I think that has worked out well.

In addition, in some cases we have been a little short of funds and we have found that at times the customer has come to our rescue by providing travel funds or letters of support to our headquarters to ask that funds be reinstated to our laboratory for support of their programs. I think that there are some problems, though. One of the major problems is that as you get involved in this sort of applications orientation, the personnel have to come from somewhere, time has to come from somewhere, and that comes from the R&D program itself. And this is of some concern. It is also of concern to the degree that the customer is sometimes a little shortsighted and is only looking at an immediate problem. We feel that we have to keep a balance between the technology base and the technology applications program, but requests from the customers are generally short-term, high-payoff, simple problems, perhaps just technology application. This tends to drive the program, and I view that with considerable concern, because I don't think we should become so deeply involved with the customer that we don't have a technology base program. As it stands now, about 50 percent of our program is oriented toward response to customer requirements. That may involve technology base requirements too, but typically does not. The other 50 percent is self-initiated in response to a requirement or need that we sense.

QUESTION: Does the Air Force cover that side, the self-initiated side? How does it get formally processed through the channels?

DR. CLARK: There is a procedure in the Systems Command, particularly in regard to the 6.3 program, it is called the investment strategy procedure. For each of our 6.3 programs, we prepare a technology program plan, which we send annually to the potential customers. They make an evaluation in accordance with the particular format described in the regulations. They send this evaluation to our higher headquarters, saying, "This is a good project; we support it." They grade it, they rank it, and so forth, and that has considerable impact on whether or not that 6.3 project will be funded.

The 6.1 program in the Air Force is consolidated in one organization, AFOSR, who controls the funds. We tell them what we propose to do, and if they like it, it is their responsibility (along with ours) to ensure that the customers like it too. But if they don't like what we are doing in 6.1, they can reorient us; they can change our funds.

In the 6.2 area, the primary controlling mechanism is the work unit review. Each new work unit is required to establish schedules for the completion of that work. The initial work unit review is conducted when the work is started and is kept in the file. Then, twice a year there is a periodic work unit review (once by the division, once by the headquarters), to determine whether you are on schedule and whether the product that you are planning will, in fact, occur at the time that you are expecting it to. But not every 6.2 program has a product. I think we've talked about that this morning. I don't think everything we do should necessarily have a customer in mind.

QUESTION: Where is the balance between 6.1, 6.2, 6.3, and 6.4 phases of the total program? Where is that decision made?

DR. CLARK: In Congress. As a matter of fact, our program was just cut.

QUESTION: I mean before that; how are decisions made about what the Air Force presents to the Congress?

DR. CLARK: The balance between 6.1, 6.2, and 6.3 within the laboratories has been somewhat the same over the years and it doesn't vary appreciably, no matter what you might submit in terms of justification for additional funds.

QUESTION: Since you have adopted the formal procedure, what has been the demand from the user community? Is it increasing, or are you able to hold it in check, or are you able to maintain this kind of 50-50 balance with the technology base program, or is it an increasing function?

DR. CLARK: It turns out that we complete RPRs (user requests) at a rate that has enabled us to maintain the 50-50 ratio with self-initiated

research. On occasion, we have had to defer an RPR until the next fiscal year. If we have to have contract funds for it, we will need to defer it until the next year.

QUESTION: I have a question on who prepares the cost benefit analysis. Presumably it would be the customer if he initiated it, but if somebody within your laboratory wants to do it and goes in search of the customer, does the researcher prepare the cost-benefit analysis or does the customer do it?

DR. CLARK: At this point, we haven't asked the customer to do a cost-benefit analysis, and, in fact, he has often asked us to do it. Although our new applications office is small, we do have a cost-benefit analysis capability in that office, and on selected programs we do ask what the payoff would be. If it is a simulator program, for example, we would like to know how much that simulator is going to cost, when it is going to amortize itself, and what the difference is between the simulator and flying the airplane.

DR. UHLANER: I think we might now ask Dr. Drucker to present the report from the Army group.

ARMY

Dr. Arthur J. Drucker
Chief, Plans and Operations
Army Research Institute
for Behavioral & Social Science

Our group, which essentially consisted of members of the Army Research Institute (ARI) and the Human Engineering Laboratories (HEL), talked of many things. We were assisted greatly by some walk-in faculty members who were most helpful in stimulating the discussion.

Although we talked for about 2 1/2 hours, my presentation is very brief. It is a distillation of what we regarded as a major problem in utilization--how to get sponsor involvement and keep it throughout the research and into the utilization phase. We decided that if we could get the sponsor's involvement at the very beginning, if he was sincere about the requirement, if he was still around during and following the research, and if the situation giving rise to the requirement had not changed, we would be in pretty good shape.

But how do we get his involvement without losing control? This has been a very real problem. We decided, without exploiting our experience as clinical psychologists, that this was perhaps a matter

of personalities. If we happened to get the right kind of sponsor, we were in pretty good shape. But that was a risk. We have had too many instances of the camel's nose in the tent and yet we have faced up to that problem where we had, indeed, been in bed with the sponsor and his representative, and managed to stay alive researchwise.

Following are some of our suggestions for stimulating sponsor involvement without losing control:

1. Try to get an agreement, in the original research plan, as to when the utilization phase will be and who will do what at that time.

2. If necessary, lean on Army regulation 70-8, which goes into considerable detail concerning the establishment of requirements and the building of the program. It includes two sections on what the sponsor is supposed to do, by regulation. One section of this regulation requires the sponsor to report on the utilization of end products when the research is completed. It requires statements of how it was utilized, what his reactions were to the research, and what changes he would have preferred in the way the project was carried out.

3. If he is not already a believer in the research, make him one, even if you have to resort to the IPR (In Process Review) which is part of regulation 70-8, or preferably an ipr (informal periodic review). In our experience, this has been more satisfactory, since we can get down to the task unit level and really work with some of the sponsor representatives in considerable detail and obtain their cooperation.

4. Get the military to sell the product to the military when the utilization stage is near. This has worked out well for the Army both at ARI and HEL (e.g., ARI's effort with computer-based training, the skill qualification test, REALTRAIN and HEL's health act).

Another form of utilization that we have perhaps not given much attention to is TAS (Technical Advisory Service) as it is practiced in ARI. TAS is particularly important in the 10 field units which we have working within Army installations. Through TAS we help pay our rent, so to speak, to the installation. We provide services to the installation commander; we gain acceptability; and we advise him on the proposals that he may want to consider (e.g., don't spend money on this; 20 years ago we researched that problem and we are pretty sure the answers we derived then are the answers today).

You know that you have really made it with the sponsor when, at

the conclusion of a piece of research, he tries to give you O&M money that he wants you to use for what would pass as a 6.4 utilization effort. Should we encourage him to do that? Well, sometimes we do and sometimes we don't. I say that with 6.4 type effort, perhaps it is O&M money that he wants to pass to us. I'm not quite sure what I'd recommend--to accept or not. I'll leave that to my boss here (Dr. Jay Uhlaner).

It was also pointed out in the discussion that there probably is more utilization of our products than we will ever know. For example, ARI puts out about a thousand copies of every technical publication; these and other products get into the public domain. The GAO hit us on this, and one of our resolves in the group was that we certainly should keep better records of where our products go, who gets them, and where we should try to gain credit.

We then discussed one of the questions on the agenda: "Is there significant opportunity for enhancing the transfer of certain military RDT&E findings to the private sector?" We feel that we have a long record of transmitting such products in the form of publications and other nonpublication products to the public sector. I could talk at considerable length about selection tests that have been transmitted to the private sector, such as state and city governments, even some foreign governments when we are permitted to do so. In the release process to the public sector, we have had incidents of test compromise where there was need to safeguard tests and products of that sort against such compromise.

Finally, let us talk very briefly about Question 6-B: "What long-run changes are necessary to improve utilization?" If we ever go to a formal 6.4 program, it is our feeling that we should try to staff such an organization, if we could afford it, with middle-level scientific talent. It is our considered opinion that we do not need the very high-level talent, except for the directorship of such efforts; GS-11s and 12s might very well suffice for that kind of operation should we ever get to that point.

DISCUSSION

QUESTION: I understood you to say that ARI publishes and distributes research reports. What I didn't understand was something you said right after that to the effect that because of GAO's comments you would have to get your house in order and know better who gets them. I don't understand how you distribute something without knowing who gets it.

DR. DRUCKER: Well, as far as original distribution, we do know who receives the reports. In my remark I was reflecting the question regarding which of those thousand recipients were the ones who should not only have received it but also owned up to it when GAO came around to check up. I think we all had that kind of difficulty and

frequently when GAO went to the designated sponsor or user, they drew a blank; that is, the person they checked with in that command did not recall receiving the report.

DR. UHLANER: Let me elaborate on that for just a moment. We sent it out on the standard distribution but GAO randomly chose recipients to check with. Some of them said, "I never saw it." It was addressed properly, but for all we know, it might have ended up in the library or with an assistant or somewhere else. I might point out that GAO used us as sort of the initial training ground, and so some of the things that happened later, we hope, got ironed out after they were through with us.

QUESTION: Why do you assume that the formal 6.4 program is such that a lower level of technical people can be used?

DR. DRUCKER: The specific reasoning behind that remark was that less creativity or scientific talent seems required for application. That was one reason. Another was that many bodies would undoubtedly be required, so there is a matter of pure economics.

QUESTION: It seems that what you are saying in the attitudes you are representing is that application research is beneath the dignity of the researcher, and, by God, he shouldn't get involved in 6.4.

DR. DRUCKER: Well, I don't think we intended that. It is a point well taken, and I agree that that is a bad and erroneous impression.

QUESTION: You really need to think about a range of levels within each of the 6.1, 6.2, 6.3 and 6.4 levels; in fact, a lot of research can be done by people on all those levels. But you seem to assume that translation or transformation functions are at a much higher order of skill than application functions. One of the problems is that you did fail to recognize the complexities and skill requirements for effective application.

DR. UHLANER: We'll come back to that point, but I think I'm going to postpone that until we hear the other discussions. Let's move onto the Navy, under the chairmanship of Bob Smith.

NAVY, GROUP 1

Dr. Robert G. Smith, Jr.
Assistant for Training
and Personnel Technology Planning
R&D Plans Division
Office of the Chief of Naval Operations

I think it is important in light of the preceding discussion that I sketch some of the major managerial outlines of the Navy R&D program, as a context for things that will be said later.

Within the Navy, the Assistant Secretary of the Navy (Research, Engineering and Systems) has control over R&D appropriations, and he delegates responsibility for RDT&E management to different parts of the Navy. The 6.1 (Research) responsibility goes to the Chief of Naval Research. The 6.2 (Exploratory Development) responsibility goes to the Chief of Naval Development, who also holds a position in the Naval Material Command. In general, the work there is planned through a series of strategies, and Jim Regan, the Technical Director of NPRDC, is the principal strategist for the training and personnel area. The control of 6.3 (Advanced Development) and 6.4 (Engineering Development) work is delegated to the Office of the Chief of Naval Operations. The Director of RDT&E (OP-098) implements the responsibilities of the CNO in this area. His office develops and staffs requirements for the 6.1 and 6.2 work, and operational requirements for 6.3 and 6.4 work. There is essentially a matrix organization of 6.3 and 6.4 activities; someone from the Director of RDT&E's office is paired with a sponsor representative from the appropriate office within the CNO's staff. (I, for example, am paired with Merle Malehorn, representing the Director of Naval Education and Training in training and education work, and Mike Letsky, representing the DCNO (Manpower) in manpower and personnel work). This is an outline of how the Navy system works.

The group that I chaired was supposed to consider some specific recommendations of the Defense Science Board Task Force on Training Technology, especially those that dealt with the utilization of training technology R&D. We broke up into groups, and each one addressed a specific issue.

The group on training devices reported that with regard to application programs, some parts of the Navy were better than others in seeing that 6.2 and 6.3 work in training device technology was brought to bear on the actual production of such devices. Their recommendation was that we try to see if we could bring the other groups up to the same high level of this one. On the research side, the R&D producer felt that he needed guidance on what kinds of specific products to produce in order to support utilization.

The group that was concerned with technical training developed the outline of an important model for implementation beginning with interaction on requirements, going through the R&D process with parallel activities between the R&D producers and users, and winding up with the actual planning and implementation of the work. They were especially concerned that it takes roughly three years to plan the resources for utilization, and so were trying to see how the R&D and planning activities could be meshed.

The group that was concerned with fleet training felt that improvements needed to be made in a variety of ways and that better ways of communicating results to the fleet and more direct ways of getting the fleet's problems back into the R&D setting need to be developed.

There was a suggestion that the development of implementation billets in various places within the fleet be considered so that assistance in implementation can be offered.

One Navy agency that plays an important role in supporting the Chief of Naval Education and Training with immediate short-term analyses and evaluations is the Training Analysis and Evaluation Group directed by Al Smode at Orlando. For some time, I have felt that it would be extremely useful to bring together NPRDC and TAEG so that, on selected work, TAEG could serve as a bridge between the R&D community and the school community. There has been a preliminary general agreement that this will be tried by the end of the year; there should be a plan developed with some specific provisions for this bridging function.

Another committee was asked to deal with the subject of linkages between sponsors, users, and R&D producers. They noted with considerable interest that the Chief of Naval Education and Training recently met in Memphis to discuss joint planning for utilization by R&D users, sponsors and producers. Hopefully, this will result in some specific actions for the 1980 POM and budget. That activity starts this fall. This group also pointed out that very often the scientist is in a position of wanting to see his work used, but at the same time, is not sufficiently familiar with all the details of the planning processes that are required to accomplish this. There was a feeling that the scientist needs to get a broader and more thorough knowledge of the Navy and how it works, especially that part of the Navy toward which his work is aimed, and of what is needed to implement research results. Those are the principal points discussed by my subcommittee.

DISCUSSION:

QUESTION: I would just like to supplement what Bob said about the last working group, of which I was a member. We also felt that the operational military man, in general, needed to be familiar with the whole R&D enterprise--who is watching what and the system the research is worked under, the constraints and the limitations. That does not seem to take place in the Navy; I wonder whether it takes place in the Air Force and the Army; do they get this at the War College academies?

DR. UHLANER: I will comment for the Army. My impression is that you almost have to be an R&D officer to really understand the R&D system in the Army, so that, for example, the typical best-qualified officer is usually not exposed to the workings of the R&D process. It is not his fault; he is just not exposed to it. I don't know about the Air Force.

DR. CLARK: I think for the most part the people in our chain are well versed in R&D procedures throughout the system. I am thinking of the people who represent us at higher headquarters, the military

officers. I think, in general, they are well selected and understand the procedures but, certainly, they are not as emotionally involved in the methods of R&D as the research scientist because they have not worked at that level.

QUESTION: How are fleet requirements communicated to operational decision makers in the Navy, and then to the R&D community?

DR. SMITH: There are several ways whereby fleet requirements are communicated to the higher reaches of the Navy. One is through various fleet readiness reports in which a variety of specific problem areas that affect readiness are cited. These include mostly short-term problems, but if you see the same things cropping up each quarter, with a little imagination you can often convert some of them into R&D requirements. The fleet clearly can pose formal operational requirements; for instance, very recently we were stimulated to produce a whole range of operational requirements because of the fact that the fleet is suffering from a lot of objection to its use of certain land for bombing and gunnery ranges. And so this stimulated us to generate requirements aimed at reducing noise and destructiveness of weapons.

DR. UHLANER: The last working group was chaired by Dr. Glenn Bryan. I think he is well known to all of you so I won't take any more time other than to give his current title which is Director of the Psychological Sciences Division, Office of Naval Research.

NAVY, GROUP 2

Dr. Glenn L. Bryan
Director, Psychological Sciences Division
Office of Naval Research

I would like to elaborate briefly on Bob Smith's comment about how 6.1 money is managed in the Navy. It is given to the Chief of Naval Research, who has several responsibilities, one of which is to serve as the senior officer in charge of the Office of Naval Research. Actually, he is in charge of the whole 6.1 appropriation, wherever it is spent in the Navy. In the military science program, that is $178,000,000, some $80,000,000 is spent under contract research programs in the Office of Naval Research. The bulk of it is spent in various laboratories and SYSCOMs, and he is responsible for that as well. And we in the Office of Naval Research are responsible for that only indirectly, insofar as we might serve as staff to him regarding certain questions that he may have and wishes us to be concerned with in the oversight management of that and other programs.

I quite expected when I saw that I was going to be the last man up that I would be able to say, "me, too" or "as he said" a lot, and am rather surprised that there is not more of that in the notes I have before me. Part of that, I suspect, is because we approached the matter differently than we were told to do. Instead of starting out with the questions in the box, I asked the group to consider what one actionable thing they would ask the tooth fairy to give them to improve the utilization of research and development in this people-related area. I have great confidence in the tooth fairy; she has never let me down. The group also seemed to exhibit a certain amount of confidence, so they were willing to play the game. We got 17 or 18 suggestions, which Wally Sinaiko and I tried to organize after the meeting. What I have before me now represents an incomplete and somewhat fragmented account of what the group had in mind.

The first item, the need for a great deal of cross-education, cross-fertilization, communication, or whatever you wish to call it, in fact, was mentioned several times. It seems to involve the idea that it is important for requirements to be properly stated and reports to go back to the potential user properly tailored in his language and to his needs. And this means that reports may have to deal with specific cases, tailored to an individual user or class of user. It entails a great deal of access, a great deal of opportunity for the researchers, research managers and users to come to know each other. One of the people suggested that it has proved useful when the circumstance exists for some trusted member of the user staff who is well aware of the concerns of his command to sit in on all of the meetings that go on and acquaint his command with certain research activities that may be of benefit, interest or use in dealing with a problem that has just surfaced at a staff meeting.

So there seems to be a consensus regarding the idea that all members need to better understand how the world works and what the world looks like. Someone summarized this by saying that it would be highly desirable for us to develop a model so that we would all know it is a complicated and complex world which looks different from the various perspectives of researcher, manager, user, operator, high seas, shipyards, and so forth; and that it would be useful to have a master model that somehow or another puts this all together. I think we might, the tooth fairy might, be hard pressed to answer that particular wish.

The second thing that was discussed frequently, avidly and noisily was the role of cost-benefit analysis--who should do it, when it should be done, what role it should play, and what should be done about research that does not seem to submit itself easily to that kind of treatment (i.e., what do you do if you need a cost-benefit analysis in a highly subjective area and you can't produce one?). The group agreed that cost-benefit analyses were useful, they ought to be done, they ought to be done early, they probably ought to be reviewed or redone retrospectively, and that there were some kinds of research for which they were not appropriate. In these

cases, decisions would have to be made as to whether or not to insist on cost-benefit analysis, go along without them, or refuse to do the research since cost-benefit analyses were not available.

The role of cost-benefit analysis in utilization, in case that point has escaped you, is that the potential user can more quickly and intelligently decide whether or not to attempt to utilize something if he has the cost-benefit information.

Another point, that may be related to the first point, is the apparent need for formal mechanisms that do not exist in the Navy which require involvement of potential users, researchers, and research managers at all stages of R&D from the very earliest conceptual design or the glimmer in someone's eye all the way through to the time that the thing is, in fact, put in place and someone can be assured that it is being fully and effectively utilized. When being pressed for an example, the individual who suggested this indicated that he was involved in software development, and in that area the procedures required that you prepare functional specifications which were discussed and argued out and agreed upon as a first stage. And then you go on to the next stage where the user and the person producing the software were sitting on opposite sides of the table but were trying to come to precise and complete agreement on that stage, the user recognizing his responsibility for participating avidly and intelligently in that process--a highly desirable state of affairs.

If I may be permitted a personal comment, let me say that one of the things that troubles me is the unavailability of users or potential users who are willing to join in that kind of process in such a continuing and time-consuming way. It seems to me that it would be advisable for that to happen. It has also been my experience that there are many occasions where representatives of the user community plead that they are too busy to involve themselves in this way, and it seems to me that that is very unfortunate indeed.

Back to the group, in talking about this interaction between researchers and users, one of the members of the group who has had many years of experience as a researcher and has been very effective in producing research that has gotten utilized, pointed out that we must not make the mistake of thinking that the user is only someone who lives in Washington, who reports to some headquarters, and is a very senior person. Many users exist elsewhere, at lower levels of the organization. It was his recommendation that researchers have an opportunity to involve themselves with, come to know, and live with, if necessary, the people at the operating levels of the organization in order to know from personal experience what the problems are. Under those circumstances, it would be more likely that research would come out in a useable form.

Going back to the comment Admiral Metcalf made about building bridges, one member of the group suggested that perhaps we need a lot of

different bridges, some of which are just short bridges, such as from the basic researcher to the mission-oriented researcher.

Another theme that came up and was discussed to a great extent, perhaps more in this group than in others, was that research utilization problems are by no means limited to the Defense Department or to personnel and manpower areas. They exist everywhere. One of the members of the faculty that was present said he was encouraged by the fact that the Defense Department was willing to address itself to the problems of utilization and that the researchers were so willing to participate in the discussions, since the agency that he was affiliated with was not yet willing to confront these difficult and sensitive issues.

I would again like to step out of my role of group reporter and speak on my own behalf. There was a lot of talk about research management and the advisability of shifting it from one location to another. I made a comment to the group about that and would like to repeat it now because I think it is very important.

Research management is a difficult "black art." It is not something that you just assign to someone as a responsibility and hope that it will be done well. If you do assign an inept research manager to a laboratory, there is no question in my mind that the quality of the research will plummet. One has to be very careful in realigning the research management enterprise, but that is not to say that it should not be realigned. I am just saying that you should be certain that the person assigned to the job knows how to do it and has the freedom and flexibility to permit him to carry it out. Just putting that title on somebody's door is not going to ensure that a good job will be done.

Along these same lines, the group pointed out that in our business, particularly in certain aspects, there exists a kind of "catch 22." The user won't become a "true believer" unless he sees it on his ship and his watch, but at the same time he may not allow the researcher to collect any data or do any work on his ship and watch. This is a serious problem that presently is handicapping the Navy's research in the human resources area. We have a couple of minutes for questions.

DISCUSSION

QUESTION: Whose responsibility is it to see that promising research findings get implementation, and what is the chief barrier to utilization?

DR. BRYAN: We are all now at the management level and have forgotten what it is like to do research. The scientists are interested in the completion of research, are anxious to move on, and are not dedicated to having the research product implemented; they want somebody else to do that. The solution to this problem is not to give up implementing

the research product but to give the researcher's supervisor the responsibility of getting the research implemented.

In potential users, the major problem is resistance to change and the resistance is primarily because they are quite busy doing other things and do not want to take the time that is required to make changes that are necessary in order to implement the research product. So it is primarily a matter of education. Potential users are not sufficiently educated that they are the key "gate-keepers" to research utilization. This should be specified at the very beginning, when there is an agreement to conduct the research.

QUESTION: Why don't researchers themselves take a more active job in promoting utilization?

DR. BRYAN: We who have been and are doing the research generally are not interested in implementation; we need other groups of people to work with on that--a combination of officer personnel and civilian operators.

DR. UHLANER: I would like to take a few moments to make some comments which I hope will give us a guide for some of this week's discussions. As I was listening to this report, I got the feeling that the working groups were excellent with respect to diagnosis but, with the possible exception of some of the remarks from Glenn, I think much more work needs to be done in terms of planning action steps.

A second thought I had is that it is becoming very clear that no one utilization strategy will do the job. You need a whole variety of strategies which are appropriate to the different aspects of the program. It is very clear that one that might be used for, say a 6.3 type effort, is probably inappropriate for 6.1 type effort.

A third point that seems to be very critical here is the fact that in our discussions we've tended to lump all the consumers together as one group. I think we have many different groups to deal with. It is quite true that the informal contact between the scientist in the field and the various officers who have some of the immediate operational problems is one kind of activity. However, I do not think any of the discussions really wrestled with the questions of how a new large project gets presented to the research and development advisory committees in each of the services so that such a project can be considered by the system in competition with the hardware R&D kind of project. It seems clear that an entirely different set of procedures are required to achieve this. For one thing, those people are very much aware that when they underwrite a particular project it may be as much as five or six years before the project bears fruit for a particular service. That realization in itself is a starting point in terms of the utilization process.

Another thing that has not been stated is that all of the utilization discussions are really part of program development, and unless one

looks at the life-cycle management of the total program development, it may very well be that we will be utilizing our own approach to utilization in a very scattered and fractionated way. You have to relate to the entire life-cycle management context.

I would like to strongly endorse the point that was made that we are short on large-scale application engineering expertise. I, for one, do not believe that this is an activity that can be manned by junior or lower-level people. It is a very challenging and high-level activity. What I do see is a great deal of potential for developing that kind of application capability. We have very high-level appointed officials in positions such as assistant secretaries, deputies, and so on, or in the uniformed staff divisions of the various services, but rarely do we have an organization whose job is application engineering on a high level and with the great deal of skill which it obviously requires.

Let me see if I can pull together some of the things that were emphasized. Almost all of the presentations mentioned the need for improved procedures of some kind to facilitate relations with the consumer. However, I have not heard addressed the problem of what happens when a consumer's requirements exceed your capacity. Unless the other services are different from my own, the Army, the consumer's requirements typically do exceed the available resources. In our case, it runs from 3 or 4 to 1. It is very clear that the consumer who brings in requirements thinks that his are very important and, indeed, to him they are. What happens when you as the research manager or lab director say to him, "Well, we are not able to meet your requirement."? Is he likely to come back the following year or the year after that? What I am leading up to is that it seems there is a real need for a procedure for prioritizing research requirements which is not done by the laboratory but rather by a community of users. I don't care what the particular format is. We need to avoid getting into the situation that because training is very powerful, personnel and manpower are sold short. Some kind of balance is essential and I do not think we have really worked out a procedure where we can guarantee some orderly process where this balance is guaranteed.

Along this same line, I think it is very critical that DDR&E also be apprised of what the problems are in terms of such issues as what is appropriate by way of successful products which are worthy of utilization in research categories 6.1, 6.2, etc. I have heard from prior groups who admittedly are more academic-minded people that they felt a 12 percent success rate of utilization was quite good. Now here we are talking about 58 percent being inadequate. I am not proposing to answer it, but I do think it is a rather important question. Why? It seems to me that we can probably project a 100 percent success rate by structuring the problems in such a way that they are very mundane, very unimaginative, and very low risk. If I predicate that we are going to build a new form of vocabulary test, the likelihood of that failing is almost zero. But if I predicate

that we are going to do some research on the improvement of officer performance for purposes of command, then I think we have an appreciably higher risk situation.

The next point that I think needs some attention in the group is the question of how one makes use of specialized capabilities in accomplishing the overall task of program development and utilization. It seems that we are assigning each of the responsibilities to everybody. I think there is a role that the uniformed R&D manager, the lab director, the user, and each of about 10 to 15 others would play specific to his particular specialty. I do feel that there is need for spelling out who does what which way.

I am just curious. How many in this room have been involved in defending what is called an "unfunded requirement" for a new project? I'd just like to see a show of hands. A small number of hands went up, which is what I expected. Now, how many of you have had to explain a particular research result to a user at any level for his use? I would have expected almost all hands to go up. I think this illustrates, very crudely perhaps, that different aspects of this total cycle really require different kinds of skills, different kinds of positions, different kinds of talents, and yet they all have to be brought together in order to achieve the ultimate objective, which to me would be to get the best possible product which would satisfy the greatest number of decision makers (including both the Congressional Committees, the GAO, DDR&E and all the services) for a given dollar. When we have achieved that kind of thing then it seems to me that we have almost reached an ideal. With that thought, I would like to encourage the working groups to continue deliberation on this problem.

REFLECTIONS FROM THE OPERATIONAL COMMUNITY

SUMMARY

In this session of the symposium several members of the operational community offered their perspectives of the central issues in the utilization of human resources RDT&E.

CDR Jack Davis, Office of the Chief of Naval Technical Training, made the following observations:

- *The research community is too comfortable with itself. The researcher must assume the responsibility for making himself known to the operator and for learning to understand the operational environment.*
- *The research community must become more responsive to the users' needs, and this means that researchers must be willing to work on problems that involve risk and problems that may not excite them. Operators find it particularly hard to get the attention of the research community on problems that require a short response time.*
- *In the area of people-related research the program category structure (6.1, etc.) is probably too rigid to serve the needs of the user and may need to be modified.*
- *The researcher's obligation does not end with the technical report. He has not fulfilled his responsibility until the product is utilized.*

LCDR Lee Mairs, Bureau of Naval Personnel, emphasized these points:

- *Cost-benefit analysis is the key to improved research utilization. The operator resists change because he sees definite implementation costs and indefinite, unquantified benefits.*
- *The research community must face the fact that it is now in a market environment and must enter the marketplace and demonstrate the value of its product.*
- *The responsiveness of the operator to new R&D products is strongly affected by the variable quality of research. From the operator's viewpoint, good research implies both quality and relevance to the operator's problems.*

LCOL Ernest Rider, Air Force Manpower Military Personnel Center, cited a number of user concerns:

- *Researchers tend to want to "do their own thing," whereas the "bottom line" for users is how much the research helps them in their job.*
- *The timeliness of research often has a strong impact on its potential for utilization. Too many R&D projects take longer than planned and thus lose their value. Better management and better*

communication between researcher and user is required to deal with this problem.

- *Researchers don't provide enough assistance with application.*

LCOL Rider also acknowledged shortcomings on the user side, such as lack of continuity (stemming from rotation), inadequate planning for implementation funding, and failure to consider political constraints on R&D utilization.

LCOL Frank Whaley, USMC, Naval Ocean Systems Center, pointed to the need for users to do a better job of specifying R&D requirements, and for the research community to do a better job of selling its capability to Marine general officers.

REFLECTIONS FROM THE OPERATIONAL COMMUNITY

OBSERVATIONS

DR. SANDS: Due to a change that we made in our program yesterday, we will now hear some reflections from the operational community. Without further delay, I would like to introduce Colonel Whaley, United States Marine Corps, who will, in turn, introduce the other panelists. Colonel Whaley...

COL WHALEY: Good morning, gentlemen. Without further ado, let me introduce Commander Jack Davis, USN, Chief of Naval Technical Training, as the first speaker on our panel.

CDR J. D. Davis, USN
Assistant for Management
Chief, Naval Technical Training

I would like to present perspectives of the R&D community, the R&D environment and R&D efforts from a fleet point of view in general, and from a shore-establishment user point of view in particular. I think that we view the research community as one that is comfortable with itself. Mr. Rostker spoke of this last night, I believe, when he said it is comfortable for the research community to work within the protective structure of the system as it is. We agree with that.

In the fleet, we do not really know who the researcher is; we do not know what he does. Every now and then we see some guy who is not one of us, who looks different, who dresses differently, and who hands out a lot of questionnaires and asks questions. Generally, he does know us either. Yesterday our subcommittee made an observation that the researcher needs to learn to really understand the environment in order to communicate and facilitate the transfer of research. I subscribe to that wholeheartedly. But at the same time, yesterday we heard several comments from some of the panelists and other members about the need to educate the user to the research problem. Outside of the subcommittee, I never heard the user's side presented.

I would suggest that the responsibility is on the researcher's shoulders. We work for the Navy, in particular for DoD, and the object of the game is to support the operating forces and enable the commanders to do their job better. It is not their responsibility to know you; it is your responsibility to know them.

In general, the research community is not responsive to the user's needs. When we cite a problem and state our needs in precise enough

terms that they can be addressed, we are not shotgunning the effort; we want that problem attacked even though it may not be especially interesting or exciting to a particular researcher.

We, in the training command, have been particularly frustrated at our inability to get help on our short-term efforts, something that might take only one, two, or three months. The system either cannot or does not want to respond to us in that time period. When we cite a problem of this sort and ask for help, generally we are told that it is a management problem, not a research problem. Well, that is a myth! Or maybe it is a management problem, but the point is that the problem still remains. There is no sensitivity to solving the problem.

If we structure things rigidly and unionize it to the point that this is management and this is research, and we define it very precisely, and we cannot cross over it, that is really no help to us. Maybe it is not a very clear-cut research effort, but it is certainly not a clear-cut management problem. What I am saying is, "Take the risk--enter into something that may not be a precisely-defined research area."

Last night, Dr. Rostker also talked about the problem of rigidity of the structure in terms of what is 6.1, 6.2 up to 6.5. He thought this structure was perhaps appropriate for the hardware research area but certainly not for the personnel research area. I agree with that; I guess the bottom line is that we have to change the system. If we have to change the structure in order to meet some very real needs of the user community, then let us do that. Let us not get to the point of thinking that we have fully discharged our responsibilities once the research is done and we have turned out the technical report, because I really do not think that this is the case. If it is good work (hopefully, it is), the responsibility really is not discharged until it is utilized, until we make the user aware of what we have done, its value, its merit, its potential, and press the opportunity to go ahead and utilize it. Thank you.

DISCUSSION

DR. GLASER: Does anyone have a question for Commander Davis?

QUESTION: I wonder if Commander Davis isn't putting too much of a load on R&D in asking them to provide help in studying all sorts of operational problems and needs.

CDR DAVIS: Well, I would be if I'd said that, I didn't mean that; I understand that there are problems we must solve ourselves, and we attempt to do that. What I was saying is that there are problems that we identify which in our opinion can be solved, or at least attacked, by the research community. And then we get into this "Who

shot John" kind of a thing. "No, it's not us, it's management," or it's something else. The fact is that there is a problem, and we can't solve it. We ask the research community for help, and they really don't think it's their problem. We're sort of a voice in the wilderness looking for help. We're asking the research community to take a chance. Maybe it really isn't research in the purest sense, but the R&D community has the ability to attack it better than we do. They have people; they have the money; they have the wherewithal to get on with it. We don't. That's what I was suggesting.

QUESTION: To what extent do you believe the inability of the research community to be responsive is caused by the failure of the user to make clear what the real problem is and what its impact is. And there's the problem of continuity of user personnel. What exactly do you feel that R&D is not responsive to?

CDR DAVIS: I guess I don't fully understand the question. I guess it's a problem of perspective. If we have been able to identify a problem and service it to the point that we can even approach the research community, working through our chain of command, then that, in effect, should establish certain credibility. If that has been done it probably is a fairly significant problem and one that needs to be addressed. The problem is that there are times that we just don't seem to be able to work the channel to our advantage to get answers to questions.

What we often have to do when we're tasked with a job is go around it, or under it, or over it. I've secured research without ever having talked to any of the people who I really was supposed to be talking to, but I was turned off early. I was told, "Gee, you can't do it because there's policy, there's rules, there's regulations, there's instructions." Much of the time when we really need something done, I know I'm not going to get anywhere by the direct approach, so I say the hell with it, and I go around it, and I get it done.

DR. UHLANER: I think this is a very fruitful kind of discussion, a very good dialogue, but it is dealing entirely in generalities. If the research community and the management community and the user are going to have a dialogue, you have to start talking specifics. It would help if you could cite one or two problems, subjective as they may be, so that the people here can get some notion of what the frustration is, so that we can at least start thinking in terms of whether there's a way around the cumbersome system. Otherwise we're going to go home after each one has made his great flowery speech in generalities and I don't think really anything will be gained.

CDR DAVIS: All right, I realize that I am talking in generalities. I don't think it's proper to name names and point fingers. We've

done this internally. What we're saying is that we'd all agree that there's a million children starving in India, and some guy says, "Name one." Hell, I can't name one.

DR. UHLANER: That's not what I'm saying. You're dodging my question. I'm asking you to mention a technical problem, mention a need, mention a requirement that in your opinion needs attention and that is a reasonable responsibility for the research community to attend to. Whether we agree or not is irrelevant.

CDR DAVIS: An example would be a good short look at why attrition rates at Recruit Training Command San Diego doubled in a one month period of time.

DR. UHLANER: Beautiful. Do you feel that you can get an answer to that problem in three months?

CDR DAVIS: I would hope so.

DR. UHLANER: Now that's the kind of dialogue we should be having.

QUESTION: Other commands have recognized the problem you described and have developed a mechanism for addressing it. During the Viet Nam war the Navy adopted a system used by the Army, calling it by a different name, the Science Assistance Program. This program has science advisors located at various Navy commands around the world. The science advisor has the ability to describe a problem and send it back to the Director of the Navy Science Assistance Program, who has the funds to task the appropriate research organization to address the problem. I would be happy to describe the program to you.

LCOL WHALEY: Thank you. I think we'd better go on or we'll end up running the ship aground. Lieutenant Commander Lee Mairs is in the economic analysis section of the Chief of Naval personnel. He'll give you the viewpoint of the Navy side of the house.

LCDR Lee Mairs, USN
Head, Economic & Cost Analysis Section
Bureau of Naval Personnel

In our discussions at breakfast this morning, when we were talking about what we were all going to say here, we felt that Dr. Rostker stole a lot of our thunder last night, and if that sounds like an indictment (of the R&D community) believe me, it is. During the small group that I was in yesterday, there was a tremendous discussion as reported in the plenary session about cost-benefit analysis--about whether it should be done or shouldn't be done, etc. The pro side

turned out to be the economists in the room and the con side was the other disciplines. Let me tell you why I think cost-benefit analysis is so important and how it perhaps might be the key in unlocking the door to better research utilization. Admiral Metcalf spoke yesterday about the resistance to change that develops when it comes to implementing any sort of R&D product. I would like to submit to you that when you look at it from the operator's point of view, the resistance to change stems from the lack of any quantified benefits in doing the change in the face of very definite and certain implementation costs. And if the operator is not given this kind of data, he feels that he just cannot take his time to do this work himself. I think this is the key that the research and development community is going to have to recognize, and start to use it to unlock the door.

In the private sector, look at Xerox, Kodak, and IBM. They do not sit around waiting for the customers to come to them. They have salesmen that sally forth into the marketplace giving out information and seeking out new customers. We do not see this in the military research and development community. You gentlemen are now operating in a market environment. In that environment R&D funds can be shifted by the program managers to buy chipping hammers, paint, and toothpicks; so if they do not see that there is going to be some value from research and development, believe me, the pot is going to diminish.

During our group discussion yesterday I heard a lot of complaint that some research areas are not amenable to cost-benefit analysis. I would like to submit to you that if there are a certain subset of cases where this is true, it certainly does not preclude all other pieces of research from cost-benefit analysis techniques. Furthermore, even in so-called "soft" areas there are "hard" aspects. The benefit of race-relations programs was one area that was thrown up to me yesterday as defying cost-benefit analysis. I submit that that can be quantified, that the dollar value of resources that the Navy now spends on race-related discipline problems can be estimated, and the amount of money that is spent on race-relations programs now could be a savings if somebody in the R&D community could develop a pill or something from the tooth fairy that could eliminate that problem overnight. I would like to refer some of you people to a book by Arnold Harberger at the University of Chicago entitled Project Evaluation, in which he talks about the techniques of cost-benefit analysis in these fuzzy areas. For example, the value of human life has been determined for cost benefit analysis purposes. Now of course, if it's my life I tend to value it a lot higher than perhaps anyone else will in this room, especially after I have been talking for a little while. But when you talk about life in the abstract and perhaps have a program that increases safety or reduces the probability of death, then there are market estimates of how much money should be spent for this. It is not infinite; if it were infinite we would ban cars. But these are the techniques that the R&D community are going to have to sharpen and really take a strong look at.

Resistance to change, I would underline again, stems from a lack of quantified benefits in the face of absolutely certain costs of trying to implement any change. This is what's got to be changed.

A minor point I would like to bring up is that the quality of research has a lot of variability. And the cost that the R&D community suffers from a piece of bad research is not balanced out by two, three or four pieces of good research. All it takes is for the operator sitting in Washington to read a paper, supposedly using discriminant analysis, that tells him that reenlistment bonuses have no effect on retention because this researcher notes that only those ratings that have low retentions are receiving the high reenlistment bonus payments. Now that is just absolutely poor research. I have a long list of examples of bad research that I left at home. But there is good research, and this is the research that identifies the problems, that goes after the relevance that Dr. Rostker talked about last night. For example: the work that NPRDC has done with all of ADSTAP models is of immediate relevance to the Chief of Naval Personnel and was virtually put on line and used before the technical reports were even written. Other examples of good research are the work of Stan Horowitz at CNA in quantifying the benefits of personnel manning relative to the mean time to repair between breakdown, and the work of Bob Lockman at CNA in developing pre-service variables to use for screening enlistments, resulting in reduced attrition. All of this was in response to urgent problems within the operational community and virtually before the reports were written the research was already implemented. These kinds of good research are things that other researchers should look at to see how they can model their work after it. Any questions?

QUESTION: I have a comment I would like to make. I'm disturbed by the factual information and the way it is selectively perceived. I was in that session yesterday and I didn't perceive the clear cut distinction between the economists and the other disciplines. In this conference there has been too much "them and us", too much finger pointing. As a matter of fact, the Defense Science Board made a special point that the R&D community is making serious attempts to include cost-benefit analysis in the area of training.

LCOL WHALEY: Lieutenant Colonel Ernie Rider is Chief of the research team at the Air Force Military Manpower/Personnel Center, and he will give you the Air Force picture.

LCOL Ernest Rider, USAF
Chief, Human Resources Research Team
Air Force Military Manpower/Personnel Center
Randolph Air Force Base

I probably should preface my remarks this morning by saying that I represent the Air Force users to some extent since I see all of the

research requests that come from agencies external to the Air Force Systems Command that are typically levied upon the Air Force Human Resources Laboratory. This covers a wide variety of users anywhere from the trainers in your Training Command to the operators in the other operational commands and the Air Staff agencies both in the personnel and manpower areas. We typically coordinate these requests with the Air Staff and make sure there is higher level recognition of the problem. It's a little hard to address the interests and concerns of all of these users in a very short time, but I might make a few comments about my overall impression in the few short years in which I have looked at this business. I'm sort of objective in my statements here because I have never been a researcher per se in the human resource area and I represent all types of users within the Air Force. I've been involved for about three years, so I guess I have a pretty good sample of what's gone through the system and what people's reactions have been.

The bottom line, I believe, on how people use the Human Resources Laboratory is how good a job it does for them, how much it helps them in their particular jobs, how much it helps them in their particular policy decisions. Obviously, don't expect all of the research to work out well. My impression is that roughly half of the "research" projects, i.e., the ones that really require experimentation and considerable time, probably work out pretty well and people think well of the research. I think that's probably about the best you could hope for in the human resources R&D area.

The laboratory also provides some valuable help on a short-term basis through what we call consultative assistance. I think they've got a wide base of knowledge and a lot of experience which is very valuable to the operators. This is especially clear in the flight simulation area, in which they have done an awful lot of good work. People are depending on them for good advice as to what's appropriate to do in these areas as far as purchase and development of simulators. They also have a very valuable historical data base, that is computerized. It contains personnel and training records, which are very valuable for short-term analysis in addressing policy questions.

Now that I've said good things about the laboratory I'm going to make a few comments about areas where improvement could come about and I would guess that the Navy and Marine representatives who we're about to hear from may have similar things to say. I think that basically the researchers want to do their own thing, and that may be necessary, but to the operator it appears that they don't always get as close to the project as would be desirable. From the operator's viewpoint, the quality of the research--the applicability and understandability of the results as far as they relate to the operational problems--could be improved.

The time dimension in which research is conducted is another concern to people. The operator who has a problem would like a solution in

the most expeditious manner. He usually recognizes that it will take some time to do good research. But frequently (for many reasons, some of which are operator problems and some researcher problems) the research takes longer than originally planned, falls behind schedule, and may not be of as much use as if it had been done on schedule. I guess it all boils down to a need for better management, better communication between user and researcher, to help keep things on track. Another problem area involves the application phase. The Human Resources Laboratory is now cranking up to give more assistance in this area. They are going to be doing the cost-benefit analysis in selected areas. Someone commented earlier that some areas are less amenable than others to this type of analysis. I think cost-benefit analysis should certainly be done for the major projects. And since the operators typically do not understand the research well enough, I think the researchers should do the analysis.

Though they do a very good job in most areas, one area where researchers could improve is in putting their ideas on paper in a timely manner, and in a manner that means something to the operators and to the operational community. I don't really think they communicate well enough with the users, particularly in the application phase. There is a salesmanship aspect of research which I think several people have alluded to. If you are going to improve your batting average on application, that is a factor which needs to be considered. I guess all of these things will sort of "come out in the wash" if there is increased communication between the users and the research managers. Hopefully, the communications process can be formalized a little bit more. I think in the Air Force we have a leg up on the formalization of the procedures. We have an Air Force regulation which I think Dr. Clark mentioned yesterday. We're thinking about increasing the bureaucracy to some extent to force people to communicate during a research project where it is appropriate, and hopefully we will be hearing a lot more good things from the users. We hear a lot of good things now, but we also hear a lot of criticisms.

I would like to summarize my comments briefly by saying that there is concern by users about the quality of research, about its timeliness, and about the fact that researchers generally don't provide enough assistance with application. Some users do not always do their job either. There is not always continuity of the people who are sponsoring the research. As you know, we move frequently in the military. We need to make sure on a more systematic basis that when people do move we get replacements who continue to work with a given project. And I guess users don't always adequately consider the application phase of a project either. They don't always do a good job of planning for implementation funds and they often fail to consider the political constraints which may be operating depending on the results and types of research. Overall, I think R&D has provided an awful lot of important inputs to the personnel and training areas. I think it could be improved. The question is, how much can we improve it without making researchers spend so much time on utilization that there is not enough time available for research?

LCOL Michael Whaley, USMC
USMC Liaison Officer
Navy Ocean Systems Center

Let me start off by saying that the Marine Corps organization for personnel research and development is in disarray. Let me add that on the user's side of the house we have not, heretofore, really gotten our act together. A couple of us are working together to get our requirements clearly stated so that we understand them. And then, hopefully, we will transmit this to the R&D people. So, I do realize that our personnel R&D activity is in trouble in the sense that at the present time the user is not laying requirements onto the system. Now, we all understand that people problems are paramount with the Marine Corps because, and I am very serious about this, that is our primary business. The Navy has ships and planes. We have planes too, but people in the squad, fire team, platoon, company, that's our bread and butter, that's how we make it. And unfortunately, the perception that exists among Marine Generals that I have talked to, basically summed up is, "Psychologists suck." And you know, it's kind of difficult when I get back to Washington to say, "We saw this neat thing out at NPRDC." I get a "You've got to be kidding me." Of course it's stated a little differently than that. The R&D community, I am convinced, is providing us with a better way to do things because I have seen in 21 years that running things based on a gut level perception isn't the way to do it. On the other side of the coin, we have not utilized the system to the degree that we should, and I intend to push the system so that we can. You ask about a specific. I have a great deal of experience in R&D units and I've been on the other side of the house where I've finished five years of command time in three different organizations, so I'm keenly aware of the problems that we have had in our people side of the house. The specific is as follows: We should have a better way to keep our troops soldiering in peace time, which of and by itself isn't much fun. We don't necessarily have to kill people during peacetime to keep them gainfully employed, but we need to have training set up and organized and run so that our people are doing what they have been trained to do, in a progressive type manner. Our people who fix radios and radars get a chance every day to do what they came in for, but our infantrymen, the main part of the corps, don't. Unfortunately, we have a shortage of ranges, we have a shortage of ships, we have a shortage of all those other neat things that we need to train these infantry guys. And you know, about the 73rd time you take the same hill you kind of lose a little of the dynamics of the situation. So, what we need is something to keep these people gainfully employed so that they are really getting something out of soldiering in a peacetime environment. The way it is now, the infantry guy ends up

running our bases. You know, five guys over in special services, two guys life-guarding, doing everything but soldiering. I don't have the answer to that. I'm sure that none of the Marine Generals have the answer either. It's one of those things that you just can't pull out of your gut and find a viable solution. But those are the kinds of things that I think we need to have addressed.

And hopefully we will clean up our act in Quantico, our R&D requirements place, so that we send something from that level that coordinates the hardware side with the people side, because we have kind of gotten our hardware act together. Unfortunately the paradox is that our most important problem is probably the least addressed. So I say to you, "Yes, we have some requirements homework to do," and this is key, I think. The folks in your community have failed to sell the pragmatic approach to our Marine General officers, and the junior officers too; let's face it, the Majors and the Lieutenant Colonels are the ones who end up getting in there and fooling around, maybe getting something done and maybe not. This hasn't been done, and I charge all of you that if we're going to address this most important Marine problem, you have to get out there and sell the capability that I honestly believe you have. But I also am well aware that, for some reasons that I'm really not aware of, it has not been transmitted to our folks. That's kind of general, but after all my experience in the business, that's where I come off at.

THE STATE-OF-THE-ART IN RESEARCH UTILIZATION WITHIN OTHER FEDERAL AGENCIES

SUMMARY

In this session of the symposium, representatives of several non-military federal agencies reported their experiences in dealing with the problems of research utilization.

Dr. Howard Davis, National Institute of Mental Health, undertook to explode the "myth" that the key to utilization is good research. He cited a number of illustrations that good research is not enough--that simply being presented with a better way of doing something provides no assurance that it will be done. Above all it is the human factor, he argued, that determines whether knowledge will be effectively transferred. He pointed out that utilization is a matter of planned organizational change, and that techniques exist for facilitating change, such as his own A VICTORY model. A VICTORY is designed to assist in assessing the readiness of an organization to undertake a given change--based on such factors as its resources, values, information, circumstances, motivation, resistance, and perceived payoff--and to assist in remediating deficiences in these areas.

Judah Drob, Department of Labor, described the systematic approach to utilization of R&D that is taken by the Employment and Training Administration of DOL. This approach includes the following elements:

- *Requirement that every R&D proposal discuss utilization, including what products the project will yield.*
- *Strenuous effort to involve potential users, via Advisory Committees, site visits, briefings, etc.*
- *Use of a "buddy system," whereby a member of the DOL utilization staff has responsibility for representing the utilization concerns and plans of an R&D project.*
- *Recognition that training and technical assistance constitute major steps in developing the capacity of the user to make use of R&D products.*
- *Acceptance of the principle that "user orientation" is the first commandment, and that it need not compromise your rights and integrity.*

Dr. Meredith Crawford, George Washington University, presented an historical view of HumRRO's struggle with utilization. He emphasized HumRRO's interest in the military problem and commitment to providing useful results. He cited several other factors (each of which may be found in the literature on knowledge utilization) that contributed to HumRRO's track record in utilization, including:

- *A dispersed organizational structure that facilitated close relations with customers.*

- *Systematic procedure for eliciting customer requirements and an active effort to conduct a dialogue to ensure a common understanding of those requirements.*
- *Use of the experimental method, insofar as possible.*
- *A flexible work program, adaptable to the short-term as well as long-term needs of the customer.*
- *Careful attention to presentation of results, emphasizing quality reports, user participation in briefings, and publication of utilization successes as a mechanism for diffusion and often multiple utilization of a product.*

Bert Griffis, Rehabilitation Services Administration (RSA), entertained and stimulated the conferees with an eloquent reminder that R&D is not the only source of knowledge that may be utilized in the solution of people-related problems, but rather that the humanities, history, philosophy, literature, and the fine arts may have abundant wisdom to offer as well. He then described the major elements of RSA's utilization program, including:

- *An effort to emphasize utilization in the planning and conduct of research (e.g., by making explicit and disseminating the utilization elements that an R&D proposal should contain).*
- *A strong focus on dissemination of usable results (e.g., by preparation and dissemination of abstracts, research briefs, and a guide for preparing final reports to facilitate use of results).*
- *A program to establish human and organizational links in the field between research and practice (e.g., funding regional research utilization laboratories, and conducting a national dissemination program of RU specialists in state rehabilitation service agencies).*
- *A program of research on research utilization (including evaluation of a large sample of R&D reports to derive principles of effective utilization).*
- *An effort to nurture the capacity for self-initiated change in service agencies (e.g., by stressing R&D utilization in training programs).*

Finally, Mr. Griffis admonished the conferees to be conscious of certain problems and limitations of research utilization, such as the difficulty in preventing RU from becoming an end in itself, and the tendency of RU to contribute to the information explosion, rather than to respond constructively to it.

Dr. Ronald Havelock, University of Michigan, discussed efforts to institutionalize research utilization in the field of education, with special reference to the activities of the National Institute of Education in this area, including:

- *Establishment of the Educational Resources Information Center (ERIC) as the first systematic step towards utilization of educational research.*

- *Transformation activities, such as summarizing, abstracting and translating from scientific language to practitioner language.*

- *The use of linking agents in several state department of education.*
- *The effort to establish a nationwide system of regional resource centers as an institutional mechanism for improving utilization.*

Dr. Havelock suggested that the function of research utilization be regarded as a full-time job rather than extra duty, and that it requires funds and trained people. In conclusion, he referred to the growing literature reporting research on research utilization.

THE STATE-OF-THE-ART IN RESEARCH UTILIZATION WITHIN OTHER FEDERAL AGENCIES

DR. SANDS: Dr. Glaser will be chairing this session, so without further delay, let me give you Dr. Ed Glaser.

DR. GLASER: Thank you. About 1954, Dr. Carl Rogers, a very eminent psychologist, and Dr. Fritz Roethlisberger, a professor of management of the Harvard Business School, wrote an article published in the Harvard Business Review, entitled, "Barriers and Gateways to Communication." I think it might be worth repeating the essence of their message because I think it has some bearing on the need for better understanding between researchers and users. The message was: when you are experiencing a difference of opinion with someone, pause and say something like, "Let me see if I understand what you're saying," and summarize back to that person what you think he said. The person then either agrees with you or not; stay with it until the person feels understood. Then take off and do anything you want in terms of argument, but at least you start from a base of caring to know accurately what the other person has said. In a way, Jay Uhlaner did that this morning by indicating his need for examples so that he could understand Commander Davis' message. He clearly indicated a desire to really tune in. That kind of effort, I think, can really pay dividends. The people who now are going to present their respective experiences with efforts to achieve research utilization in their respective Federal agencies, probably have been wrestling with this problem of how to facilitate research utilization longer than anyone else in the United States. Our first speaker is Dr. Howard Davis, chief of the Mental Health Services Development Branch, National Institute of Mental Health. Howie says his real claim to fame stems from his being an old Air Force bomber pilot.

NATIONAL INSTITUTE OF MENTAL HEALTH (NIMH)

Dr. Howard Davis
Chief, Mental Health Services Development Branch
National Institute of Mental Health

It's been a tremendously impressive meeting so far for one who comes into your group from outside. Beginning with Captain Clarkin's comments yesterday morning clear through to the panel of the operational arms this morning, I have been most impressed by the

sophistication that is held by this group in the area of research utilization and the problems that are contained in it.

One of the issues that I heard last night from Secretary Rostker and also during the small group discussion, was that the problem may lie with the researchers. That is, if you only did good research then, of course, it would be utilized. I have heard this for so many years, particularly from our academic brethren in health research. They say, as someone did during the small group yesterday, "Please tell us of some good research that hasn't been adequately used."

This matter came out last week at our meeting of federal research managers at American University, where again people were challenging us to give some illustrations of research projects that were really worth using that hadn't been used. And I had to admit to the heads of the Department of Transportation's R&D program who were there, that if you people came up with a mixture for pavement that would resist freezing except at very low temperatures, then of course the Northern states would rush to use it. I would have to agree with Dr. Glenn Bryan that if the Navy had invented a device that would successfully lift bombs to the wings of air craft and effectively replace the hernia bars, then of course the commands would use it.

I had to agree at that meeting with Lou Caresse, who heads R&D policy for the National Cancer Institute, that if their researchers ever came up with some findings that would really tell us how we could lower the likelihood of lung cancer, of course we would use it. My point is that the best disseminated research information is on the back of every pack of cigarettes, yet some of us still keep puffing away and the sales of cigarettes continue to go up about one percent a year. Surely there is something wrong in the assumption that if you just present good information, change will occur. We did have a little humorous interchange at that federal research managers meeting, recalling that some time ago the American Medical Association had issued a series of news releases on the finding that men who smoke run a greater risk of impotency. We played around with how much better the research findings could be disseminated if on the side of every pack it were to say, "Caution: the Surgeon General has found that if you smoke you may find your craft ebbing." On that I think I should stop. That will be my one single message this morning.

There's been so much wisdom expressed here that I am frankly a little intimidated about giving you a litany of some of the practices and techniques we feel are advisable for increasing the likelihood that research will be effectively transferred. But there is one conclusion that I think is incontrovertible, and that is that research utilization is above all a matter of human factors. It's what people are inside--their need systems, how they feel about things, how it comes across to them--that determines whether knowledge will be effectively transferred. I think I can actually say with

absolute sincerity that the real way to plan a research utilization program and a research management model is just one of good common sense, which I heard an abundance of yesterday. Since I carry no credentials in common sense, I'll have to fall back on what the psychologists say. This doesn't mean that one has to be a psychologist to effectively plan a good research and utilization program. In fact, I think that psychologists usually muck things up by getting involved with all of their theories and principles, and so I would have to ask to be forgiven for that, but what else do I know to say.

I think I would go all the way back to the Book of Exodus for documentation of this. Moses found that change was very hard. Even helping the ancient Hebrew slaves change to a lifestyle of free persons was so difficult that he retreated into the desert for 40 years and waited for a new generation to come forth that could accept freedom a bit better. Eric Hoffer says that we really can't change anyone, except through the generational approach, to any effective degree. I might also refer to another citation, Romans 5:17, where the apostle Paul says, "That which I would do I would not and that which I would not do I do. I find the will to perform but how to perform that will I find not." What he is saying, as I understand it, is that we all have better ways of doing things--all of the users certainly don't have to depend upon forthcoming research findings to improve their practices. But there is some reason that we don't change simply out of the awareness of a better way to do it. I am fond of saying that anyone who thinks being presented with a better way to behave is sufficient to bring about a change in behavior has never been married. We experience a constant supply of free consultation on how we can improve our behavior, but it doesn't really do a heck of a lot of good. Well, not in me anyway.

What can we do about it? At NIMH, through the help of Dr. Glaser and other people who have been tremendous in assisting with this, we have developed an eight factor approach to change that we feel represents the necessary and sufficient variables that must be considered if we want utilization of knowledge to be effective. Let me run down some of these briefly. If you should want to read about them more fully you will find a more complete discussion in Dr. Glaser's manual, Putting Knowledge to Use. Sometimes when people hear us talk about this or see our writings on this they say, "That's a bother. What I want to know is how I can disseminate information. I don't want to get into organizational change, program change, and all of those variables. That's simply too complex." All I can say in response is that we don't have to consider all of these variables, but if we don't they will master us. Our only choices are to be their slaves or to try to deal with them. They are not there by our invitation, they are there by their own. They play a role in all instances of human organizational change. I find, I might also say, that it isn't necessary to plan an approach to handling and massaging each of these factors.

The technique is something like this: the model is never mentioned to the people with whom we're working, such as to our researchers. It must remain in the back of our heads, though, and we do try to make observations of where we stand on each of these variables. In a formal sense, we do use tests to determine the readiness of an idea for adoption. Tom Kiresuk in Minneapolis, for example, has developed a 120 item scale, using factor analysis, that allows one to predict with great reliability and validity whether a change is going to come a cropper or be successful. I find that we can use only a seven item quasi-semantic differential check list and get a pretty good summary of how people are feeling about these variables. Then what you do is develop a profile of these seven factors and not try to deal with all of them. You might find that one, say resistance, is going to be a particularly tough one to overcome and then one works only on that; or perhaps it's a motivational factor and so we work only on that. It isn't necessary to deal with the entire array of factors. There's something called the Pareto Principle. Vilfredo Pareto was an Italian economist and sociologist who lived about the turn of the century, and his assertion was that, in instance after instance, 80 percent of human achievement comes out of about 20 percent of the effort. Now what we need to do is find out what 20 percent needs our investment and we're 80 percent of our way to our goal. Well this is the way the scale operates. We try to figure out those one or two items that need massaging and work on those only. Not only does this system help us to analyze the likelihood of successful change but it also gives us clues as to what we can do to massage each of these factors.

Now let me in the time that I have remaining briefly tell you about a few of these factors just for illustration. Certainly one is the information itself--how well is it disseminated, how practical and cogent is it. In the manual that I referred you to, Dr. Glaser also has an acronym that he calls CORRECT. It covers six factors, six attributes of information, that determine to a large extent how well that information is going to get across, what its impact is going to be. You can check the reference to find out what those factors are. We are also aware of factors like legitimization. If you have a new device or an innovation that you want some command to accept, of course it has a greater likelihood of being used if you find some person who is an authority who will put an imprimatur on it, a stamp of approval. If it can be modeled or demonstrated by someone in the command who is prestigious and an opinion leader in your particular service, then of course it has a greater likelihood of being picked up.

In terms of massaging the translation of information we can draw on the old work of, say, Carl Hovland and this is only one of the many, many examples that one could draw from. If you're dealing with a sophisticated group such as this one, one doesn't try to present answers as to exactly how you do it. Sophisticated people are irritated by closed gestalts and answers. On the other hand, if you are presenting information to people who do not consider

themselves sophisticated, such as the typical users, they are irritated by an open gestalt, by not really having the answers. They want training manuals with things explicitly spelled out down to the last word. There is a whole array of knowledge from the persuasion field such as Cohen's or Carlin and Ableson's synthesis of this field. Some of these references just abound with ideas that can be used in increasing the impact of the transfer of information.

Let's move on to another one of the factors, motivation. Now the determination that there is a problem, that there is a need to do something better, is okay, but that in itself doesn't change us. I may know that I will die if I keep smoking, but if I don't feel the need to change I'm not going to do much about it, so it's felt need that really matters. Now there are ways that a good change agent, a good research utilization specialist, can increase the felt motivation for something. For instance, once in Minnesota we were concerned that a small psychological services team that was operating out of my office and doing psychological tests for the public school system around the state, was not doing the job adequately. We had objective data to show that we couldn't cover the task but none of the local school districts had developed their own programs. What we finally did was to cut out the service altogether so they had no one coming around to do the legally required testing, and then the pain came. We increased the obligation, as we say in this particular model, or the motivation. They had to do something, so throughout the system local school psychology programs began to be developed. Well, there is much we can do to increase the felt need for change before we try to move in with it.

I think circumstances and timing represent terribly important variables. Sometimes it's necessary to withhold research information until its time has come. The flux of things may be just right for a ready accommodation of it. Right now if they were to wheel in platters of food probably you wouldn't buy it. If they do it at 6:00 this evening or at noon, then the time will be right for you to transfer that commodity into your own bodies. I think, again referring to religious history, I would like to recall the experience of Martin Luther as he brought about the Protestant Reformation in 1532. He did not publish in some obscure theological journal, though they existed at that time; instead he waited until the priest Tetzel had been going through the German communities requiring the people to pay for their penances and the poor people who didn't have any money couldn't be forgiven for their sins and so there was a great deal of unrest growing at that time. But he waited for a special night, and that was Halloween, the eve of All Saint's Day, when people gathered in the small town squares to drive evil spirits out with effigies. He waited until the crowd was in the town square and then went up to the church at Vicksburg and nailed his 95 theses on the wall and there people mobilized around him. It was an example of exquisite timing on the part of a change agent. Whether or not you agree with his theological concepts we must agree that he really demonstrated how a good change agent can operate.

There are other factors, such as how to measure and deal with resistance, how to increase the payoff, the reinforcement to people. For instance, when new legislation is established for licensing for a professional group, they are afraid they might have resistance from the older people who don't want to take the exams, so they have the technique called the "grandfather" clause that disarms and reduces the resistance, builds a little payoff, reinforces their participation in it, and by that method they overcome what could otherwise be a great obstruction.

If you are interested in reading about this model I think you might see that there are a number of ways that we can be much more instrumental in fostering the change process as a result of the transfer of knowledge. Now as to how we build this into management of R&D, well that's a question that everyone has to answer for himself since all your programs vary so tremendously much, but with the kind of talent that I saw here yesterday and see today, I am sure that if you care to you will have no trouble finding a way to achieve the very important mission that you're involved in. Thanks very much.

DR. GLASER: Judah Drob has been in charge of the research utilization area for the Department of Labor for some 13 years or so, and we will hear from him now.

DEPARTMENT OF LABOR (DOL)

Mr. Judah Drob
Chief, Division of R&D Utilization
Office of Research and Development
Department of Labor

What do you say the morning after the bomb has been dropped. I thought about what it was that I might do by way of relief, hopefully some kind of rehabilitation effort, but of course an outsider has really very little right to say very much about your internal matters and problems. What I've heard in the course of yesterday and today, I found to be really very heartening and significant because what I heard everybody saying is that utilization is everybody's problem and that's exactly right. But there is also a danger if you say that utilization is everybody's problem. The danger is, like anything that's everybody's, it turns out to be nobody's. We say, for example, that public parks belong to everybody and in fact and in practice a lot of us abuse the public parks because we feel that they belong to nobody. Therefore, I want to spend a little time discussing with you the opposite side of the coin--that while utilization is clearly everybody's responsibility, it will probably not be adequately

done unless it also is the specific responsibility of some particular people. Now how you organize that, how you approach it within your very different organizations, is obviously up to you. It would be very unpolitic and would fly in the face of good psychology for anybody to prescribe what form the specific responsibility for utilization should take. However, even though there is some danger in doing what I am about to do, if you understand that I speak to you very humbly, I think there might be some value in telling you how we do it at home. Now the guy who shows up some distance from home and talks about "how we do it back in Toledo" usually gets short shrift, and I don't know how to short circuit that. But I think it would be interesting to you to know how we do it, as long as you understand that I'm not telling you to go do it the way we do it. I'm simply trying to illustrate one way that this might be done. You very likely are doing it better already. But perhaps without presenting any kind of model I can give you some sense of how somebody else is approaching the problem and maybe that will be helpful. If it isn't, I apologize.

I want to describe to you what I like to think of as a systematic approach to the utilization of the R&D findings and products that are produced for the Employment and Training Administration of the Department of Labor. We've been at it about 11 years. We started with the conviction that R&D wouldn't find itself into use just by itself, that it required some specific effort. Over the years we have developed what we think of as a system--one that's still being built and still has some gaps in it, but one that is slowly approaching what we would like it to be.

Let's start at the beginning. Mostly what we do is fund extramural research and development. We require that every proposal that comes to us discuss the utilization that would follow successful completion of the project. In the discussions and negotiations about the funding of a particular project, we require consideration about what kinds of products would be needed in order to utilize what might be learned. Obviously, since we cover a wide range of kinds of R&D, from pure research to instrument development, the nature of the products will vary a lot. But in the case of research that might have some action implication, we're looking for the kinds of products that can be used in the field. We're talking about how-to-do-it materials--guidelines, manuals, instructional materials, curricula, things like that--that are planned to be produced by the project in the course of its life, so that if we have a good project, at the end we will have materials with which to facilitate utilization. Now saying that quickly might give you the impression that it is easily done. I have yet to receive a completely satisfactory product out of this process so I don't want you to think that it's easy. Any time that I tell you how great we are I am also going to try to mention an odd little thing like this. The consequence is that we very often have to have somebody else do it after the project is completed. We very often have to spend some money to get somebody to put the results into usable form out in the field.

During the life of some projects, particularly those that are not pure research, we try very hard to involve potential users on advisory committees, through briefings, through site visits and such activities as that, with the aim of persuading at least some representative potential users that the product is really their product as well as the product of the researcher or the developer.

When the project is completed we try to consider all possible utilization strategies that might be appropriate for the particular project. And for this purpose we have invented something that I think is unique in the utilization field. We have what we call a "buddy system." For every project that we fund a member of the DOL utilization staff is a utilization buddy. That person may be described as a conscience, a consultant, an associate project officer, or whatever you want to call him. That person has the responsibility of representing the utilization concerns and working on the utilization plans for the project. Now let me say right here that the best project officers are the ones who won't let go. I don't like the project officers to come to me and dump the project on me. I want them to work along with me all the way through the life of the project on utilization plans. Utilization plans might include, for example, publications for external audiences, news releases, dissemination through our own publications for our own universe of users, and might include efforts to get other organizations to pick up where we drop the project. Obviously this is not an all-inclusive list. Utilization efforts such as these are less likely to succeed if you come along after the project is completed. Clearly, the best results are obtained if, during the life of the project, plans are built into the project for what we call spin-off, so that regular programs and operations pick up what we have developed.

Now I want to get into what I think for us is the heart of the problem. The line from R&D to the academic community or to policy makers is pretty direct. I don't think R&D has much influence on policy making, but that's another matter. Anyway, the line is direct. But when you talk about R&D affecting people who deliver service, or talk about the armed forces, you're talking about changing the behavior of large numbers of ordinary folks, and obviously you're talking about a training program. So for me the obvious next step in the system of knowledge transfer and achievement of change is the training and technical assistance that would arise out of the R&D results. Fortunately, over the past few years in the Employment and Training Administration we have been strengthening our technical assistance and training capacity, and so we have some institutions in place. I want to stress the importance of this kind of activity. It doesn't just happen that you have a good relationship with the organization that's next in line, into which you have to feed your products. I had to woo the people in charge, and the consequence is that we now have a good relationship with them and an opportunity to feed into the regional training institutes.

Let me give you an illustration of the kind of result that we like to crow about. I had funded a project to experiment with linkages with

the regional training institutes to improve our relationships with those institutes. One of the things I'd been advocating for years is something called a regional resource center, which perhaps you can imagine without my describing it at any length. I never could get any regional office to establish one. The technical assistance and training program established a clearing house by which it circulated the curricula that were developed in all the ten regional training institutes, the theory being that you want to avoid re-inventing the wheel. Well, as the curricula piled up in all the regional offices with nobody responsible for sorting them out, shelving them, indexing them, making them available to the appropriate people, all of a sudden the light dawned. They needed regional resource centers for their own products, for the products for which I am responsible, and for the products of state and local agencies that might be helpful in their training and technical assistance work. So all of a sudden the regional resource center became a major attraction. And my contractor was picked up by the technical assistance training people to install regional resource centers in all the regions on a turnkey basis.

What I'm trying to illustrate is the systematic progress that one has to look for from R&D on through some kind of connections. In the early days when I first met Ed Glaser, Howie Davis, Bert Griffis and the others, we were trying to substitute ourselves for all the elements of this system of knowledge transfer. We were trying by ourselves to be the entire system. It's very difficult. It probably in the long run is impossible, but by beginning to get the rest of the organization to fit in and to set up its own appropriate agencies, we're starting to get what I consider to be the beginnings of a truly systematic approach.

Now there's one more step I have been working on a long time. I've raised the problem often with Ron Havelock and others. I think maybe I'm beginning to get some products, if I can get some--pardon the expression--some damn slow academicians to deliver what is long overdue. What I'm getting at is the problem of the capability of the user to seek out information and to use it to solve his problems. It doesn't absolve us of the responsibility for doing the things that we have to do, but if you're broadcasting and nobody has a receiver not much is going to happen. So it's important, we think, to develop the capacity of the ultimate user agency and individuals to make use of the kinds of products that we think are useful to them.

This, in brief, is some account of the approach we take. Now I want to say a word about philosophy. You are probably fed up to your ears with the notion of user orientation by now. I must say to you that user orientation is the first commandment for us. We feel, however, that while you have user orientation you can have your own dignity and rights as well, and that it's perfectly proper to tell a potential user that you don't have anything that will help his particular problem. However, we try not to do that. We

try very hard to help people solve problems and if we don't have the answer we try to help them find places where they can get answers. We think that's very important. We try to develop their own capacity to seek information and to find answers. I particularly want to commend to you what I have seen described in the literature as the consultant mode. Now the consultant mode is different from a situation in which, as frequently happens of course, somebody comes to me and says, "We're going to do something, larumphing, what do you know about larumphing?" And I go to the shelves, to the records, to my memory and we draw on as much as we can about that particular subject. That's relatively easy. The consultant mode consists of responding to a question about something for which you don't have a direct answer, and don't have exactly the right materials, but you have the problem of extrapolating from what you know to the somewhat different circumstances about which those people are asking you questions. I think that's the real challenge for those of us in the utilization business: to be able to extrapolate from what we think we know to the real and current problems of the people that we're trying to serve. I've talked long enough so I'll shut up. Do you have any questions?

DISCUSSION

QUESTION: At one point you indicated that you generally receive certain products that aren't directly useable in the field, so you have to get somebody else to assist in refining the project. What kind of agencies do you use for this purpose?

MR. DROB: Well, it's kind of hit or miss. We try to find people that have some writing or curriculum development ability. We don't have a large stable of such people. Some of them also disappoint us. Some of them are unreliable. But we try to use people that we think know enough about the particular subject that they're writing about to be able to do a reasonably good job. This is very tough. It's also tough under procurement regulations which were designed for the purchase of hardware, to do what we think is required in any of our contracting and granting activities. That's a whole different matter.

DR. GLASER: Thank you Judah. I think Dr. Meredith Crawford is probably better known to this community than any of the other panelists. Before coming here Meredith has been head of HumRRO for a number of years and now is at George Washington University. Meredith.

HUMAN RESOURCES RESEARCH ORGANIZATION (HumRRO)

Dr. Meredith P. Crawford
The George Washington University

For many years when I talked about HumRRO my remarks were carefully coordinated, scrutinized, and criticized by my senior staff. Two

of those senior staff members are here today. You'll hear from the current president of HumRRO, Bill McClelland, shortly. You've already heard from Bob Smith. These gentlemen may be surprised because I have not coordinated these remarks with them.

Perhaps the most valuable contribution that I could make today is to bring to this symposium something of an historical note. The observations that I will make come from my own notes and recollections about the first 17 years of the existence of HumRRO, that is, from 1951 until 1967. I choose this first phase principally to tell you how we wrestled with some of the problems of utilization in the early days. Also, it was because at that time we had a single sponsor, the United States Army, and dedicated all of our efforts to that one organization. The fact that our research was utilized accounts for our continued presence. The reputation that we had for a reasonable record of utilization probably accounts for why I am here today. Now, the methods that we developed or stumbled onto were certainly in part a function of the particular circumstances of how we came into being and how we grew. I think, though, that many of the kinds of general principles that are found in Ed Glaser's blue book (Putting Knowledge to Use) can be illustrated by the things we did.

Let me speak just briefly about the climate of the times in 1951. There was, at that time, a substantial belief in the country that science had made a contribution to our victories in World War II. There was also a reasonable belief that psychologists had played a useful role in that enterprise. There was already in existence in the Army, with continuity from World War I, research in the personnel branch of the Adjutant General's office, which has evolved today into the Army Institute for Research in the Behavioral and Social Sciences. There was also a very substantial program under Dr. Arthur Nelson in the Air Force. At that time money was perhaps somewhat easier to obtain, though in smaller amounts, than is the case today. Also, there had been a very large study by the Defense Research Board of the Department of Defense which outlined many new things that could be done in the area of behavioral and social science. With all of these background activities the Army was ready to move forward in other areas of research in human factors. I might also point out that while the climate in DoD for this kind of activity was favorable, it was much less so in the civilian sector. Massive funding for research in education and training by the U.S. Office of Education was years away. The American Education Research Association numbered a couple of hundred members as compared to its twelve thousand members today. There wasn't much precedent for applying research and development to military training, to industrial training, or to the methods and curriculum of civilian education.

It was within this climate that Dr. Harry Harlow, on leave from the University of Wisconsin to serve as the Army's Chief of Human Resources, authored a series of staff studies which resulted in the

award of a sole-source contract to the George Washington University for the establishment of HumRRO. The new organization was to conduct research in training methods, motivation, morale and leadership, and psychological warfare. This was to be accomplished by research in the central office, by subcontract and by providing civilian staff technical supervision to research units to be established at military installations.

We started with a broad mission and with adequate funding. What we needed was a staff that could begin to do things that would make sense to Army people. So, making sense to operational military personnel, especially those who are in the field and who are not directly concerned with R&D, was an early task as we set about the establishment and staffing of our field units, the first at Fort Knox and then at Fort Ord. In order to justify our presence at local installations and to receive the support and privilege to use the troops necessary for the research, we had to propose things to do that made sense to operational people, things that would likely at least, yield information that would be useful in improving operations, especially training. So we started out with an immediate orientation toward usefulness. In attempting to respond to this orientation toward usefulness we were fortunate in building our original research staff. In those days a large portion of the new PhDs were veterans of World War II, many with combat experience. Many had completed their education under the G.I. Bill and learned most of their psychology after their military experience. They knew a good deal about military life and they could understand the skeptical view of the "long-haired" PhDs that were held by many operational people. Thus, for the most part the initial HumRRO staff had a sense that we needed to produce something that the Army could use. I should note that very early in the game I had the rule that there would be no white rats at the Fort Knox laboratories for psychological research.

So my first and most fundamental point is the attitude of the research people. We were interested in doing things that gave promise of being useful to the Army. We recognized that at the end of a research project there should be an answer to the question, "So what?" We worked at developing good relations with our military colleagues and we found them both professionally and personally rewarding. We learned in some detail about military operations and came to recognize the type of military scholarship to which we could relate in the Army schools, in the Command General Staff College and in the War College.

This attitude of interest in the military problem and the desire to become involved suited most of the people who stayed at HumRRO. But it took awhile to clarify our thinking about the nature of applied research and how to deal with practical, rather than laboratory problems. Some hard thought was done by those who had recently come from the academic laboratory and this took place over the first several years. Finally, a clean-cut summary of that thinking came

in a chapter written by Dr. John L. Finan in Gagne's Psychological Principles of Systems Development. Finan compared and contrasted the methods appropriate to building scientific knowledge through theoretically oriented inquiry and research from a practical or engineering point of view. Of the eight dimensions along which he made comparisons I believe that three influenced our thinking most. The first concerned the criteria of acceptable inference; that is, the statistical vs. practical generalizability of results, which is easy with a single-variable laboratory experiment and is difficult with a multivariable practical situation. The second concerned the differences between the usefulness of demonstrating a statistically significant difference for purposes of testing a well-stated theory, and the demonstration of differences which are large enough in magnitude to be of practical or what we now call cost-effective use. The third concerned the difference between the making of a prediction and the making of a forecast. I take time to mention this paper because it was so necessary to think these problems through in the early days to help us determine the criteria of good applied work. This labor made us "respectable" with our "basic" colleagues and helped us to develop appropriate standards of quality. We were oriented toward carrying our work through to an ultimately implemented solution, and having thought through methodology we felt sound in doing so.

I might add that we were not immediately perceived as useful by the Army. At the end of the second year I went before the R&D review board, a group of general officers, and presented what we wanted to do for the next year. And the chairman said to me very simply, "Well, doc, we'll give you money for one more year. If you don't produce, you're out." Fortunately, TRAINFIRE came along soon after that.

In addition to this fundamental observation about attitude and orientation toward useful results, I want to mention four other factors, all of which may be found in the knowledge utilization literature, that I think were important in the development of HumRRO. They are: (1) the organizational structure, (2) the choice of problems and methods, (3) some administrative categories of work which facilitated getting to useful results, and finally, (4) some comments on the presentation of results.

With respect to organization, I have already mentioned the early establishment of field units. These were dual organizations, made up of the research personnel, who reported to the director of HumRRO, and a military contingent, headed by a field grade officer who reported to the commanding general of CONARC, the training headquarters. The mission of both of these groups was the same. At first they were confused, later they were clarified on an organization chart. The enlisted personnel served as research assistants, one of whom, Dr. Dick Atkinson, is now the director of the National Science Foundation. The chief and the director of research of each field unit worked hand in hand, representing the unit at the local command in briefings and in discussions, and along with the researchers briefed on

research at the high headquarters. We found it was most desirable to have a chief who was respected in his branch of the service (infantry, artillery, etc.), a man who could relate to his peers in that branch. The divisions in the central office of HumRRO had a less immediate relation with operations, but they too had their clientele.

The second point I would like to make in the context of organization is that our relations with the intermediate training headquarters, CONARC, were intimate, early and fruitful. We were fortunate that our first staff officer (who had been an artillery officer in World War II and who came to me for civilian employment, and agreed to go back on active duty) was superb in helping the first two years make sense to those at Fort Monroe. Later we were invited by the commanding general of CONARC to place a representative there and that representative, who at one time was Bob Smith, took every occasion to be alert to what was going on in the headquarters and to the need for bringing researchers to the headquarters when we had relevant information, as well as to the need for arranging formal briefings when we had completed phases of the research. The attitude at CONARC was favorable in this sense. I was very pleased once when a commanding general of CONARC said to me, "We cannot afford to ignore a HumRRO report." Also, when our relations with one officer were difficult I went to the commanding general to point out that many times in order to do our work it was necessary to seem to criticize the Army in a positive and constructive manner. The general understood this much better than the colonel, which is another story.

Another point in connection with the organization is that our relations at the Department of the Army were with the Chief of Research and Development. This, I always felt, was an extremely important relationship, particularly when it was coupled with that at CONARC, because it made us part of the larger research and development system. We had a model, a hardware model that we all know doesn't fit exactly, but it was a useful point of reference and we were with colleagues who were concerned with doing new things within the R&D mechanism. The combined relationship to Headquarters, Department of the Army R&D and to an operational headquarters at CONARC was very beneficial. We used to speak of the triumvirate relationship between the Department of the Army, CONARC and the Director of HumRRO. It had its problems but it paid off in good communication.

Finally, I would make one other point with respect to organization. We were fortunate in being able to have a dispersed organization and yet one with substantial communication across the organizaton so that things which developed in one part of the organization could be shared in another setting. There was a "not invented here" phenomenon with which we are all familiar. But there were occasions where one division, say the infantry division at Fort Benning, came up with something and through our organization and our understanding

of problems, say in air defense, that solution could be moved over. We spent a good deal of time in conferences, sometimes with our military chiefs, sometimes as directors of research, in discussing our methods, in discussing how we could relate to the Army, and how we could make our combined impact felt more keenly.

The second observation I will talk about concerns our choice of problems, some of which turned out to be nutritious objects of attention. Later, at our suggestion, the "dragnet" started. That is, each year, the CONARC headquarters began to send inquiries throughout the command with respect to problems. Now, as has been discussed here today, often these problem statements are not ready to be undertaken as research projects. We found that if it was possible for us to go to the originator of the problem and talk with him, the problem would be much more clearly defined and perhaps it was somewhat different from what he perceived it to be. But the dragnet, which developed into a requirements survey, was an extremely useful way of getting broad coverage and of combing various kinds of problem statements into a single investigation, the results of which might have some generality.

With respect to method of research, insofar as possible we relied on the experimental method. I remember way back in 1952 going down to Fort Monroe and lecturing with a big chart on the experimental method, talking about the experimental group and the control group, and some of my staff thought that didn't make much sense, but it "took" and within a year people were asking "Well, where's your control?" The sharing of what we were trying to do and how we were trying to do it was extremely useful and more importantly we were able, in most instances, to demonstrate with hard data that this technique yielded better results than that.

A third point I want to make is about the flexibility of our work program, particularly the categories of work in which we operated. We began with nothing but tasks, which I believe we call work units now. These were rather long efforts involving several people. We introduced a new category called exploratory studies, in which we would take a problem and not more than one or two research personnel would stay at it for a matter of months. Either we would determine that we weren't getting anywhere or that, with apologies to an earlier speaker, there could be an administrative solution, or that it was worth a full scale effort. Then we would turn it into a task. About 50 percent of these exploratory studies were abandoned and it was understood that that was the expectation. As I told General Gavin, Chief of Research and Development, a good R&D program has about 50 percent duds. But we provided for attempting to identify those duds as early as possible and getting on with the workable problems.

Another aspect of flexibility is that we made an effort to respond to inquiries at the local installation or elsewhere, like "What

do you know about so and so; is there any research data on this?" We took time to do that because we wanted to be useful. We also wanted to learn more about the Army and responding to these inquiries helped us do that. Eventually we also got into the work program a category of technical advisory service, TAS as it was called, and we engaged in some 100 or more TAS activities each year. These were important not only in furnishing information but in enabling us, even though we were funded with 6.2 money, to help write training manuals or help do whatever was necessary to get a project or product implemented. I said earlier that we concerned ourselves with the kind of work we did and I remember that at the director's meeting one day we discussed with great care the circumstances under which we would give TAS, because we were concerned about shooting from the hip, and we wrote a rather specific directive to ourselves that when the problem was sufficiently important and when we felt we had a probability of slightly better than .5 of giving a useful answer, we would do so. I emphasize that we were concerned on the one hand to be helpful, but we were equally concerned that we not go off half cocked or give misleading information.

The final point I want to talk just a little bit about is the presentation of results. We, like all other organizations, struggled with such issues as what a technical report should be, to whom it should be directed, and whether we make recommendations or draw conclusions. We spent a great deal of time on the quality of technical reports. Fortunately, in those days we were not bound by contract deadlines so we sometimes took several months to get a good report, but we also found that once that report was in the literature it was often used by the Army, in some cases years later. Reports, of course, were not enough. Briefings were essential, and having the military personnel who were involved in the research (not only our chiefs but the user) take part in these briefings was most convincing. We did a little project for the Navy and when the research leader briefed the admirals he said very little himself. He had the chief petty officers do the briefing. That was substantially more convincing in that case than doing it himself.

One other point worth mentioning is that the Chief of Research and Development sent a letter of transmittal with all our technical reports. We usually drafted that letter but the letter attempted to show ways in which the report would be useful, and in particular, to whom it was directed. In addition to our concern with the presentation of our own results we were fortunate that for a number of years the CONARC staff prepared what was called a utilization pamphlet, a regular CONARC publication, in which all of the instances of utilization of HumRRO work were reported, and this was widely distributed throughout the land. It often resulted in requests to us for reports of some of these pieces of work and in a good deal of TAS. We also blew our own horn. We published a thing we called "What HumRRO is Doing," first as a sort of illustrated annual report and again as a newsletter. We did believe in persistent, but I hope dignified and effective, selling. We liked the Army. We enjoyed

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working in the Army. We found our contacts stimulating, in many cases scholarly, and we felt that we were part of the team.

I think that in summary what I would like to bring from the historical perspective is first, the attitude of our research people. Our paramount interest was in doing high-quality work but with the needs of the user understood as completely as we could. Second, we had an organization which was dispersed but yet communication within it was good so that we could understand and communicate widely in the Army. Third, we had a flexible work program that was adapted to a variety of short-term and long-term needs. Finally, we took substantial care in the various forms by which we presented our results. Well, that's the way it looks to an old man who may like to talk about the way things used to be, but I think there are some lessons there.

DR. GLASER: Our next speaker is Bert Griffis, who is representing the Rehabilitation Services Administration.

REHABILITATION SERVICES ADMINISTRATION (RSA)

Mr. Bertrum W. Griffis
Assistant Chief
Division of Program Support
Rehabilitation Services Administration

"What a piece of work is man." In that one sentence I do believe Shakespeare summarized quite a few of our problems. I perceive, as you perceive, that I am still somewhat under the influence of having seen Hamlet at the Globe theatre Sunday evening and I do hope you will bear with me. Short though my time may be, I cannot refrain from bringing greetings from Virginia, home of several of our leading founding fathers who utilized some of the simplest but most important lessons of history in framing our Constitution, and thereby produced a document that has been called one of the greatest ever to spring from the mind and pen of man. And I think we can conclude from this happy event that the future of utilization is immense and uplifting, especially when the findings that are put to use have been tested in the laboratory of history as Will and Ariel Durant put it in their little book, The Lessons of History.

Now I would also bring greetings from Washington if I knew what to say, but I don't for doth not yet appear what shall transpire, because one of the innovations adopted by the founding fathers was that of a system of checks and balances which they wove into the constitution, their intent being to prevent rule by any one man, party or philosophy, to facilitate the rule of law rather than of men. And the result

is that we do not really know what is going to happen. We do not know, we cannot know, what the net outcome of those checks and balances is going to be. So, then, the founding fathers created a paradoxical situation. Mainly by utilizing a particular bit of historical wisdom they made it impossible to predict precisely or even approximately what may happen in a given instance, and that, I submit, is in accord with the spirit of liberty which, as Judge Learned Hand has noted, is the spirit that is not quite sure it's right. Whereas the spirit of tyranny--and I do think it permissible to speak of the spirit of tyranny in 1977, seeing that quite a few tyrannies do exist--the spirit of tyranny, I say, is always sure it's right and always knows exactly what is going to happen; I mean what it will permit to occur. A tentative conclusion, if conclusions may be drawn from an introduction, may be that with respect to certain deep, enduring, recurrent and really important human problems, the humanities, history, philosophy, literature, and the fine arts may have more to offer than R&D in the usual sense of the word. Well, I have drawn conclusions from an introduction. But please bear in mind the influence I am under. Hamlet behaved erratically, but in the end got the job done, after a fashion.

I represent the Rehabilitation Services Administration in the department of HEW and we manage a nationwide state federal program of rehabilitation for disabled people, funded overall at an annual level of about 800 to 900 million dollars, with most of the money going for the multiplicity of services needed by handicapped clients in the field. Our mission is to help as many of these clients as we can to become as independent and self-sustaining as possible. Our emphasis has been vocational with more attention lately to the severely handicapped. As a part of all this we fund an R&D program of about 30 million dollars annually, plus a program of about the same level to train professionals needed to work in this interdisciplinary field of rehabilitation.

Our utilization program began in 1966 with a memo directing us to identify usable R&D results and establish ways and means to get them used in service programs. From this has grown a modest research utilization program with the following broad goals: (1) to plan, conduct and report research so as to maximize the likelihood of usable results being produced, (2) to identify, package and disseminate usable results to consumers in the field, (3) to establish human and organizational links in the field between research and practice, (4) to generate or otherwise acquire knowledge on research utilization and the diffusion and adoption of innovations, (5) to build into service agencies a receptivity to change and a capacity for ongoing self-renewal, and (6) to evaluate the impact of these research utilization efforts.

Now, we have really spent very little money, only a few million dollars, I believe, over several years, and in this regard we feel quite good. Our hands are very clean. Though we have spent little, we believe we have accomplished much, namely:

1. We have abstracted and indexed all R&D reports received. These are substantive abstracts with the use-potential section. We have published those abstracts along with a general index and an R&D thesaurus, and distributed these documents to strategic users in the field. And we have also published a series of research briefs and disseminated each one to as many as 30,000 users.

2. We have entered all R&D reports into the National Technical Information Service (NTIS) to give us storage, retrieval, microfiche and hard copy capability. The reports are in NTIS; some people have told us you can't get them out, but they are in there.

3. We have published and disseminated a guide for preparing final R&D reports, emphasizing utilization factors, calling for a document that will facilitate use of results, and requiring a utilization plan (assuming there is a usable result) that identifies the usable product, the clients and problems to which it applies, the resources needed to use it, its limitations and the cautions to be observed in using it, and the expected benefits from its use.

4. We have evaluated a large, random sample of our completed R&D reports and thereby derived findings and principles to make them more productive.

5. Using these and other data, we have specified criteria for evaluating R&D proposals (and here we are also greatly indebted to Dr. Glaser and to Howard Davis), setting forth in some detail desirable utilization elements that a proposal should embody; and we have disseminated these criteria as one part of our application kit.

6. We have conducted and evaluated a national demonstration program--a five-year program of agents in state rehabilitation service agencies--to link practice with research, somewhat along the line of the county agent in the Department of Agriculture. We are greatly indebted to Dr. Glaser for his evaluation of this program, for conducting a utilization conference on it to which were invited all directors of state rehabilitation agencies and power figures, and for preparing guidelines for installing these change agents in state service agencies.

7. We have contracted to have designed for our agency alternative utilization systems that might serve our needs more comprehensively, the powers that be permitting (which they have not up to now). We are much indebted to Dr. Ron Havelock for this most useful piece of work.

8. We are funding two research utilization laboratories to serve, on a regional basis, as institutional links in the field between

research and practice, and have partially evaluated the work of one of them.

9. We have instituted annual participatory planning conferences to feed real operating problems into our R&D planning hopper.

10. We fund six or eight rehabilitation engineering centers, primarily to develop hardware to be used to help the handicapped, and to be used by the handicapped to help themselves. These centers are currently, in addition to the other work, preparing state-of-the-art papers on 10 hardware areas relevant to improving services for the handicapped.

11. We have infused a strong R&D utilization element into our $30,000,000 program to train a variety of professionals needed to serve the handicapped.

Those are some of the main things we have done. Now, in the course of this and other work not mentioned, we have become conscious of certain problems, of which I will mention several.

1. Science cannot resolve conflicts of interest, cannot be made to yield value judgments. This is our opinion.

2. We have become mistrustful of research utilization (RU) insofar as it counts its chickens before they are hatched. I myself have been involved in quite a few activities to count these chickens rather accurately before they are hatched. Now it is true that chickens do hatch, but sometimes they are birds of a strange feather.

3. It is idle to hope that our troubles as people can be cured by any amount of knowledge or knowledge utilization per se. We seem to want knowledge in RU to accomplish painlessly for us what can in fact come only from quite another quarter. We doubt if lack of scientific knowledge is always the main problem.

4. There are three great sources of reliable knowledge: science; the humanities, which dramatize and summarize human experience; and the intuitions of great ethical and moral geniuses. Now, with respect to science, a sure prescription for quackery is to succumb to such externally imposed mandates as those from below by students--for "relevance," and those from above by funding agencies--for preconceived responsiveness. Whatever responds primarily to such mandates, ought not to call itself science.

5. It is very hard, if not impossible, to ensure that RU benefits trickle down to the ultimate clients (in the case of our agency, handicapped individuals) that are most in need of help. In other words, it is hard to prevent RU from becoming an end in itself. That is most unfortunate for many of us--not only the handicapped--who see our actual lives as deformations of

our possible lives. And as Ortega has noted, "every life is more or less a ruin among whose debris we have to search to discover what it might have been."

6. RU has a tendency to contribute to the information explosion, rather than to respond constructively to it.

7. In a world so full of change and innovation, it is almost impossible to know what causes what, very hard I mean to evaluate RU results. Nevertheless, I am optimistic, for as the poet has written, "Hope burgeons in the soul and sings and never stops at all". Thank you.

DR. GLASER: Ron Havelock has probably written more on research utilization, especially related to education, but not by any means limited to that, than perhaps anybody in the country. Ron is from the University of Michigan and the Institute of Social Research within which there is an organization known by the acronym of CRUSK, which stands for the Center for Research Utilization of Scientific Knowledge. Ron will tell you about the program of the National Institute of Education in the area of research utilization.

NATIONAL INSTITUTE OF EDUCATION (NIE)

Dr. Ronald G. Havelock
Program Director
Center for Research on Utilization of Scientific Knowledge
Institute for Social Research
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When we talk about research utilization we can talk about it as a process of something that happens, but we can also talk about it as a system, and also as an institution. Somewhat buried at times is the fact that these speakers are talking about institutions which specialize in research utilization and, as I understand it, none of the military services at the present time actually has an institution or set of people who are specifically and exclusively responsible for research utilization. Now that is quite distinct from many of the speakers that have preceded me. In Meredith Crawford's speech we get an idea, through HumRRO, of how an institution can emerge that in effect plays a utilization function. The distinction would be that HumRRO represents an organization that was concerned, and continuously concerned (in part because of the style of leadership and motivation of its own leadership) with research utilization, but did not devote itself exclusively to that task, nor perhaps was there even room or permission to do so.

Well, coming at the end of these speakers, I want to say something about what has happened in the education field, because probably we have had more deliberate effort there to set up institutions for research utilization on a fairly large scale than in any of the other examples we have heard. The Agriculture Cooperative Extension Service, which was previously mentioned, is by far the largest and oldest research and utilization system in the world and it probably is the best working. Indeed, we could say we are a bit remiss in not having somebody on the program to describe it, because the experience of that program is extremely helpful to the problem of research utilization in the military. We have not talked about how we can make use of all the rest of the R&D that is available, the wisdom of the ages, not just of recent times. No one has mentioned the Defense Document Center, which is interesting.

When they decided to do something about research utilization in the field of education, R&D in most consumer sectors was not popular, until maybe in the 1960's. But there was an accumulation of research information under the Cooperative Research Act and National Defense Education Act, stimulated in part by competition with the Russians to build a research program in education. Our national investment in education is probably the largest of any particular categorical sector in the entire economy, much larger than the military. But in terms of R&D it is probably the smallest area, in the sense of the ratio of R&D investment to total investment. Nevertheless, over the years starting in the early to mid-1950's, probably as much as one-and-a-half or two billion dollars worth of research has accumulated. Indeed, there are people who carry on research on a small scale in various settings all across the country in education, mostly in schools of education. The first step towards making an effort to utilize this research was the creation of a thing called ERIC--Educational Resources Information Center, really centers. It was an attempt to apply all the technology of information retrieval in the early 1960's to educational R&D products. The idea was to have a system that would enable any research utilization activities to tap into all the existing research that was available in the field of education, not just what happened to be in the head of a particular person at a particular time.

I entered the act in about 1967. One of the first projects I had in research utilization was to look at what could be done to create a system, in addition to ERIC, that really made a connection between information and use and between the R&D community and the user communities. Out of the thinking about what we could do in addition to ERIC gradually emerged what might loosely be called a research utilization system for education. Today it is part of the legislative mandate of the National Institute of Education (NIE) to provide dissemination services. Out of the total budget of 70 million dollars for R&D in the National Institute, 17 million is devoted to dissemination activities, including about 5 million dollars which supports the ERIC system. That's a pretty good ratio of funds devoted to research utilization out of the total research budget. I'm sure

that it's by far the largest, proportionally, of any agency. So what they do is worth looking at and is an experience that I think the people in the military who are concerned about setting up institutional mechanisms for research utilization really ought to look at.

NIE has experimented with a number of kinds of activities that are similar to what you've talked about here. One of the first things that they realized they had to do with ERIC was to engage in a great deal of transformation activity. And indeed there are innumerable kinds of transformations you could think of, such as: summarization, abstracting, transforming for particular user groups, transforming from a print medium to audiovisual presentations, taking documents that are in research language and translating them into practitioner-type language, etc. For at least ten years a certain portion of the budget has systematically been allocated to transformation functions.

Beyond transformation, however, it was obvious that connections were needed of what one might call a more human nature, and again they looked down the street to what the Cooperative Extension Service was up to, or had been up to for years: the much talked about but actually very little studied county agent notion. And they decided that they should try to do a little experiment to see whether you could have a county agent in education who might work in a similar kind of way. Institutional realities being what they were, they thought they would set these up in state departments of education. They did so in three states in the early 1970's. It was a relatively small program, a pilot project really, to see what might work and whether it might be something that could blossom into a rather large program nation-wide. Not only did they install these agents but they compared them. They arranged to have them studied by a fairly distinguished sociologist who was quantitative in his orientation.

The results of the study were that this special linking agent was very much appreciated by local practitioners, much more so, for example, than the traditional curriculum consultants who went out from the states. They were appreciated probably because they didn't have an axe to grind. They provided information, and also they were trained in such a mode that they went to practitioners and listened to their problems. They stayed around, and they came back, and they did things that consultants often don't do. They tried to apply in working with practitioners what we really knew was good process for research utilization--that indeed many of the user people here this morning talked about. It turned out to be just a darned good idea. But the results of the research study were not utilized, because of course things change in Washington and one of the things they did find out was that it was going to cost some money. But NIE has maintained some semblance of a program for installing linkers in state departments of education. They are trying to encourage the states to build their own capacities and are giving the states and other agencies subsidies for short periods of time so they can build in the kind of linking agents,

with the supporting information services, that would be required to make this thing work. They are moving currently and I think are one of the reasons why I'm pleased to be working with NIE as a consultant. (Actually I'm what they call a Visiting Fellow; I'm there for a year or so and I have fairly wide latitude in the kinds of things I can look into.)

NIE is also trying to establish a nationwide system of regional resource centers--not unlike the kinds of things that Judah and Bert mentioned --to act as a feeder mechanism, something like the role of the extension specialist. They are trying to transform a set of institutions called Regional Educational Laboratories, of which there were at one time 20 and about 12 are left now. They are trying, in effect, to knit together an institutional mechanism that will be an effective vehicle for research utilization.

This, roughly speaking, is what NIE is up to in RU, and I commend it to you, along with the other models that were discussed here, in terms of thinking about an institutional mechanism for research utilization, something that for one thing, has a memory for past research. I would also like to note that you can think of the function of research utilization in two ways, one of which is to add it to existing responsibilities, sort of as extra duty. For example, yesterday it was suggested that the role of research manager (which is damn well a full-time job already) should also include the function of research utilization specialist, the person who monitors the whole research utilization activity. And there have been suggestions by researchers that users have a responsibility for the pull of research utilization and on the other hand suggestions by users that researchers have a responsibility for the push of research utilization. These are all ideas about research utilization as a function that is added onto what people are already doing. Now, the significance of thinking about these institutional ideas is that we are pointing out some other options that are available and that I don't believe have been seriously considered by the military. In particular, we are suggesting that some of these research utilization jobs are full-time jobs. Then, if we come to the point where we realize that something is important we're eventually going to have to start thinking not only about getting some money to do it, which seems to be a big problem (that is, nobody can quite figure out whether it's 6.1, 6.2, etc.) but also about getting trained people to do it.

I won't take the time now but I was going to tell you how we had tried to look across several federal agencies to see whether there was a common pattern in research utilization activities. Thanks to some support from Judah Drob's office we were able to look at what was happening in the various agencies--in Howie Davis's agency, in what was then the Educational Communications Institute, and in the rehabilitation field--and what we came up with was a framework within which we could look at research utilization functions. The basic model was that you had to have a dialogue between the research

community on the one hand and user communities on the other. And there were certain functions that had to take place to make that dialogue work, both communication-of-results functions and communications-of-needs functions that had to interconnect the two communities on both the micro level of person-to-person communication and on the much larger and long-term level. We did produce a analytical report which covered research utilization across the agencies. So I think that if you're really interested in the question of institutionalizing and also looking at the gaps in military research utilization for each of the services, this is one kind of alternative to follow.

The last thing I'd like to leave with you if you are interested in research utilization is that in the literature there is a growing accumulation of research information on research utilization. I would suggest that you start thumbing through the volume Putting Knowledge to Use if you have not already and at least use it as a resource when you're thinking about this in the future. It is probably the best and most current key to what's available in the literature on research utilization. I suppose if you're interested in research utilization it's logical that you would utilize the research on the subject. It's logical, I said.

Finally, nobody has mentioned Glenn Bryan's paper, that was circulated before the conference. I thought it was a pretty good paper. I sometimes use other people's stuff myself, not often. I think the concept of symbiosis that Glenn used is particularly relevant, and I would like to call that to your attention and ask you to take another look at his paper because in a rather informal and I think very readable way, he really has presented the main issues of research utilization for our consideration. I remind you that he mentions that the dictionary definition of symbiosis is "any close association of two dissimilar types of organisms." The dissimilar types of organisms that we are talking about here are, of course, the R&D community and what we loosely call the community of military practice. Glenn said that the relationship between the two communities could go one of three ways. The first way he labeled commensalism, where one member of an association is benefited while the other is apparently unaffected. I would suggest that that probably is the way a lot of people look at research utilization when they're looking at it positively--that is, that somehow or other practitioners can gain benefits from ongoing research without the research community being particularly affected, and research can continue on its way in it's ivory tower. The second way is parasitism, and I think that when we get paranoid about this two worlds phenomenon that we are dealing with, we do tend to move towards thinking about each other as parasites. In other words, the R&D community is quite capable of thinking of users or practitioners or would-be-users as sucking out their vital fluids, and perhaps even more so the practitioners are saying, "Well look at those R&D dollars going to waste. These people clearly have no interest in us; they're simply parasites on the living body of

the military machine." And indeed, I have been surprised at the level of hostility that seems to exist in this area in the military field when I can't think of any field in the behavioral sciences where there are more positive examples of good research utilization. But be that as it may, I would suggest that the true state of affairs ought to be, can be, and when it's really working at places like HumRRO, is mutualism, where both members are benefited by their living together. Thanks, and I'll take whatever questions you may have.

QUESTION: Are copies of the blue book available?

DR. HAVELOCK: You should have this, Putting Knowledge to Use: A Distillation of the Literature Regarding Knowledge Transfer and Change. I think if you need other copies the sponsor (Howard Davis) and the doer (Ed Glaser) are here. The author is the Human Interaction Research Institute.

QUESTION: Is the comparative study that you mentioned available?

DR. HAVELOCK: It is called R&D Utilization Strategies and Functions: An Analytical Comparison of Four Systems. (We could learn a lot about titling processes in research utilization.) The project director was myself and also David Lingwood. Copies are available from the Manpower Administration, Judah Drob's office. The companion piece to this was a report that Bert mentioned. After we had done this comparative study we also looked at several R&D information services including the Defense Documentation Center (DDC) and the NASA technology utilization system, and tried to compare them according to the same kind of model, and we also tried to conjure up images of what ideal R&D utilization systems would be. This is contained in a report from the Rehabilitation Services Administration. That's in NTIS so you can get it out if you want. It's also available from my institute at cost, which is about eight dollars or something of that sort.

Incidentally, there might be some general interest in the process we used for coming up with the four alternative models of research utilization systems. The idea was suggested to me by Ed Glaser, who had done a similar kind of study previously. What I did was get together three teams of experts on research utilization, but the three teams represented somewhat different points of view towards the RU process; their writings reflected a different orientation. Each one had a budget and a deadline to come up with his own model. Then we got together to see if we could integrate a single model that contained the best elements of each. Again, if you're really into thinking about how to institutionalize new mechanisms for this sort of thing in any of the services, this might be a worthy resource to investigate. The authors really are not just myself but Ed Glaser was the head of one team and in fact is the author of that piece, Ronald Lippitt was the head of another of the teams, and the third one was Everett Rogers who is really the world's foremost authority on the diffusion of innovations. Thank you.

OVERALL RESEARCH UTILIZATION PERSPECTIVE

SUMMARY

Dr. Thomas Backer, Human Interaction Research Institute, and Dr. William McClelland, HumRRO, identified a number of recurring themes in the first day and a half of the symposium, themes that are verified in the research literature on utilization. Dr. Backer cited the following common threads:

- *Research utilization takes a serious commitment of resources.*
- *A multidimensional RU activity in an agency tends to work best since it enables you to connect with different components of the potential user audience and to have the synergistic effect of several RU strategies operating conjointly.*
- *Personal contact is a key to effective RU.*
- *RU demands a bona fide commitment of the agency at the policy level for funding, staff cooperation, and coordination with other activities.*
- *RU must be integrated with the total R&D program.*
- *Early involvement of RU staff in R&D programming is critical.*
- *Technical assistance is extremely valuable in facilitating RU.*
- *Effective RU requires the willingness to take risk.*

Dr. McClelland suggested these general issues:

- *There are major differences in goals among the communities represented at the symposium (for example, as to how the total RU effort should be apportioned between problem-solving and development of tools to assist in solving problems).*
- *Similarly, different agencies operate in different contexts (with different missions, etc.) and adaptation of an R&D product must take that into consideration.*
- *The structure of the military enterprise introduces RU problems that are different than in the civilian environment.*
- *Although it is convenient to refer to "the user," there is a whole conglomeration of users--with different interests.*
- *We need to adopt a broader perspective and seek solutions wherever they may exist--inside or outside the military establishment.*
- *Technology transfer is a specialty in and of itself.*
- *Strategies for planned change are legion, and selection from among them is a complex art.*

Dr. Backer concluded this session with a review of resources that may be particularly useful to people concerned with improving research utilization.

OVERALL RESEARCH UTILIZATION PERSPECTIVE

COMMON THEMES

Dr. Thomas E. Backer
Senior Staff Associate
Human Interaction Research Institute

The purpose of the few minutes that Bill McClelland and I have to spend with you today is to tie in what some of our previous five speakers here have said about research utilization and the experiences they have had in their own agency settings and in their own professional work with some of the other things that have been said at our conference in the last two days and also with the literature on research utilization. I'm going to take a first crack at that in just a minute.

As I look over some of the notes that I've been scribbling down here this morning, I think that it would probably be wise for me not to bore you with quotations from the literature because I notice that Howie Davis has quoted the Bible and Bert Griffis has given us quotes from our founding fathers. I'm afraid that quotations from the research utilization literature might appear a little trivial by comparison, so I'm going to get right to what I feel are some common themes in what has been said here today, themes which are verified in the research literature on utilization and which also, I think, express some of the concerns that we've been hearing around the table and in our small groups yesterday in this conference with respect to a military environment. After I take a couple of minutes to do that, then Bill will comment on some of the differences among the five agency perspectives that we've heard here today and what we might be able to learn from them. Then I'd like to take a couple of minutes at the end to continue a process that Ron Havelock started a few minutes ago. That is, I want to share with you some information about resources in the research utilization field and how you can get hold of things that might be of some use to you as you address the issue of research utilization in your own settings.

In terms of the common themes that I have heard from our speakers today, and to some extent from all of the discussion at this conference so far, I see the four service delivery agencies that have been described here--National Institute of Mental Health, Department of Labor, Rehabilitation Services Administration, and National Institute of Education--as wrestling with basically the same problem: how to organize their R&D system for maximum payoff. Indeed, that's really the reason why we are all here, to try to get "more bang for the buck" out of research that is done in various organizational

settings, specifically the military at this conference. I think the underlying motivations for this effort are twofold: First, the increasing press for accountability of R&D systems, now mandated by the Congress and by pressures from various public interest groups; and second, the awareness that the capacity of a service delivery system to help people in need, as specifically represented by the four agencies that have been discussed here today, depends in part on making the best possible use of knowledge resources. I think those two fundamental motivations are shared by all four agencies that you heard about today, and as a result of that their research utilization efforts have a number of features in common. I think many of these features are also shared by research utilization efforts in military organizations as well.

Through some judicious note-taking here this morning, while listening to the gentlemen that preceded me, I have identified eight such common themes and I'd like to tell you about those now.

1. Research utilization takes a real commitment of resources. Only so much can be done on a shoestring. The amount of money now available is, I think, pathetically small in comparison to the $20 billion plus that is invested in research each year in the kinds of environments that our five speakers have been talking about. As Howard Davis remarked in his introduction to the blue book that most of you have a copy of, Putting Knowledge to Use, the knowledge industry, broadly speaking, has paid remarkably little attention to the utilization of its product, to the marketing of its products. In the human service area in particular, I think in part this has been because utilization efforts attached to R&D programs have been underfunded and understaffed. I think we've heard some similar kinds of criticism of military R&D organizations in the GAO report that was discussed yesterday.

2. A multiple kind of research utilization activity in an agency setting seems to work the best. By that I mean that the research utilization programs that Howie and Bert and the others have described to you today have chosen not to put all of their eggs in one basket. And so we've heard about the support of what you might call basic research on research utilization, we've heard about publication of research summaries, about publication of magazines like the two that Howie Davis just mentioned to you, and we've heard about efforts to produce improved (more readable, more usable) research reports. We've heard about research utilization conferences like the one we're all a part of right now. We've heard about indexes to the literature and information systems, about consultation, about direct service efforts of one sort or another--a whole cornucopia of activity in the research utilization field. I think that is one theme that typifies the research utilization efforts of all the agencies that you've heard about today. And I think it is highly desirable not to concentrate all your energies in one area, because you can hit different parts

of your potential user audience at different times if you have a number of things going on rather than spending all of the money that you have available for utilization in one area. Through that kind of multiple activity, in many cases you can achieve a kind of building or synergistic consequence in terms of getting R&D knowledge used.

3. Personal activity and contact is a key mechanism for effecting research utilization. I think the literature certainly supports this. In fact, if there is one principle that research on research utilization tells us, it is that personal contact is the primary mechanism by which change takes place. We've heard all of our speakers here today say that in different ways. And we've heard Howie Davis talking about some of the very personal and psychological factors that bear on organizational change that he summarized under the eight factor A VICTORY model. So I think that is another commonality that characterizes the research utilization programs that we've heard about today.

4. Research utilization requires a real commitment of the agency at the policy level for funding, for staff cooperation, and for coordination with other activities both in the research area and outside of it. Another way of expressing that is what I've heard several other people say here today and that is that research utilization really is everybody's problem. I think there is a natural tendency for all of us to do a little bit of finger pointing and say, "Hey, the problem is really over here on this other side; I'm a researcher; you users are the ones who are all fouled up," and for the user to say the same thing from his or her perspective. But I guess the way I see it, and what I really hear as a philosophy that underlies all of the research utilization programs in these agency settings that we've been hearing about today, is that research utilization does require mutual effort and to the extent that the effort is one-sided and to the extent that energy is invested in finger pointing rather than sitting down and trying to figure out as a team what we can do to solve the common problems, the research utilization effort is going to function less effectively. It's everybody's problem and unless everybody works together and minimizes the finger pointing and thinks more in terms of what we can do to improve the system, research utilization unfortunately will take a back seat to political infighting and to a lot of consequences that are not very desirable in terms of program improvement.

5. Research utilization must be specifically tied in with the overall research and development program in every way possible, from planning to evaluation and all the stages in between. I think we've heard Judah Drob talk especially persuasively this morning about the kinds of things that can flow from that sort of close organization.

6. Early involvement of research utilization staff in R&D programming is particularly critical. I suppose that is another way of saying what Admiral Metcalf said to us yesterday, that planning is critical to good research utilization.

7. The availability of technical assistance or consultation is critical. We've seen examples of that today in terms of RSA's experience with the research utilization specialist and in Judah Drob's "buddy system" that he described for us so eloquently.

8. Research utilization, to be worthwhile, requires the willingness to take risk, to be wrong, to fall on your can. I think that is an important point that everybody knows but not everyone is willing to acknowledge. For those of us who come from a research background and from a professional discipline that stresses the purity of scientific inquiry, it is a little tough to acknowledge that you are taking a chance and that you can be dead wrong about something. But unless you acknowledge that to yourself as a researcher and unless the system permits you to make a mistake and not go under because of it, I think research utilization as an activity is going to be far less successful, because without the ability to take those risks, there are many kinds of potential payoffs that you can never get to.

So those are the eight generalizations or themes that I see coming out of the discussion that we've had here this morning, and to some extent from all of what we've heard in the conference so far. I want to leave you with one other point that I think may help in conceptualizing the issues that, hopefully, we will be bearing down on a little bit more concretely in our recommendations session in the next couple of days. And that is that in your own thinking about research utilization activity, it is useful to think about this experience that we're all having here together as a research utilization activity itself. I know that may be an obvious point, but that's what it is, because this conference has been designed very much along the same lines as the research utilization conference that Bert Griffis mentioned to you that our organization coordinated a couple of years ago. The objective of that conference, in essence, was to disseminate the findings from our evaluation of the research utilization specialist through RSA and other funding agencies that have supported the development of the research utilization conference as a strategy for effecting change.

There has been a literature accumulation and a body of practice accumulation that has been followed and I think followed quite wel in designing this conference. The consequence is that if you process your own experience and the kinds of reactions you've been having as you heard other people talk and you reacted to the activities of this conference, to what we're trying to do, and perhaps as importantly, to how we're trying to do it and to the

strategies that we've used in attempting to effect a transfer of knowledge, I think you can get a good handle on what research utilization activities are like for other populations of researchers and practitioners. You can use your own experience in that way if you process it and you look at it in that fashion.

That is the final common theme I'd like to leave with you from the discussion that we've heard today from our five federal agency perspectives. I think each one of them has done a commendable job of looking at their own experience and processing it in a way that is relevant to the needs of this conference, thereby making that experience useful. Each one of you, in terms of the things that have been happening to you over the period of the last two days and what will be happening in the next couple of days, probably will come away from this conference with some new knowledge yourselves about how to do research utilization and what works and what doesn't. It's there for the taking, and so my invitation to you all is to give it a try and see if you can use it.

That's all I have to say right now; are there any questions that anyone would like to raise right at this moment? If not, let's go on to Bill McClelland.

Dr. William A. McClelland
President
Human Resources Research Organization

The listings that we have heard from the speakers who have stood before you have frequently added up to the magic number seven, plus or minus two, and it is indeed with some effort that I have followed established HumRRO tradition to come up with seven points that I would like to make. They are on general thematic issues which I have read in the materials for this conference or have extracted from what has been said by speakers before us this morning and by those with whom I have attended group sessions. I want to say just a sentence or two about each of the seven issues: goals, contexts, structure, roles, what is to be utilized, technology transfer, and change strategies. Since there are people here who have written books on one or more of these individual points, obviously I'll be very brief.

First, in the matter of goals, there are clearly some major differences among those of us who are here. It's quite clear that the emphasis of users, of sponsors and of operators has been very strong on problem solving, and I think that's an emphasis that most of us can accept for at least part of the activity in which we are engaged in human RDT&E efforts. However, there are some fairly major differences among us as to how much of the total effort should

be devoted to the equally desirable, if not essential, goal of developing tools in order to solve problems. This issue keeps coming up in terms of whether we're talking about research or development. I note two things being stressed in the papers, talks and discussion. I hear two emphases. One is on research and one is on what is called research but what is really developmental activity. I think that's a distinction we're going to have to be sure to keep fairly firmly in mind. Research is not development. It is not technical advisory service. They are different ballparks.

Second, as to context, I hear some differences here among us and with the agencies involved, both in terms of the mission of that particular agency and in terms of the time or the climate in which we happen to be operating. Meredith gave a very lucid statement, which is consistent with my experience at HumRRO, in which he talked about a kind of organization which existed at a particular time. The parallel to that now clearly has to be, it seems to me, the in-house laboratories. The contexts, I think, are different in a variety of ways. I'm not going to belabor that particular point, I'm simply saying that in the research utilization process it's important to realize that adaptations that are made have to take these sorts of variables into account.

Third, I want to say a word about the structure of the organization. When I speak of structure I'm including the trappings that come from the regulations and the rules and the procedures which in many cases are quite laboriously developed in order to make up a system that will enhance the likelihood of utilization of R&D. A lot of different structures make sense here. I'm a little frightened at times (and this stems directly from the kind of experience that I have had) of the complexity of interpersonal relationships at different hierarchical levels when we are dealing, as we are, with at least three or four different and definable organizational levels within the Department of Defense. I don't say the situation is any simpler in the civilian settings about which previous speakers have talked, but certainly hierarchically it's somewhat different. I don't worry too much about the differences between the civilian and the military contexts on this point of structure. I am simply pointing out that we face different problems in these two environments. I don't think that necessarily invalidates some of the inferences that can be drawn from what has been said earlier.

A fourth point has to do with roles. I think we're talking about different roles. In fact we've had a fourth one introduced this morning when we talked about the user and the researcher and the research manager and added to that the research utilization specialist. These are indeed different roles. I'd also like to point out, however, that there is no such thing as "the user." I'm a little disturbed by some of the comments I have heard which tend to make unequivocal distinctions among people operating at various levels. Admittedly there's a priority here, but I do think that a whole lot of different hierarchies are involved, a lot of different users

are involved, and that their interests obviously have to be considered before a commitment is made to undertake a project which hopefully will solve the particular operational problem. So we aren't talking about individual users, we're talking about a family of users and I think their interests are different and have to be somehow taken into account. I think that's true, incidentally, of civilian contexts as well, and the parallel there is probably a lot closer than one might suspect at first thought.

Fifth, I'd like to say a bit about the event itself. I'd like to applaud Ron Havelock's emphasis, which Meredith also mentioned, on what is to be utilized, what is to be put into practice, what is to contribute to change. It's not just what is currently being done. It should include that which has been done by your agency, by related service agencies, and should also consider what has been done outside the military context which might have relevance to a particular presenting problem. The "not invented here" phenomenon is a very insidious one and it's one that frequently we will find in our own labs and our own organization, such as people being unwilling to cite the work of someone working next door to them. As far as research utilization is concerned, I think that's a completely unforgivable perspective. We talked about the "here and now" phenomenon. I think our perspective has to be broader. And to restate what Glenn Bryan and Jay Uhlaner and others have said earlier, I think our expectations for utilization must vary as a function of the different kinds of events. The same requirements cannot be posed for each.

Sixth, technology transfer, I think you will now agree, is a specialty in and of itself. Most of us are practitioners of this particular process but we are not experts in it. There are a few living experts, but for the most part they are not here today. It is a specialty area and if we're to take seriously the kinds of demands that are being made upon the R&D community we'd better recognize that fact and recognize it more fully than we have done in the past. Tom has already spoken to that particular point.

Finally, change strategies are many. The change strategies that are going to work are varied and the application of these strategies is an art. The choice of change strategy is going to be a function of a great number of things, one of which, as has been suggested, is the category of R&D that's involved. I would simply call your attention to all these other points that I've tried to mention as points of difference, that is: goals, context, organizational structure, roles, and the events. All can influence the kind of strategy which might be most effective. It is an art, we need specialists in its practice, and we need to learn more about it ourselves.

RESOURCES FOR RESEARCH UTILIZATION

DR. BACKER: There are a few things that I'd like to mention in

terms of resources for research utilization. We've already heard about one that is quite important, the blue book that most of you have a copy of, Putting Knowledge to Use, and access channels have been arranged so that you can get a copy free if you don't already have one. That is the most recent review of the literature. However, it is not the only review. I think that it is worth mentioning two other important reviews of the literature on research utilization and organizational change. Both of them are referenced in the blue book. So if you have a copy of the blue book, you can also get the citation data for the other two that I'm going to mention to you.

One of them was published in 1969 and was authored by Dr. Havelock, and the title is Planning for Innovation. At the time it came out, it was certainly the most comprehensive and up-to-date review of what had been done to that point in the knowledge utilization field. It includes quite an extensive bibliography as well as Ron's analysis of the whole problem of research utilization from a systems perspective. That is one resource that I commend to all of you in order to get into the literature in more detail if you have not had that opportunity or responsibility already.

The third volume of the three volume bible on research utilization is Everett Roger's book, Communication of Innovations, published in 1971. That again contains a bibliography. It also includes Dr. Roger's analysis of the question of how innovations get diffused. His particular theme is the diffusion of innovations in fairly large organizations or throughout a society. He offers a rather interesting set of some 220 generalizations about what promotes effective diffusion and use of knowledge in a social setting. That is something not duplicated anywhere else in the literature. I think it would be worthwhile for anyone who is a serious student of this subject to get acquainted with that list of generalizations, because some of them are immediately relevant to real life problems you may be facing.

I would like to mention a couple of other general resources which are also referenced in the blue book, so that you can get the citation data if you want it. One is the Directory of Federal Technology Transfer. The most recent edition, I believe, was in 1976. This book was developed by the National Science Foundation under the auspices of the Federal Council for Science and Technology. It provides capsule descriptions of a great number of technology transfer and research utilization programs in, I believe, 50 or 60 federal agencies. Some of the agency settings or organizations from the military that are represented in this room have probably been described in that book. All of the programs we've heard about from our speakers here this morning are also described in the book. And I think you might call it sort of a "Whole Earth Catalog" of research utilization and technology transfer. As such, it is a convenient and easy way to get an idea of what people are doing in this area, because in four or five pages of material on each program you get an overview of what is happening, what kinds of activities are being

pursued, what sorts of publications are being put out, and what amount of money is available in different programs to support research utilization and technology transfer. I guess if I had to recommend one reference for learning what's happening in this specialized field that Bill just made reference to, that would be it. I think it is a very useful way of getting started in understanding a very complex and not terribly well interconnected set of activities in different public settings which affect the use of new knowledge in practitioner environments.

So that is another resource. What you might refer to as the "Yellow Pages" of technology transfer and research utilization is a publication entitled Technology Transfer Directory of People. The most recent edition came out in 1976 and I understand a new edition of that publication is underway. In any event, the Technology Transfer Directory, just like a telephone book, gives names and addresses of people who are active in the research utilization and technology transfer field. I expect that a fair number of people here in this room are in that directory. It is a good place to get names of people you might want to contact with reference to a particular problem in the research utilization area.

I would also like to reiterate what Bert Griffis very modestly mentioned a little bit earlier today--the Rehabilitation Services Agency has prepared their guidelines for research utilization and for preparing R&D reports in a fashion that will promote their utilization. I think they are very excellent publications that might be worth getting a copy of and reproducing and distributing to everyone in your own organization who has a responsibility for generating research knowledge. This set of publications, in a short number of pages and a small number of words, gives a lot of practical guidance about how to write things so that people will use them and about how to do research so that the results will be more easily utilizable. Both publications are also mentioned in the blue book, so you can get the citation data from there.

Another publication, kind of an appendix to Putting Knowledge to Use, is this little booklet called Information Sources and How to Use Them. It should be possible to get a copy of it either through us or through Howie Davis. If you leave your name with us here today, we'll be happy to send you a copy free of charge. Information Sources is a minidirectory to the different kinds of information systems and publications that are available in a broad variety of areas and that give people access to research information or information from different fields of practice. It includes a description of the various computerized information retrieval systems, including ERIC and NTIS, which Ron Havelock mentioned, and a great variety of others. If you want to know how to get information in almost any subject area, this is a good place to start. It also includes the names and addresses and brief descriptions of a number of publications, indexes, periodicals, and various other sources that may be helpful to you if you want to get information on any given

subject. I think it is a handy reference guide you might want to have on your desk in case you need to get information about almost anything. It has that kind of broad utility and relevance to a lot of different subject areas.

Those are the resources that I have to talk about in terms of print publications. I'd like to wrap up this part of our discussion session by reminding you again of a very obvious point I'm sure you've thought of, that print resources, as valuable as they are, are only the beginning of research utilization or knowledge transfer or organizational change, all of the things we've been talking about here. Once again, personal contact is the way most organizational changes take place. Although you can get information out of this booklet or the blue book or the other books that I've mentioned to you another very valuable resource that is accessed in part, but only in part, by publications like this are people. People you run into contact with in this conference and people you might be able to contact through the mechanism of the Technology Transfer Directory of People can be equally, or in many cases more, useful to you than anything that you can get in print, because you can have a two-way communication with them. The inherent limitation of any book is that although you can read it, it can't talk back to you. It can only give you information to the extent that it is already worked into the pages and happens to be relevant to your needs, whereas with the dialogue that is made possible by two people sitting down and talking, there can be some tailoring of the information and therefore a lot more specificity in terms of whatever your needs might be.

So, using the directory that I mentioned to you a few minutes ago and contact that may have been established through this meeting or others are other ways to get information you may need about research utilization. Thank you.

TECHNOLOGY TRANSFER PANEL DISCUSSION

SUMMARY

The principal focus of this session was on the transfer of technology from the Federal laboratories to state and city jurisdictions.

Allan Sjoholm, San Diego Technology Action Center, defined the critical need for new technology to reduce costs and improve operating efficiency in local governments.

George Linsteadt, Federal Laboratory Consortium for Technology Transfer, described the role of the Consortium in facilitating secondary research utilization or technology transfer. He also recounted the historical evolution of government policy relative to technology transfer. Finally, he discussed a number of obstacles to the transfer of Federal laboratory technology, including budget limitations; statutory restrictions (such as the Mansfield Amendment, which precludes the use of defense R&D for applications that do not have a direct relationship to the DoD mission); lack of policy in Federal agencies supporting technology transfer; lack of information in local settings regarding laboratory capabilities; poor communication between federal agencies and local governments; lack of technical assistance to support technology adaptation; and the problem of competition with private industry.

Gerald Miller, State of Oregon, cited a series of concrete examples of instances where he, in the capacity of Technology Transfer Coordinator, has been able to track down technology produced by the Federal laboratories and bring it to bear to solve critical problems faced by cities, counties, and states. He urged the conference to get involved in this process.

Charles Miller, Lawrence Livermore Laboratory, described several activities of that Laboratory in support of technology transfer. He also reported a number of conclusions regarding successful transfer activities:

- *The activity must be a full-time directed effort by the technology source.*
- *The receptors in the local government must be active and informed.*
- *The technology transfer agent must have access to a broad spectrum of technical information, and must have freedom to act and drive to respond to needs.*
- *Personal contact is crucial.*
- *Disseminating reports is not technology transfer.*
- *Transfer is an "integrating" process.*

D. M. DelaBarre, California Innovation Group (CIG) related the evolution of CIG as an important, institutionalized mechanism for putting together

a team from the public and private sectors to assist in technology transfer to local governments.

John Lockwood, City of San Diego, discussed the National Consortium for Technology Initiatives, a group of large cities and urban counties that have formed an alliance for the purpose of identifying, prioritizing and addressing common technological needs.

Robert Crawford, National Science Foundation, described the activities of the Intergovernmental Programs, a component of the RANN program of NSF, as another vehicle for supporting the technological needs of state and local government.

Finally, Dr. Kay Inaba, XYZYX Information Corporation, endeavored to summarize the technology transfer session from a practitioner's point of view. He urged that:

- *Researchers stick to research and leave applications to practitioners.*
- *More research be conducted on the applications process.*
- *More attention be devoted to procurement practices, the systems approach, and the optimal timing of moving projects from research to application.*
- *The effectiveness of the consortium concept be recognized and further exploited.*
- *A truce be declared between researchers and practitioners, and that they collaborate in the development of a series of applications program plans.*

TECHNOLOGY TRANSFER PANEL DISCUSSION

DR. GLASER: I just want to take about three minutes to read a rather important statement by Frank Press, Director of the Office of Science and Technology Policy, Executive Office of the President, and George Busbee, Governor of Georgia. The statement appeared as an editorial in Science Magazine, 27 May. They say:

> There is a growing awareness, both in Washington and throughout the country, that if science and technology are to benefit our people more effectively, a better R&D partnership must be established between the federal government and the states, counties and cities. Properly designed and directed towards state and local needs, federally supported R&D could help to protect regional and local environments, reduce demands on energy and various natural resources, and improve the delivery of state and local services.
>
> In recent years, federal funding of R&D for the civilian sector has been growing rapidly. It is now in excess of $7 billion annually. But its impact on meeting public expectations--on filling the everyday needs of the people--often seems disappointing.
>
> Past intergovernmental science and technology programs have been primarily one-sided affairs, relying heavily on the federal government offering money and off-the-shelf technology to the states and cities with little concern for or understanding of the user's needs. Much of this technology was a spin-off of aerospace and military R&D which might be adaptable to the needs of a local fire or police department or serve some other public need. In addition there were programs to supply governors and mayors with science and technology advisors.
>
> These efforts at domestic technology transfer in several cases have met with some success. But the residual problems of the state and local levels remain enormous and deserving of a greater effort. Clearly some new stimuli and new approaches are needed.

And that's what Al Sjoholm and his colleagues will be discussing this afternoon.

INTRODUCTION

Mr. Allan A. Sjoholm
Director, San Diego Technology Action Center
and Navy Personnel R&D Center

For the next two hours we would like to change the scene just a little bit and talk about technology transfer with primary emphasis upon local government--an area close to all of us.

Essentially, this involves the movement and utilization of such things as existing procedures, techniques, and equipment from the Federal laboratories and other sources into state, county, and city jurisdictions.

Today's local governments are faced with budget limitations, resource constraints, rising costs and, at the same time, demands for additional services. They cannot realistically afford a large research and development investment and yet urgently need new technological developments to reduce costs and improve operational efficiency.

How does this relate to Federal laboratories? To quote Mayor Kenneth A. Gibson of Newark, New Jersey, "The $26 billion in national investment in science and technology has not yet begun to be significantly tapped in terms of its potential to benefit state and local governments. The Federal laboratories represent a $12 billion publicly owned gold mine of national knowledge, methodologies, and end-products which could be devoted to local government service."[1]

There is ample expressed concern and emphasis from the White House level. To quote former President Gerald Ford:

> ...the progress we seek requires a new partnership in science and technology--one which brings together the Federal government, private enterprise and state and local governments, and our universities and research centers in a coordinated, cooperative effort to serve the national interest.... Only if this happens...can we be sure that our scientific and technological resources will be used as effectively as possible in meeting our priority national needs.[2]

President Carter stated his perspective in a communique to his cabinet agencies instructing them to seek local government involvement because:

- State and local sectors constitute the delivery mechanisms for most of the actual services the Federal government provides.

- State and local concerns, as well as their expertise, should be considered as programs are being developed in order to ensure the practicality and effectiveness of the programs.

- Such early participation by state and local officials in our planning process will help ensure broad-based support for the proposals that are eventually developed.

- It will ensure that priorities developed at the Federal level will work in conjunction with, and not at cross purposes to, priorities at the state and local level.[3]

And one final quotation, a very important one from the May 27, 1977, editorial in Science Magazine entitled, "Intergovernmental Science and Technology":

> There is a growing awareness, both in Washington and throughout the country, that if science and technology are to benefit our people more effectively, a better R&D partnership must be established between the federal government and the states, counties, and cities. Properly designed and directed toward state and local needs, federally supported R&D could help to protect regional and local environments, reduce demands on energy and various natural resources, and improve the delivery of state and local services.
>
> In recent years, federal funding of R&D for the civilian sector has been growing rapidly. It is now in excess of $7 billion annually. But its impact on meeting public expectations--on filling the everyday needs of the people--often seems disappointing.
>
> A feeling is now developing along the lines that intergovernmental action in science and technology must become more of a two-way flow. More initial state and local involvement in setting federal R&D agendas appears to be one way of generating this. Governors, mayors, state legislators, and county and local officials have far better ideas of the problems and the needs of their communities than do Washington officials. They should have more of an input into the decision-making that results in federal R&D budgets in the civilian sector.
>
> A related problem is that much federally generated R&D that might be applicable to public use on a state or local level is not adequately assessed or demonstrated. As a result, its usefulness cannot be properly evaluated. In many cases, research that might ultimately serve a public purpose is not carried far enough into application, implementation or the federal

> commercialization stage. This situation could be improved by more attention and closer cooperation between federal and state and local officials concerning research utilization.[4]

It is from this perspective that the technology transfer process emanates. A clearly existing need and a potential solution source.

The speakers today represent the various facets of the current technology transfer process and will be addressing their respective portions to provide you with a cohesive overall picture complete with problems, needs, and accomplishments.

The scenario of the session has been so constructed as to provide you with exposure to different levels involved. To begin with, the first speaker will set the stage by describing the objectives and functioning of the Federal Laboratory Consortium, one of the most important national technical networks. We will then proceed to the heart of the technology transfer process by hearing from a local Science Advisor. As a further amplification of depicting "how" technology transfer works, we will then hear described the application techniques of one Federal agency. Representing the requirements side will be a speaker from one of the oldest and best regional innovation groups in the country--the California Innovation Group (CIG)--and a Deputy City Manager from San Diego addressing the Urban Consortium. Finally, for an overall perspective and a vision of the future, we will close with the Director of Intergovernmental Programs, National Science Foundation.

As one added stimulant, I have asked Dr. Kay Inaba, President of XYZYX Information Corporation of Los Angeles, to provide us with his reactions in a summary of the session.

Our speakers are ready, you have had an opportunity to become familiar with their backgrounds from the handouts you received and my introductions will therefore be as brief as possible. A limited number of questions or comments will be entertained at the conclusion of each with a portion at the end of the session reserved for general discussion.

It remains also to be said that this entire process as you will hear is really rather new and its future is before it. It is our hope that by discussing issues and developing recommendations at such major conferences as this one today, we can together, contribute to its ultimate future and direction for our common benefit.

SECONDARY UTILIZATION OF RESEARCH, OR TECHNOLOGY TRANSFER AND THE R&D LABORATORIES

Mr. George Linsteadt
Chairman
Federal Laboratory Consortium for Technology Transfer

INTRODUCTION

What are the barriers to research utilization? How can we better utilize our research products? What are the reasons for less than optimal utilization of research efforts? These questions are asked not only by DoD but also by other Federal government agencies. DoD developed research products are, in one way or another, intended for use in the nation's defense. Therefore, it seems only natural that the principal concern of this symposium should be improvement of research utilization within the military services.

However, others, outside of DoD, could also benefit from existing military research efforts. Many military R&D "spin-offs" have found their way into the private sector and become household items. Often these spin-off products just happened; they were not the primary product of a research effort. Perhaps other existing research products developed by and for DoD could be systematically shared with other Federal agencies or state and local government agencies. Such a transfer is a form of research utilization--perhaps the ultimate in DoD research utilization.

If the results of DoD research can be utilized by other government agencies, then the original DoD research investment can be seen as having contributed over and above its primary task of satisfying a military need. Secondary research utilization, or technology transfer, has attracted the attention of many individuals and organizations as a logical method of enhancing the productive output of research efforts.

The transfer of DoD research to other Federal, state and local agencies can be provided through the department's many laboratories. These laboratories, such as the Navy Personnel R&D Center, contain a vast reservoir of technology, plus facilities, equipment and capable professional people.

Two facts justify making the resources of these laboratories available to other Federal, state and local government agencies:

1. The resources of these laboratories could provide solutions to many of the problems faced by these other agencies.

2. The secondary utilization of research results presents the taxpayer with a greater return on his investment in science

and technology. Enormous sums of taxpayers' monies go to research and development, and every effort must be made to ensure effective primary and, where possible, multiple use of that investment. In today's inflationary environment, this is an absolute necessity.

THE FEDERAL LABORATORY CONSORTIUM FOR TECHNOLOGY TRANSFER

Of course, secondary research utilization or technology transfer is more easily said than done. The Federal laboratories are presently accountable to many Federal government agencies and no integrating management system exists over these laboratories to make certain that the secondary technology transfer and research utilization process is fully productive. A voluntary organization, the Federal Laboratory Consortium for Technology Transfer, has been established to coordinate the technology transfer efforts of its members. To date, 70 of the largest Federal government laboratories and centers from a number of high technology agencies are participating.

The Federal Laboratory Consortium emerged from and is patterned after the Department of Defense Technology Transfer Consortium which was established in July 1971. At that time, representatives from eleven DoD laboratories met at the Naval Weapons Center to discuss the potential ability of DoD laboratories to transfer military oriented technology to other government agencies for nonmilitary applications. There are now 42 DoD facilities involved in Consortium activities. The previous DoD Consortium and the newly emerged Federal Technology Transfer Consortium have received administrative support from the Naval Material Command and the National Science Foundation. The purpose of the Consortium, as stated in its operating policy, is as follows:

> The Department of Defense laboratories are a source of technology for the solution of those civil sector problems which are amenable to technological solutions. The primary role of the in-house laboratories is to provide a research and development base for the development of systems required to fulfill the national security mission of the Department of Defense. However, these laboratories can serve a vital secondary role in the adaptation of technology to other fields and areas of need to the extent that it does not adversely impact on the primary Department of Defense mission. A consortium of Department of Defense laboratories is formed for the purpose of coordinating interactions with other Federal agencies and technology users at the Federal, state, and local level, and of coordinating the efforts in this endeavor. The Technology Transfer Consortium is an association of Department of Defense laboratories working together through an informal affiliation. The main thrust of the consortium activity is

through the individual and cooperative efforts of the laboratories involved, with an emphasis on the transfer and adaptation of technology through person-to-person mechanisms.

THE EVOLUTION OF POLICY

Many recent policy and analytical milestones have paved the way for the current expansion of the Federal technology transfer activities. The National Science and Technology Policy, Organization and Priorities Act of 1976 states, "...The Federal Government should support and utilize engineering disciplines and make maximum use of the engineering community...advise and assist the Director in identifying and fostering policies to facilitate the transfer and utilization of research and development results so as to maximize their application to civilian needs...."

Likewise, President Ford, in a report to Congress in February 1975, declared: "One of the clear lessons of the past few years is that our society, as well as that of the rest of the world, is intimately tied to technology and the science that produces it. Certainly our own approaches to problems in energy, environment, food production, and the well-being of the national economy will include substantial contributions from science and technology. As a nation we are fortunate to have an extraordinary, strong science and technology base to draw on in dealing with these and other important problems."[5]

The Committee on Federal Laboratories of the Federal Council for Science and Technology, in a report to the Office of Management and Budget in March 1974, recommended that "...consistent with existing laws and with established relationships with private industry, universities and nonprofit institutions, existing research and development capabilities in Federal establishments be utilized effectively to define and solve technological problems and guide the technical content of policy decisions relating to such urgent national needs as the environment, transportation, and health."[6]

Studies by the Federal Council on Science and Technology in 1974[6] and by the Council of State Governments in 1973[7] found a high potential for bringing federally developed science and technology to bear on the operations and performance of state and local governments. These same studies noted serious barriers to the effective application of such technology.

A December 1972 report from the General Accounting Office[8] recommended:

1. A government-wide policy for technology transfer with guidelines issued to Federal agencies to implement a formal, active technology transfer process;

2. That the Secretary of Defense establish policy and procedures to encourage more extensive application of existing defense technology to civilian problems; and

3. The establishment of a technology transfer consulting team as a central focus to help Federal agencies match technological resources with pressing needs.

The Action Conference on Intergovernmental Science and Technology Policy, held in June 1972 at Harrisburg, Pennsylvania, and attended by over two hundred leaders from both the public and private sectors, made a number of resolutions. They called for (1) strengthening of state and local government through applied science and engineering, (2) Federal-state-local partnerships in applied research and development, and (3) using Federal laboratories in domestic programs.[9]

The President's March 1972 message to Congress on science and technology also noted that "Federal research and development activities generate a great deal of new technology which could be applied in ways which go well beyond the immediate mission of the supporting agency. I believe the government has a responsibility to transfer the results of its research and development activities to wider use in the private sector."[10]

PROBLEMS IN TRANSFERRING FEDERAL LABORATORY TECHNOLOGY

Laboratories *within* the various Federal government agencies have diverse missions which reflect the missions of the parent agencies. It is, therefore, not surprising that those agencies established for the specific purpose of serving the people in rather obvious ways should have technology transfer effort written into their missions. However, the Congress, viewing DoD primarily as a defense establishment, is inclined to limit activities of the Department to those related to defense. During times of relative peace, the natural viewpoint of the people and the need for tight financial constraints tend to limit DoD activities. Unfortunately, this happens at a time when the Department is in the best position to provide a useful service to the people by making defense-generated technologies available for use by the general public. This has been the aim of DoD's technology transfer efforts and many successes have been achieved both by the Department of Defense and the Consortium. But, there is still much to accomplish.

Before addressing the various constraints on the intergovernmental use of DoD laboratories, it should be mentioned that legal support for such use already exists in the form of the Economy Act of 1932 and the more recent Intergovernmental Cooperation Act of 1968. These legal precedents exist to allow DoD facilities to assist state and local governments. However, focus of mission agencies and appropriations provided them do not permit large formal undertakings.

A report by the Council of State governments [7] points out some of the severe constraints that hamper the technology transfer efforts of the Federal laboratories:

1. Budget Limitations. No funds are budgeted for technical assistance to state and local governments. This lack of funds means that, for all practical purposes, the policy of intergovernmental technology transfer can be implemented only if (a) the state or local government can reimburse or (b) the laboratory is persuaded to sacrifice some part of its core activity.

2. Statutory Restrictions. In the case of DoD laboratories, the so-called Mansfield Amendment prohibits the use of R&D funds for any research project or study unless there is a potential for relationship to a military function or need. This permits cooperative R&D projects having civilian benefits only if they can also be shown to be relevant to the national security mission. While the Mansfield Amendment is considered by some as a potential barrier to a more extensive and productive utilization of the spin-off potential of defense laboratories, it is in fact less of a problem in the near-term than employment and money limitations.

3. Policy Inadequacies. Few Federal agencies have an affirmative action policy to encourage their R&D centers to diversify their roles and services on behalf of state and local governments. Still fewer have requested budgetary resources or manpower. Nor have they, for the most part, sent out a signal to state and local governments that the principal laboratories are being designated as technology support centers.

4. Information Gaps. Despite the genuine desire of many Federal R&D centers to apply their resources to state and local governmental problems, there is a general lack of information and data on available laboratory skills. The Council of State Governments recommends that, as a first step in bringing the laboratories together, a clear definition be compiled on the capabilities of the respective laboratories. The laboratories can thereby define what they have to offer in response to user needs and what they believe they can do in addressing such specific problems as air quality standards or instrumentation for monitoring changes in water quality.

5. Communications. The problem of communication between local government officials and laboratory researchers has also been a block in attempts to involve laboratories in state activities.

6. Technology Adaptation Capabilities. Frequently, simply providing a given technological response to a state or

local problem is not sufficient. More than likely, the user needs technical help to adapt or modify the laboratory's knowledge. Few Federal laboratories are in any position to provide this service to state and local governments.

7. Competition with Business. This issue could become important should the Federal R&D centers move significantly toward providing contract services to state and local governments or Federal civilian agencies for research and problem-solving. The Council of State Governments recommends that a policy position be implemented which would enable the laboratories to provide at least first-stage services to state and local governments, and also set boundary conditions effectively limiting the laboratories from extending themselves into full-service providers of public technology.[7]

SUMMARY

In conclusion, many statements have been made during the past few years indicating that obtaining the maximum return from our research investment is a worthwhile goal. However, to derive this maximum benefit from the nation's investment in research, primary technology must also be applied, if possible, toward a secondary application. The Federal government invests large sums of money in research annually, and means must be found to better utilize this technology through improved secondary technology transfer.

The Federal R&D laboratories represent a large technology resource which may be applied to civilian needs. These laboratories, located throughout the nation and operating on annual budgets totalling in the billions of dollars, can supply technical assistance and management support to those state and local governments, and in some cases, private industries attempting to solve the nation's problems. Many of these laboratories are actively seeking to share their facilities and expertise with public and private agencies having compatible requirements. The Department of Defense Technology Transfer Consortium, as a subset of the Federal Laboratory Consortium for Technology Transfer, is actively participating in this endeavor.

As far as policy is concerned, there do not appear to be any barriers to DoD laboratories providing assistance to state and local governments. The President's message in March 1972 provided good reason for intergovernmental cooperation in the use of science and technology, and the General Accounting Office and the Office of Management and Budget have supported this principle.

TECHNOLOGY TRANSFER IN ACTION

Mr. Gerald E. Miller
Technology Transfer Coordinator
State of Oregon

In reading the announcement of this conference, I noticed that the intent is to increase the utilization of research data produced by R&D Laboratories of the military services. Certainly the title and topic is appropriate for I would suggest that at no time in the history of the Federal research community has there been greater pressure by Congress and by the public for maximizing utilization of our research efforts. Judging from the quality of previous speakers and from the attendance, it appears that those of you here feel the same way. From the program outline it is obvious, as it should be, that the emphasis of this conference is on the greater utilization of the research data produced and used by the Department of Defense. But those of us on this panel are here today to tell you of potential new users which probably most of you have considered before.

As you know, I am also a Federal scientist, employed by the United States Navy since 1969. But I am somewhat unique in that I have, for the last six years, devoted full time to finding civilian uses of the technology produced by the Federal laboratories, both military and nonmilitary. The ultimate goal of my job is to use this information toward solving problems faced by the cities, counties and states in the United States. Thus, I have been born of the innocence of the lamb at the Federal level and subsequently fed to the lions at the local level. I do not use the term to describe the political and economic environment that is faced by the local officials in running, on a day-to-day basis, the cities, counties and states in which you and I live. And believe me, it is an entirely different ball game in that area than you and I, as Federal scientists in Federal laboratories, are exposed to.

As an example, let me cite several situations which you may not be aware of. I was recently told that in the Boston Fire Department, the average retirement age is slightly over 40 years and three-fourths of all firemen that retire in Boston do so under disability retirement, not service longevity retirement. This means that the city of Boston has to budget literally millions of dollars to pay for individuals who are on disability retirement and yet who have years of potentially productive life ahead of them. In Oklahoma, eight cents out of every dollar spent on the collection of urban refuse pays for the liability insurance each city must have since collecting garbage and trash is the most hazardous duty any city employee can perform. In fact, in some of the smaller communities in Oklahoma the insurance premiums cost more than the cost of

actually collecting the refuse. In Poway, California, a small community northeast of San Diego, topographical conditions prevented the fire department from communicating with their fire trucks in certain parts of the city. In Klamath Falls, Oregon, five firemen have suffered heart attacks during the last two years. All have survived; all are drawing disability pay. In Nashville, Tennessee, two police officers are killed within a six-week span. One stabbed to death; one shot by a 17 year-old youth with a .22 caliber pistol. Neither officer was wearing body armor which is highly available and relatively inexpensive. Aside from the tragic human loss, the City of Nashville is out over $100,000 for widow payments and medical costs. In Multnomah County, Oregon, the most populated county in Oregon, the nearest good aggregate for road construction is now over 35 miles from the asphalt plant. The added haulage, plus increased cost of oil and labor has significantly increased the cost of repairing city streets. And finally, approximately six weeks ago, a small state-owned bridge along the southern coast of Oregon collapsed. Fortunately, no one was injured, but the bridge collapsed because the wood pilings that supported it had been eaten through by marine borers and this damage was not visible to the casual observer or the naked eye. But this collapse now forces the State Highway Department to seek a method of determining the structural soundness of all other wood pilings of state-owned bridges in Oregon. If done manually, this could cost the State several million dollars a year alone. I could continue to cite literally hundreds of examples of problems which are daily confronting city, county, and state governments in the United States. This is why I'm here today to talk to you about what you people can do to help local government reduce, or at least hold in line, these costs.

Now, let's go back and take some of these examples to show you how research, knowledge and information generated by Federal agencies has, in fact, assisted local governments already. In the case of the Klamath Falls, Oregon Fire Department, information gathered on physical fitness training programs in other fire agencies, and brought together by the National Bureau of Standards, was directly applicable to the potential establishment of a physical fitness training program for the Klamath Falls Fire Department. Further, information generated by the National Fire Research Administration was used to verify that such physical fitness programs could reduce heart attacks in firemen. This makes the program much more acceptable to the community, to the firemen themselves and to the City Council. In the case of the police officers in Nashville, Tennessee, the second death resulted in an immediate demand by the mayor that body armor be provided to all law enforcement personnel in the city. The technology advisor in that city put in an urgent call to the Department of Defense, via a technology transfer contact, and considerable research data generated by the United States Army was provided to the city of Nashville at no cost. In addition, the information used by the San Diego Police Department, which had been previously generated with the assistance of the United States Army, was also forwarded to Nashville and a

complete body armor specification was prepared in three days and delivered to the mayor. I am told that today, all 750 sworn officers in the Nashville, Tennessee, Police Department daily wear body armor. Closer to home, the fire chief of Poway, California, after hearing of the interest of the Federal labs in helping solve local problems, contacted the Naval Ocean Systems Center (NOSC) here in San Diego for assistance. Their problem was basically one of radio propagation and certainly if the Navy or the Department of Defense had any technology appropriate to local government, the study of radio wave propagation problems was one clearly adaptable to local government. A quick check with technology experts here at this laboratory indicated that they could, in fact, offer technical advice to the Fire Department. Topographic maps, tower heights, power output of the transmitter and other technical data were requested and furnished by the Poway Fire Department in a matter of 24 hours. Four days later, NOSC provided a written report to the Poway Fire Department describing, in complete detail, how to solve their problem by the use of repeater sites on appropriate hills. I might mention that this was done by a single scientist from NOSC at home on his own time and he was absolutely ecstatic to be able to offer his assistance to the community in which he lived. Subsequently, the Commanding Officer received a letter of appreciation from the Fire Chief and a note that funds had been requested from the City Council to implement the recommendations provided by NOSC.

In the case of the Oregon bridge collapse, I can't offer such an outstanding success story because we have found that there is little existing information that would be directly appropriate to that problem. But what we have found, and I think it's extremely appropriate for this conference, is that the National Bureau of Standards which houses a large nondestructive testing research group, has said that they believe this program could be of significant national interest and that they might be able to adapt their present research program to include nondestructive testing of bridge pilings. You probably have noted that the examples given are more hard-technology oriented, and as I understand, you are involved in people-related research. But local government has a lot of those problems also. Alcohol counseling programs, productivity improvement, employee training, job stress for police and firemen, personnel performance measures, and selection criteria for policemen are all problems I have been given through the years.

I am well aware that most of us in the room today do not have the kind of flexibility potentially exhibited by NBS with the bridge piling problem. Frankly, I am not asking that you change your mission or change your R&D projects. What I am asking is that you make an effort to let local government know what data you already have existing. I am further suggesting that, unless you are working in an exotic field such as lasers, destruction of orbiting satellites, or some other type of highly speculative technology, the chances that your research results may have civilian application are good.

What I would like to see is you people making an effort to see that it is utilized at the local level. Assuming that you have that interest, allow me to give you some thoughts about assisting local government.

Perhaps the most significant advice that I can offer is that the local government officials near your base or your federal agency will never come to you for help. I think this is for two principal reasons: First, local officials never anticipate, particularly if you come from a DoD laboratory, that you are interested in working with local government. You must let them know that. Second, the majority of local officials which I have met find it hard to believe that a Federal agency has anything to offer to the local government. Most of the local officials with which I have dealt conceive of a Federal scientific laboratory as a place where all those exotic, neat things are done, but which they would never understand in a million years. Again, it is up to you people to dispel that myth.

So, what can you do specifically to enhance the utilization of your research data by local government? First, you have, or will shortly hear, the discussion by Mr. Linsteadt of the Federal Laboratory Consortium. Certainly, your participation and cooperation with that consortium gives you a step-up in the potential utilization of your research data from your particular laboratory and I would heartily encourage your joining or at least participating with the Federal Laboratory Consortium. But whether you do or not should not limit you in taking the second step and that is making yourself known to the local governments in which your laboratory resides. I'm referring specifically to the city manager, the mayor, or any other principal city, county or state administrator. Go to them, explain who you are and why you are there. Simply tell them you would like to share your information and help them solve problems which are facing their communities. Now, I must warn you that you will be received initially, I suspect, with some skepticism. Local officials are inundated with consultants and others who offer cure-alls for local problems. Further, most local officials feel their problems are not of a scientific nature and thus will find it difficult to initially understand what you have to offer. Finally, city officials are confronted on a daily basis with labor crises, citizens' complaints, financial problems, etc., so that it is very likely that they will forget your initial offer. This means you must be prepared to go back several times. But please, don't give up.

When you do talk with the local official, ask him what kinds of problems are facing his community. See if you have any projects on-going at your laboratory which might be appropriate. Be willing to provide reports, phone consultations, personal on-site visits, if appropriate and possible, because nothing works as well in this business as the one-on-one discussion. And once the local official finds out that you are sincere and can, in fact, contribute, the chances that your research data will continue to be utilized are greately enhanced.

There is one thing, however, which you should not do and that is approach the local community officials emphasizing that you are a scientist. Instead, approach them as a member of the community with possibly some unique contribution. That is why it is extremely important that you take your research data and adapt it to the city problems. In other words, find out what the problems are and offer solutions. Do not go in with the solutions and look for the problems. Now, it is likely that your technology will not be directly appropriate and adaptable to the city problem. It might take some modification, or interpretation, and that is where you, as an intermediary between the Federal laboratory and the local government, can serve a very useful function.

Up to this point you may be saying, "Gee, that sounds okay to me, but it also sounds like he's talking about hours of my time, I just don't have it." Frankly, that is not true. It is absolutely amazing to me how much help can be provided in a relatively few minutes of your time each week and I think you will find that once you make those initial contacts, you will realize the potential that can be gathered from your laboratory.

Finally, one always asks, "What's in it for me?" Well, I guess I could ask the same thing of the 70 laboratories that presently comprise the all volunteer Federal consortium, particularly those that are in the Department of Defense because as you all know, there is no charter in DoD requiring us to support local government. I guess I could ask that same thing of the electronic engineer who so graciously helped the City of Poway. I will be honest to say that there will be no kudos from the Department of Defense and there will be probably very little from your laboratory management. However, I think I can offer two rewards. First of all my experience has been, while serving as a technology transfer coordinator for NOSC that the working level individual in the laboratory is very eager to finally find somebody who really wants to use the results of his research.

Furthermore, he is able to see a direct result of his efforts. Secondly, there is in fact an intrinsic satisfaction that can be realized from knowing that you're solving real world problems, particularly in the community in which you live and pay taxes. It is my personal opinion that the concept of technology transfer will someday be accepted at the Federal level, and that in fact, there will be a Federal technology transfer program. Until that day arrives, however, I personally believe in the concept, and feel that those of us who are scientists and produce scientific research data can realize a personal satisfaction in finding greater utilization of that data by applying those results to problems in our own community. I have worked with approximately 150 cities in 38 different states since I got into the technology transfer business back in 1972. As a result, I believe I can honestly say, as one of the comedians used to say on television, that if you make the effort to find greater utilization of your research data at the local level,

"your mother will thank you, your father will thank you, I will thank you, and I know damn well that the local government will thank you."

SOME APPROACHES TO TRANSFERRING FEDERAL TECHNOLOGY TO STATE AND LOCAL GOVERNMENT: THE LAWRENCE LIVERMORE LABORATORY EXPERIENCE

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INTRODUCTION

Since its inception, the Lawrence Livermore Laboratory, operated by the University of California for the Energy Research and Development Administration, has supported technology transfer efforts. Initially, these efforts were under the auspices of the Atomic Energy Commission. The AEC's programs relating to technology transfer grew from an early narrow policy of permitting only nuclear-related interactions to one encompassing energy research of all kinds. The scope of these transfer activities reached full flower with the formation of the Energy Research and Development Administration (ERDA) in January 1975.

ERDA's legislative authority states "...the Administration shall disseminate scientific, technical and practical information acquired through information programs and other appropriate means, and shall encourage the dissemination of scientific, technical and practical information relating to energy so as to enlarge the fund of such information and to provide that free interchange of ideas and criticism which is essential to scientific and industrial progress and public understanding."[11]

Additionally, ERDA has been mandated to reach national energy goals as soon as is feasible through research, development, test, and demonstrations involving cooperative efforts with industry and with other public bodies. To successfully develop new sources of energy or to develop energy conserving technologies requires that technology transfer be an integral part of ERDA's program development.[12]

Beyond those programs with inherent technology transfer elements, ERDA is committed to achieving maximum utility of all technologies arising from its research activities. Each ERDA Laboratory is encouraged to support efforts to spinoff specific and useful ERDA technologies from the Laboratory to industry, and to state and local governments. The technologies are diverse in that they consist of

ideas, hardware, processes, special facilities, technical projects, developments, and individual expertise.

At the Lawrence Livermore Laboratory (LLL), the Technology Applications Group (TAG) is responsible for these activities. Over the past few years a variety of approaches have been used to help meet the challenge of delivering a very broad "product line" to an extremely varied set of "customers." The purpose of this paper is to describe briefly some of these activities directed toward state and local governments and to present some conclusions based on the lessons we learned.

SELECTED STATE-WIDE PROJECTS

In most areas of the United States, various public programs support activities designed to provide technical assistance or advice to members of state and local governments.[13,14] In August 1975, a one-year experiment was begun to test methodologies of transfer to state and local governments with the State of Hawaii as the test location. Before this experiment had concluded, ERDA's San Francisco Operations Office requested that we perform a similar task in the State of Arizona. The Hawaii experiment has concluded [15] and the Arizona effort continues.

THE HAWAII EXPERIMENT

Six visits, each for about one week, were made to the State of Hawaii with the objective of developing and testing a methodology of tying Federal sources of technology to civilian receptors, with LLL serving as a broker or "linker."[16] The State of Hawaii was selected as the location because it represents a separate, self-contained, socio-economic system for which data, technological needs, and results of efforts could be identified in a short period of time. Additionally, the time and cost constraints associated with communicating with the mainland tend to discourage the use of technical resources outside of the State.

The initial visits were devoted to meeting the appropriate people, to gaining an understanding of the structure, needs, history, institutions, and strengths of the state, and to establishing working relationships with key people at the State and city/county level. Probably as much as one-third of our time was spent on these efforts before sufficient rapport and confidence were established to effect technology transfers.

The strategy was, first, to establish credibility by providing useful information to requestors, then to effect transfers of ERDA energy technologies, and, finally, to encourage and abet institutional relationships between the State and mainland resources.

In addition to visits by LLL personnel, a number of other activities were conducted. The Department of the Navy, with National Science Foundation assistance, presented a two-day Public Works Management and Maintenance Seminar in Honolulu in response to expressed needs. The seminar was effective and well received. Later, three Technology Transfer Workshops were held, one each in Hilo, Maui, and Honolulu. The workshops, directed toward representatives of city/county governments and local industry, were conducted by technology transfer representatives of three Navy Laboratories in California, the California Innovation Group, and LLL. We also assisted the University of Hawaii in planning and presenting a one-day Solar Energy Workshop.

These face-to-face meetings and workshops led to a large volume of correspondence between the Hawaii participants and the mainland representatives. Significantly, since the end of the experiment (and the end of face-to-face contacts) the frequency of correspondence has dwindled to an occasional letter among a few of the key people involved.

Our overall goals seem to have been met. The awareness level of key Hawaii people of mainland resources of technical information has been increased; "useful" transfers have taken place; and, with the assignment of a full-time employee to a new ERDA Honolulu office and a strong tie to a state-wide office, an important step has been taken toward an institutional tie to mainland, Federal technology.

THE ARIZONA PROJECT

To help carry out his responsibilities within Federal Region IX, the manager of ERDA's San Francisco Operations Office appointed as his representative to the State of Arizona, Mr. Don Pearman, Deputy Director, ERDA Los Angeles Office. Mr. Pearman, following several meetings with officials of state and local governments, requested that we assist him in his Arizona responsibilities. The request came from his desire to offer a broader base of technical assistance to the various institutions in the State and his feeling that our activities in technology transfer could bear fruit in Arizona.

Again, the initial marketing efforts began: meet the key people; gain an understanding of their backgrounds, needs, constraints; learn and understand the local structures, hierarchies; identify and become acquainted with ready receptors. These activities brought us into contact with the State capitol, county governments, city governments, and officials of the Navajo and Hopi Indian Nations. As in Hawaii, the plan was to establish credibility by attempting to address the broad spectrum of technical needs, to establish an awareness of other Federal sources of available technology, to effect significant transfers of ERDA technology, and to help create self-sustaining linkages between state and local governments and federal technologies.

To date, the project appears to be progressing satisfactorily. Solid connections have been made with active receptors and dialogues have been initiated between Arizona personnel and other Federal laboratories. The Navy's Public Works Management and Maintenance Seminar will be presented in Flagstaff this summer for Public Works personnel in Northern Arizona. The Naval Weapons Center, China Lake, has arranged for the loan of instruments to help acquire data on several solar projects within the state. Our Laboratory is planning several solar energy workshops in the state and is developing energy projects with the Hopi nation. Within the year, the need for frequent face-to-face meetings will diminish as the technical relationships solidify.

TECHNOLOGY TRAINING PROGRAM

In another approach to Technology Transfer, LLL's Mechanical and Electronic Engineering Departments, with initial funding from the National Science Foundation, established TTP--the Technology Training Program. Starting in September 1975, 198 students representing 91 different organizations have been trained at LLL in three areas of technology.[17] Three courses were developed (microcomputers, digital logic, and welding and bonding technology) and two of these have each been offered three times.

The courses are offered at no charge to the participants, but each participant's institution is responsible for personal expenses such as travel costs, meals, and lodging. The lecture portions of the courses are presented in a specially designed classroom contained in a double-wide trailer module. The trailer forms a 24 x 60 foot room with space for 32 students. Television cameras and two monitors enhance students' visibility of the instructor and visual aids and cameras record the entire lecture on video tape. The courses also feature hands-on training in laboratories, custom fitted for each course, in a building adjacent to the classroom. Carefully prepared workbooks are also supplied to the students.

To measure the effectiveness of these courses, several feedback pathways are used. Each student participates in two surveys. During the first class day, a questionnaire is completed which evaluates students' expectations. At the end of the course, another questionnaire allows the students to evaluate the course in terms of their pre-course expectations. Results of pre- and post-course surveys have resulted in appropriate modifications to course material, working areas, or presentations.[18]

Another important measurement of the effectiveness of these courses is a series of follow-up studies of selected organizations whose employees have attended the course. The studies include visits to the organization and interviews with former students. Some benefits to participating organizations have been reported.[19]

Some identified results are listed below:

1. To improve efficiencies, the California Department of Water Resources is using a microcomputer data collection system at the Oroville Dam to relay information directly from the dam to the control center in Sacramento, California.

2. As a result of the Welding and Bonding course, Bay Area Rapid Transit District (BART) maintenance personnel have adopted techniques estimated to save thousands of dollars.

3. A physician with the Kaiser Hospital, Oakland, California, has developed a prototype interface between a Coulter-S Blood Counter and an LLL-designed microcomputer which creates a system to automatically flag abnormally high or low blood values.

4. Engineers of the San Francisco Bay Area's East Bay Municipal Utility District are applying advanced weld evaluation techniques to determine if segments of a 50-year old pipeline can be repaired or must be replaced.

5. California Department of Water Resources personnel have applied TTP-taught welding techniques to repair eroded water-pump impellers at a savings in time and money.

6. The City of San Jose, California, has applied microcomputer technology to the design and specification of traffic controllers with estimated annual savings of $75,000.

Potentially more important than results reported by former students may be the multiplier effect of these courses. Video tapes and course materials are available for loan so that former students may present the courses to others in their own establishment. For example, Mr. Monroe Postman, the Public Technology, Inc., technology agent for the City of San Jose, borrowed video tapes, workbooks, and other materials from LLL. He then trained 17 San Jose employees in microcomputer technology and applications. In addition to the traffic controller application earlier, the city employees will apply this newly gained knowledge to minicomputers to be installed in the city's library system. Presently, over 35 organizations have borrowed video tapes and course material and an additional 20 organizations are on a wait list. Ultimately, literally thousands of technical employees will benefit from this training.

CONCLUSIONS

Experiences with an active (as opposed to reactive) technology transfer program at LLL have led to a number of conclusions about the necessary ingredients and steps to ensure successful transfer of Federal technology to state and local governments. These conclusions

are reinforced by our experiences in transferring technology to industry [20] and by reports from other Federal laboratories.

The most important conclusions are the following:

1. The technology transfer activity must be a full-time, fully funded and directed effort on the part of the technology source.

2. Without active, informed and enthusiastic technology receptors in the state and local government, transfer efforts will fail.

3. Technology transfer agents, in the field or in the office, must have access to a broadly based body of technical information and experience, such as The Federal Laboratory Consortium for Technology Transfer.

4. These agents must have the freedom and the motivation to aggressively seek opportunities and to respond satisfactorily and in a timely manner to all requests for assistance.

5. Person-to-person contacts, over a long period of time, between sources and receptors in the field are essential.

6. Merely providing information in the form of reports is usually not sufficient to effect transfers. Often, additional development work (tailoring a solution to a problem) and/or training the receptor in the use of a technical fix is required.

7. The transfer of a technology will be completed when the technology becomes generally accepted practice, or when the chief officer of a governmental unit routinely assesses available technology when presented with a problem, or when the technology is readily available in the marketplace.

8. The transfer of Federal technologies to state and local governments is an integrating process, involving considerable effort on the part of the receptor as well as the source and sometimes involving assistance from other sources, receptors, or technology "brokers."

Recently, we read the written testimony of Mr. Joseph W. Smollen, III, presented to the U. S. Senate's Subcommittee on Aerospace Technology and National Needs, Committee on Aeronautical and Space Science at hearings held September 22, 23, and 24, 1975.[21] Mr. Smollen was at that time a NASA employee serving as an advisor to the Regional Planning Commission for Jefferson, Orleans, St. Bernard, and St. Tammany Parishes, Louisiana, under Title IV of the Intergovernmental Personnel Act. In his testimony, Mr. Smollen offered "A Few Comments on Technology Transfer" which so closely followed our experiences

that we thought it appropriate to close with these thoughts (for "NASA," of course, one can read "ERDA," "DOT," "DoD," "EPA," etc.):

1. It's much more difficult in actual practice than in the fine brochures and polished presentations on the subject.

2. There are no experts in technology transfer--only varying degrees of ignorance.

3. Full-time men-on-the-scene are necessary.

4. Fast response and technical back-up are required. Local and state agencies don't care about the internal Federal budget and justification cycles--they just want results or signs of progress now. In-depth technical experts need to be ready to catch the next plane to talk with the local people. The local officials also don't care about Federal travel budgets and justifications.

5. Knowledge of the local state people, government, culture, history, and trends is imperative. People still distrust "outsiders." You can be the best technologist in the world--and if you don't understand what is important to the local population--you will do more harm than good.

6. The local elected and appointed leaders must be progressive and want innovation in government. And the local leaders (not the NASA man) should conduct the press conference when you have results to show.

7. Progress and results will be painfully slow under the best of conditions.

8. Data, information, and information systems may be the most important "product" transferred.

9. Not all technology transferred is NASA technology. What is important is the solution to the problem at hand whether it involves technology or not.

10. A lot of the technology is not carried far enough by the federal laboratories to be cheap enough for city and state governments to afford it.

11. Much of the Federal technology is not put in a form or format that is recognized as useful to the local government.

12. There are few financial incentives for cities to experiment with new technology.

13. Industry has no great incentives to pursue new technology to the point of commercial feasibility or market aggregation--especially with the cities.

14. Once you are successful with a few things in a location, you begin to be inundated with phone calls, visiting firemen, and stacks of mail--to the point that it almost interferes with your basic mission and overwhelms your mind with obscure facts. But buried in the mail and visitors is the occasional "pearl"--that will help solve one of your local problems--or where you can help someone else. The problems of success are more pleasant than those of failure--but they are no less difficult to deal with.

15. There will be more failures than successes at first. The most tragic failure is to quit trying.

16. The best technology transfers are done quietly with little fanfare.

17. A lot of good tries will fall through the crack.

18. You must have "godfathers" in local, state and NASA organizations or you can't survive to do the job.

19. Talk is cheap in technology transfer.

20. The customer (local and state government) is (almost) always right.

21. If you can't put an existing working device or product in the local man's hands, then don't talk about it until you can.

TECHNOLOGY TRANSFER, A CASE STUDY - LOCAL GOVERNMENT

Mr. D. M. Delabarre
President, California Innovation Group, Inc.

On behalf of the California Innovation Group, I would like to express our appreciation for the opportunity to come together with all of you to exchange ideas on how we may improve our individual technology utilization programs. We have many issues which need to be addressed in the area of technology transfer and utilization. I will, however, be speaking primarily of the technology transfer and utilization process and how we may elevate our current "affair" with the Federal

laboratories to a legal marriage. I feel it would be useful to spend a few minutes summarizing the background and evolution of the California Innovation Group. Additionally, I would like to give you a few of my personal views concerning science and technology transfer and why I feel the CIG's and related projects are so essential to the future health of our cities.

First, let me say that for our purposes, we view the term "technology transfer" to mean "Learning to use available materials, techniques and processes to improve our effectiveness and save money." Most of what I have to say today is aimed at trying to make that happen for us in local government.

It is our opinion that the majority of the problems we run up against are not really the technical problems associated with transfer or the application of high technology, but the political and administrative aspects of government. Some dramatic failures have been noted in efforts to implement a technology transfer activity and most of these can be related directly to personality problems or unwillingness on one side or the other to make any adaptations in communicating with each other. Commitment by people such as yourself and those in local government who believe in what we are all about here today, can overcome those problems and allow the technical people to operate in a much more efficient manner. Commitment and desire, however, will not do it without some mechanism or structure for us to work within. We feel that explaining the history and evolution of CIG may help in sorting out a more comprehensive plan of attack.

THE CALIFORNIA FOUR CITIES PROGRAM

The California Innovation Group is actually the result of an experiment which was started in September of 1971, known as the California Four Cities Program. The original participating cities in California were San Jose, Fresno, Pasadena and Anaheim.

The original concept consisted of putting together a team of participants that were considered essential to providing technology transfer for the cities. The primary sponsor for that initial program was the National Science Foundation, with the National Aeronautics and Space Administration an associate sponsor, providing program administration and support through the Jet Propulsion Laboratories in Pasadena. The two remaining elements of the team were the four cities and the sponsoring aerospace firms (Northrup, S.A.I., Aero Jet and Lockheed).

Program organization during the first three years of our program was quite informal. A contract agreement was made between the National Science Foundation and JPL with subsequent contracts directly to the industrial firms providing the Science Advisors. Typically, the Science Advisors reported directly to the City Manager, and his industrial back-up site provided support to his activities. The

Science Advisors came from aerospace firms which were to act as primary resources in the transfer of technology to cities.

Although the Four Cities Program established quite a lengthy list of objectives to be achieved, I think it is fair to say that the primary objective was to provide a feasibility test to determine the acceptability and usability of a high technology transfer agent housed within local government management. Generally speaking, the results obtained during those first three years of our existence have been well accepted by both the sponsoring agencies and the City personnel.

At the conclusion of that initial experiment, the United States General Accounting office was asked to evaluate the program, and in a report to Congress, concluded, and I quote: "The program generally achieved the specific program objectives and showed that such partnership arrangements can bring about improvements in operating local governments through technological innovations." We should also mention the fact that the cost of providing these Science Advisors has continually increased while the per city-dollar financing from the National Science Foundation has decreased.

In summary, the principal objective of the program, that of proving the viability and usefulness of a Science Advisor, was clearly shown, and we still believe that the Science Advisor is the most important element of both programs.

THE CALIFORNIA INNOVATION GROUP

Building upon the success of the initial Four Cities experiment, the California Innovation Group was established. The initial expansion of the Four Cities Program resulted in the Cities of Santa Clara, Burbank, Santa Ana, Garden Grove, Huntington Beach, and San Diego joining the original four cities. Since that time, the City of Brea has also been added. In our expansion efforts, it became obvious that if we were to truly represent a statewide activity, the League of California Cities would be an absolute necessity to have as a partner in this technology transfer effort.

The primary objective of this expansion effort was to develop a more "program oriented" activity, and rather than operating as individual projects in each city, we would utilize an intergovernmental approach. The specific objectives developed for the California Innovation Group are quite lengthy and I will not go through them in detail. However, they can be categorized into several general areas. They include the development of the team approach and the intergovernmental aspects of such an approach; the establishment of a statewide technology communication network through the California League of Cities; the identification and implementation of the necessary steps to institutionalize the activity, which I will go into very shortly; the

expansion of our involvement and linkage with programs such as the Urban Consortium, the Urban Technology System, and Public Technology Inc., in general, and other networks interested in providing technology transfer assistance to cities; and finally, it was our objective to develop a more diversified resource base with less dependence on the National Science Foundation.

Our basic approach to achieving these objectives I will go into in some detail later. However, we continued the successful aspects of the Four Cities Program and have established our statewide capability through the League. From the point of view of the participating city managers, we can safely say that the results obtained during the past two years of the California Innovation Group's existence have clearly demonstrated the value of such transfer capabilities, and we have established the necessary mechanisms to take on various types of programs ranging from test and evaluation to proof of concept for new systems or hardware. Simply stated, we have gone from an experiment to an operating support function for the participating cities.

For the purposes of this meeting, I believe a brief explanation of the evolution of the CIG organization may be worthwhile. One of the problems identified with the original Four Cities experiment was the lack of active program management. The very nature of the experiment resulted in a very passive role being taken by NASA/JPL to determine the worth of the individual Science Advisors. This approach, although acceptable for the initial phase of the program, did not seem to provide the type of local government control that would bring the program into clear focus with our overall needs. For this reason, the participating city managers elected to select an individual to act as Principal Investigator/Program Manager, and more or less work directly for the cities.

Originally established as an informal consortium, the California Innovation Group was not a legal entity. As a result, it was necessary to establish a pass-through agency to monitor and disburse NSF grant funds. This was accomplished through the Institute for Local Self Government, a non-profit corporation associated with the League of California Cities.

We tried to establish more effective lines of communication with Public Technology, Inc. (PTI) and the Federal Laboratory Consortium (FLC). The FLC support has been very effective and, in fact, they have established a California Federal Consortium, made up of 14 laboratories located in the state, working directly with our program office and the individual Science Advisors. George Linsteadt will be speaking on the FLC later; however, I would like to say that through the efforts of these Federal Laboratory Technology Utilization personnel, the FLC has emerged as a primary resource to CIG. It is our desire to expand our partnership and meetings such as this one today will surely help. The League of California Cities provides a full-time field representative devoting her time to science and

technology dissemination activities. I might note at this point that the dissemination coordinator for the League is available to all other programs including Federal Laboratory Technology Utilization activities and cities in the state, not just the CIG participants.

The next evolution the CIG went through was that of becoming a California non-profit corporation. This action has provided us with the necessary status as a legal entity and organizational structure of sufficient strength to function in a statewide or regional capacity. A Board of Trustees comprised of private sector people was formed and the city managers, previously serving on the Policy Board, became a local government Advisory Board.

We have learned from the California Innovation Group that individual cities require a slightly different or modified organizational approaches within their individual political structures. Generally, the Science Advisors report directly to the City Manager. San Diego has established a separate office called San Diego Technology Action Center (SANDTAC). Allan Sjoholm, the Science Advisor there, is on an IPA assignment from the Navy Personnel R&D Center, San Diego.

I hope that this explanation of our organizational evolution has given you some insight into the various problems, and hopefully, some potential solutions to those problems that arise in the development of such an organization.

I thought it might be worthwhile for purposes of this meeting to very briefly note the primary elements of our work breakdown structure. They are the ongoing functions of: (1) Technology Analysis (which includes (a) problem/needs update, (b) technology resources analysis, and (c) task force support); (2) Technology Utilization (which includes (a) problem solution analysis, (b) alternatives selection and implementation, (c) technology brokerage, and (d) utilization documentation); and (3) Information Network (which includes (a) technology dissemination, (b) CIG Handbook, and (c) information exchange); and (4) Special Projects (which includes (a) product development, and (b) evaluation and test of existing products). We feel that these on-going functions really must be supported and nurtured by the program office, the individual Science Advisors and outside resources such as the Federal Laboratory Consortium. In addition, we have special projects that basically fall into two categories: (1) Product Development or Proof of Concept, and (2) Evaluation and Testing of Existing Products.

Very briefly, I would like to explain the program support that we've been able to generate for the California Innovation Group. The prime sponsor is the National Science Foundation, with contributing sponsors in the financial area such as FEA, HUD, ERDA, and local government cash. Also very essential to the program are the non-financial contributors (including Aerospace Industries, DOT, Federal Laboratory Consortium, University of California, League of California

Cities, NLC/USCM, FBI) in the form of staff time, equipment on loan, brokerage service, and all different types of activities. We've had varying degrees of success with these support agencies. We've run into certain problems with the University system in that, generally speaking, it needs to be a well-defined, specific project before we have had any degree of success. One obvious reason for this is that our work is generally not very sexy from an academic point of view. One resource that we have been able to tap and very effectively use is that of the Federal laboratories, as I mentioned before.

In summary, I'd like to ramble just a little bit and give you a few of our thoughts about what this all means to local governments involved in the California Innovation Group. The mechanism of CIG has been able to develop an effective team of participants from both the public and private sectors to provide technology transfer assistance to local governments. This team consists of local government people themselves, high technology firms, support from the League of California Cities and, perhaps most important, the individual Science Advisor who resides in each one of our participating jurisdictions. I have mentioned that, coupled with this team, is the technical resource of the Federal Laboratory Consortium. We feel that the efforts of CIG have had positive results in bringing this national technical resource into a posture of accessibility to local government. I believe we have learned that institutionalization of an activity such as CIG requires considerable exterior stimuli and resources. The basic problem here, as we all know, stems from the difficulty in effecting change in government. That change has been taking place within the CIG cities, and we feel maybe to a lesser degree in cities which come in contact with the program through the League of California Cities. We must also effect change within the Federal Government including the vast resources of the Federal Government including the vast resources of the Federal Laboratory System. The results of the California Innovation Group to date clearly indicate that large cost savings or cost avoidance can be achieved through the applications of programs like ours.

One of the serious problems associated with expounding on the success of that program is that it becomes more and more difficult to explain why we feel that continued federal assistance is necessary. That is why we must also consider our failures. The activities associated with technology transfer inherently carry some degree of risk. As a result, CIG and other transfer programs need the luxury of failure. This is not possible without outside support. You all know that cities are in the forefront of visibility and pressure from the individual taxpayers. Risk money of any kind is difficult to come by at the local level. A good example of this problem was a recent demonstration that CIG cosponsored with the U. S. Conference of Mayors and NASA to demonstrate a satellite-based teleconferencing system. As it turned out, the demonstration was exceptionally successful; however, if it had gone the other way, if it had

gone badly, it would have been a National Science Foundation/CIG program. Both of these organizations could survive that type of failure since it represents the very nature of the enterprise. It might not have been that easy to explain if local government tax money was used to finance the demonstration and it had gone badly. We need that once-removed identity that CIG, PTI, and other innovation groups provide to protect the cities and people who enter into these innovation experiments.

We feel that the efforts to establish national networks are heading in the right direction. We want to be part of that. In fact, we hopefully will provide a leadership role on the west coast to establish these national networks. Additionally, we feel that some type of federal assistance on an institutionalized basis has got to be developed. Currently, the National Science Foundation cannot provide that kind of assistance, since they are restricted to experimental projects of a limited duration. We are not sure if an interagency approach should be pushed or some other arrangement. It is possible that the Federal Regional Councils could take on the responsibility of sponsoring regional technology transfer activities; however, the interest has not been expressed to date.

In closing, I would extend the offer that CIG is willing to work with all of you in developing a national network. We are convinced that if we are to achieve the type of return on investment we talk about wanting, it's going to take a lot of working together. Every new technology transfer activity we become involved with has expanded our own capabilities.

THE NATIONAL CONSORTIUM FOR TECHNOLOGY INITIATIVES

Mr. John Lockwood
Deputy City Manager
City of San Diego/National Consortium for Technology Initiatives

I'm really wearing two hats today. As an employee of the City of San Diego, I'd like to welcome you to San Diego, and while you're here if there are any city facilities you'd like to visit or anything else that our office can do to assist you, we'd certainly like to try. So, please call us. Secondly, I'd like to take just a minute or two to discuss with you the National Consortium for Technology Initiatives. What is it? Four years ago approximately, a group of local government officials got together to discuss the problem of transferring technology between the cities and counties of the United States. The problem is obvious; cities were working on problems, they all had problems, but the technology transfer vehicle just wasn't there.

Out of those discussions and with some financial assistance from Bob Crawford and our friends at the NSF, also DOT and HUD, the National Consortium for Technology Initiatives was formed. That's a different consortium from the one you were just hearing about. It consists of the 28 cities in the United States who have populations in excess of 500,000 persons and six large urban counties. Collectively, it's big business. They spend over $20 billion a year; they have over one million employees. The Secretariat for the National Consortium is PTI, which is a non-profit corporation based in Washington, D. C., sponsored by the U. S. Conference of Mayors-National League of Cities governmental jurisdictions.

The Consortium's purpose is really two-fold. One, to identify the needs of the cities that have some commonality. Obviously, a new solution to cleaning beaches doesn't have a whole lot of appeal to Kansas City, Missouri, and snow removal doesn't have a whole lot of appeal to Miami. So, the first step really was to identify the needs of the cities. We each knew our own but we didn't know those of the other 33 jurisdictions. Questionnaires were sent out, some sessions were held, and I think we were all surprised at the commonality of the needs. There were the exceptions as the ones I just mentioned but most of the needs that were identified by San Diego were common to Atlanta, Milwaukee, Seattle, San Jose, everybody had the same problem--shortage of funds, not enough people, rising demand for public services. After those needs were identified, they were then prioritized. Those needs that were highest in priority were then compartmentalized into ten task forces: Transportation, Energy, Finance and Personnel, Public Works and Utilities, etc. Each of those task forces then is represented by from eight to ten of the 34 agencies, and the task force then prioritizes--within the needs that are assigned to that particular task force--those eight to ten needs that they wish to address. The purpose then is to find out if somebody has developed the mouse trap that everybody else is looking for and if they have, if we can identify it in Seattle, then we can transfer it to other agencies. But, if none of the agencies have solved the particular problem, our purpose then is, using R&D money, to either ourselves or by contract or in cooperation with the Federal labs and the other resources that are available, to set to work to solve the particular problem. Once solved, again, to try to transfer to the other 33 agencies.

We have received support from the Federal labs, San Diego City has participated in the Science Advisory program, and Al, Gerry, and Dick have all been a help to us as Del and the CIG have been of help to us. We're just getting our act together. We're really only in our third year of operation. We are dependent for funding now, primarily on Federal agencies, but we think it's worth doing. We're committed to it, the other cities and counties are participating, and I wouldn't be surprised if some of you in this room won't be hearing from us with a cry for help somewhere along the line. We certainly hope three or four years from now at a session like this,

we'll be able to come back and point out problems that have been identified, solved, and then the technology transferred to the cities of the country.

A REVIEW OF THE NATIONAL SCIENCE FOUNDATION'S INTERGOVERNMENTAL PROGRAMS

Mr. Robert C. Crawford
Director, Intergovernmental Programs
National Science Foundation

It should be evident to you, from some of the speakers here this afternoon and from your side discussions with others during the meeting that there is a high degree of enthusiasm and dedication among the people who are involved in intergovernmental technology transfer. One of my jobs is to try to keep up with this bunch of enthusiastic rascals that are stirring up the system all over the country.

Some of you might have noticed an editorial in Science magazine, in the 27th of May issue, which summarized pretty well, the question of intergovernmental science and technology relations, posing a fairly succinct statement of the kinds of objectives that interested people are working toward in this area. It's noteworthy, I think, that that editorial was signed by the President's Science Advisor, Dr. Frank Press, and also by Governor George Busbee of Georgia, who happens to be the Deputy Chairman of an intergovernmental science, engineering and technology advisory panel which is connected as part of the new Office of Science and Technology Policy. That's an indication, I think, of the interest at the highest level in our country in exploring what beneficial things we can achieve through better use of scientific methods and technologies at the State and local level. That is not to say that there hasn't been a lot of technology transferred in our traditional system. We all know that that's the case. In fact, as I look around the room and at your agenda, I see some Federal agencies here at this meeting that have been in the forefront of innovative ways to try to maximize the payoff from their investments in the R&D area. Your group leaders this morning are outstanding personalities in this regard. Programs like theirs have made maximum use of the available system we have.

What we are talking about today is ways of achieving fundamental changes in our system for investing in R&D and using R&D outputs for the benefit of our state and local governments as they deal with domestic-sector problems. One of the luxuries that NSF has in this area is a flexibility to experiment and to respond to the state and local governments and the resource-providing institutions of the

United States as they come up with new ideas and new ways to try to deal with this highly significant issue. NSF is not constrained by a functional mission or by a traditional bureaucratic system. We are free to respond to state and local governments, universities, Federal labs, other Federal agencies, and, in fact, about any other piece of the institutional system that could make a contribution to this review and exploration of experimentation. The intergovernmental Programs are a part of the RANN program, which is the applied research of the NSF. The RANN program represents a thrust by the NSF starting in about 1971 (at the request of OMB) to undertake applied research in national need areas, environment, energy, productivity, and, most recently, in resources. We, in the Intergovernmental Programs do not sponsor research, per se, but we are fully integrated with RANN's research projects in the sense that the people performing the research and our own program managers in RANN often use some of the experimental mechanisms that we have been involved with around the country at State and local government levels, for the purpose of facilitating the utilization of RANN's research products. The California Innovation Group, for example, has been a vehicle for a multiple city test of some research in scheduling models that have come out of the RANN productivity program--a fairly successful test where in at least five cities the techniques developed have been evaluated for possible application, and in several instances applied in an operating situation.

The Intergovernmental Programs of NSF are structured not only with a focus on local government; they include State level activities as well. We deal with State executive branches with both the Governors' offices and with the line operating departments of the states as they try to maximize the potential for science and technology in their activities through different kinds of organizational relationships, new communication devices, etc. We are the only Federal program that we know of which has a special major program sub-element dealing with state legislatures. We have worked with a number of the legislatures around the country in this often forgotten, but highly significant governmental area, to help them to improve the base of information on which they can make their policy decisions. With such improvement, they are no longer hampered by either a total lack of knowledge or just a knowledge input which comes from perhaps a lobby source which would not reflect a total spectrum of options and perspectives.

We also have been involved with, as a major program element, and increasingly so, the Federal laboratory activity which has been described today. Many of you are personally familiar with this thrust. We have had on our staff since 1971 a program manager from one of the participating laboratories to support the Federal Laboratory Consortium, and as George has indicated, we have been able to provide some small amount of program funds to help facilitate the testing of ways by which the Federal Laboratories may heighten their assistance to State and local governments.

I would like to elaborate to some extent on the degree of interest in the subject of Intergovernmental science relations which goes far beyond the NSF and even far beyond individual cities and states which are involved in projects. For example, I came to California by way of Tucson where there is underway a national meeting of the U. S. Conference of Mayors. One of the reasons that I stopped at this major national meeting is that one of the activities underway was the first meeting of the U. S. Conference of Mayors Committee on Science and Technology. This Committee is composed of representative mayors of cities large and small all over the country. These mayors came together to develop policies and directions for the Conference with regard to the question of how technology can be made as relevant as possible to help local officials deal with issues they face in their towns. This committee met and proposed a resolution which expected to be passed at their plenary session this morning. The title of this resolution is "Priority Concerns Related to National Science and Technology Efforts." The resolution focuses on the activities of the Office of Science and Technology Policy, the Office of Management and Budget, and local governments from the standpoint of how these institutions can facilitate technology transfer on the domestic scene, and it includes a special section on the Federal laboratories. This section calls for a continuation of efforts to organize the labs to heighten their impact on technology transfer to the State and cities. The resolution calls upon the Carter Administration, and I quote, "to take whatever steps that are currently available under present law to direct this resource (the labs) away from its almost exclusive dedication to the purposes of the central government and to those of state and local governments. We call upon the Congress to examine this resource and to lift any restrictions which might limit the realization of these potentials." The resolution also talks about strengthening local institutions to permit them to better participate, restructuring local government where necessary to facilitate this. It is interesting to note at the bottom of the resolution where the Conference has a practice of showing the projected cost of implementing this resolution that there is estimated to be no additional costs required. This is in contrast to many of their resolutions concerning reverse economic stimulation, etc., wherein the estimated cost is stated in billions of dollars. The Conference, in this case, feels that to do this reflects basically a redirection of and maximizing the impact of already in-place investments.

As another example of national interest in State and local technology transfer, the National Conference of State Legislatures, which represents the 7,600 state legislators all over the country, formed both a Committee on Science and Technology and a Committee on Information Needs. This latter committee focuses to a large extent on the issue of how they can improve the data inputs that they receive on which they base their decisions regarding environmental matters, energy, growth, etc. One of the features of a project that the NCSL is proposing is to tie, for the first time, selected State legislatures to the Congressional Research Service of the

Library of Congress. This proposed demonstration project would gain access on an on-line basis into the computer of CRS so that the States may obtain information about various technology-related problems, the list of advisors and technical specialists around the country that the Congress uses in various areas, etc. This type of activity is indicative of the sorts of potential that the State legislatures see in increased linkages to S&T resources. The NCSL's interest and that of the National Governors Conference, as well as the interest of certain parties in the Congress led to the authorization, this year, of a $3 million program that is called, "The State Science and Engineering Technology Program (SSET)" under which there will be grants made available to each of the State executive branches and the State legislatures up to the amount of $25,000 with matching requirements of $12,500 (if they get $25,000), to help them conduct studies of their posture and capabilities in science and technology and how they might better organize themselves to take advantage of the resources that exist in their states. Presumably, those resources could include the universities, the private non-profits, and private profit institutions that might help with technologically related matters, and of course, it could involve the Federal laboratories as well. There are indications that the states, as they prepare to respond to this overture by Congress, will probably, in some instances at least, involve Federal labs in their proposals in some way. First-round proposal for this program will have to be submitted to the Foundation by August 15, hopefully to be funded this fiscal year.

Our final element that must be mentioned is the Intergovernmental Science Technology and Engineering Panel, which is part of OSTP. That panel is a statutory panel, and was included in the science priority act that George Linsteadt referenced in his remarks. It's composed of four governors, four mayors, a number of city managers, a number of county officials, three or four state legislators, and has staff to support it in the Office of Science and Technology Policy. Governor Busby, the Panel's Vice Chairman, has indicated that if the Panel isn't for real, with some quantifiable impact, he does not want to be involved. The thrust of the Panel is to make meaningful inputs into the Federal government's policy in the science and technology area. I have a document here which reports on the activities of that panel for one recent month. The kind of sound and fury that is coming out of that Panel, and the fantastic high level of activity, bodes well for achievement. The state and local government people and the science and technology policy people that are involved with the Panel are quite serious about it and dedicated, and are driving to make it an effective instrument for impacting on national policy.

It is clear, I think, that all of us involved in this effort in the Foundation and the other Federal agencies with whom we relate, the people and projects in State and local government with whom we deal, and those persons in the technology resource community who have gotten involved in the State and Local government service

arena, represent a highly committed and dedicated group, one which has a feeling, if you will, of being embarked on a meaningful crusade--one, which, given success, will result in a better utilization of the increasingly scarce resources available to our nation and better lives for our citizens.

A PRACTITIONER'S SUMMARY OF THE TECHNOLOGY TRANSFER SESSION

Dr. Kay Inaba
President, XYZYX Information Corporation

I will not be so presumptuous as to try to summarize this afternoon's session for the total audience. However, I thought it might be of some value to summarize the session from a practitioner's point of view.

I am now in business as a practitioner. I used to be a researcher, like many of you. However, I am now a practitioner in business, and to stay in business I must make good use of research results. Thus, I (and fellow practitioners) are your primary customers.

I believe that three basic messages were conveyed today. Based on these messages, both individual conclusions as well as a general conclusion are in order.

1. The successful research utilization discussed today result primarily from practitioners who are sympathetic to or have been members of the research community. Mr. Gerald Miller is a prime example of such a practitioner.

   It would appear that one answer to the research utilization problem would be to xerox Mr. Miller. Obviously, this can't be done physically, but is possible conceptually. That is, we should train more practitioners.

   Consider the normal practitioner--or our cohorts in the application of personnel-related research data. One such practitioner is an engineering drop-out shunted to a position as a training director. This is usually an individual with little or no knowledge of the learning process--but controls millions of dollars in training equipment and programs.

   Another colleague is the director of publications with a technical writing background. He has lived in a world of specifications with little or no concern with usability. Or, take the case of the design engineer taught from school onward

only about equipment--and virtually nothing about the people who operate or maintain the equipment.

Too often, we put the pressure on the researcher to improve the utilization of his research results. I believe the focus is on the wrong place. Most good researchers are neither inclined towards nor skilled at applications. Why force him into a level of incompetence.

The applied researcher must listen to and meet the needs of the practitioner. However, I believe that utilization should be the task of the practitioners. I believe more emphasis and effort should be directed to developing practitioners, with an effective line of communication with the research community.

Within DoD, the practitioners should be freed from artificial criteria, such as "publish or perish." The practitioner should be rewarded for successes in applications--not research.

2. An expenditure of $26 billion for research (50% in DoD) would indicate that it is not enough to just try to improve research utilization. We (researchers and practitioners) must succeed.

   I suspect that the research community no longer has the luxury of just trying. The pressure from politicians, accountants, bureaucrats, etc., experienced to date can probably be expected to increase, unless utilization is improved.

   Unfortunately, the pressure is forcing researchers to act as practitioners--often with less than satisfactory results.

   I believe that problems of application are bona fide subjects for research. NPRDC's study of the role of the change agent in introducing new equipment items is a step in the right direction. More such research and attention are needed.

   I personally believe that more attention should be given to the following aspects of technology transfer:

   a. Transition from research to development.

      In the human factors field, concepts seem to jump from the research state to the application state. Frequently, this results in technology either staying in the research mode too long, or premature application.

      For example, the Job Performance Aid concept has been "studied to death" during the past seven years. Yet, the state-of-the-art of JPAs has not been advanced significantly.

In contrast, task analysis techniques have been imposed on industry without adequate research. Consequently, much data have been created over relatively unimportant events.

b. More systems approach.

We need more human factors people to apply the systems approach. Personnel-related concepts and techniques need to be integrated into a system for proper application. Often such applications are assigned to engineers because of their systems experience. Unfortunately, they too often do not understand the human factors variables. Consequently, the effect of the new is often dissipated, or cannot be identified.

c. Procurement practices.

More professionals in people-related research/applications agree that the competitive bid approach is not effective. Yet, few have dared to do much about the problem.

Generally, ASPR has considerably more flexibility than most researchers assume. Unfortunately, many researchers are intimidated by the procurement agents and take the path of least "risk."

However, it would probably be worthwhile to examine ASPR to see if it meets the needs of personnel-related research/applications. The ASPR is supposed to serve, rather than be the master.

3. The consortium works. The frequent reference to the consortium indicates that the consortium works. In fact, the speakers were all saying that the research results are sorely needed to help the local government.

During the past few years, people-related research has been the target of much criticism--for inadequate research utilization. Thus, it is encouraging to hear practitioners say they are utilizing the research results and services.

Personally, I believe that considerable advancements are being made by personnel-related researchers. In fact, the value has probably been far greater than given credit by the GAO. I suspect that much of the problem is inadequate communication with the lay evaluators and managers. Perhaps the practitioners may be of some help.

4. A truce is needed--between researchers and practitioners.

The small group of practitioners tend to resent researchers telling them how to apply--often using impractical criteria.

In turn, researchers are wary of practitioners who seem to be salesmen.

I believe it's time both parts of the community recognize that we need each other, and call a truce. We need to sit at a truce table and determine our mutual needs, and develop an implementation program.

I would suggest the above be done by a working committee of people from the following areas:

Practitioners
Research Centers
Academia
Procurement Agencies
Upper DoD management

This group should develop a one, five, and a ten-year program of applications. I suspect the program will include training of practitioners, communication with the research community, defining research needs, identification of key development programs and development of spokespersons.

CASE PROBLEM ANALYSIS

SUMMARY

In this session the conferees met in small groups to analyze case problems of RDT&E project outcomes that have not been optimally utilized and to formulate strategies for improving utilization. The small group discussions were then summarized by the group leaders in plenary session. The case problems (contained in Appendix E) were:

Stereoscopic Viewing
REALTRAIN
Naval Training School
Armor School
Armed Services Vocational Aptitude Battery

Bert Griffis, Rehabilitation Services Administration, reported his group's discussion of the stereoscopic viewing case problem. He emphasized the need for the researcher to understand the total system context, including such factors as vested interests. He also pointed out that transition to the operational community might have been successful if a linking agent had been assigned at the beginning of the project.

Dr. Herbert Clark, Air Force Human Resources Laboratory, also discussed the stereoscopic viewing case. He stressed the need for closer coordination with the customer and for a formal agreement as to what criteria will determine whether a given result will be used. He also noted that there is more than one potential user, so there is a need to determine where else the results might be applied.

Dr. Ronald Havelock, University of Michigan, reported on the REALTRAIN case problem. He discussed a number of issues suggested by this case, including:

- *The problem of premature adoption.*
- *The problem of the self-fulfilling prophecy, whereby defenders of the status quo engage in sloppy implementation of the new technique.*
- *The importance of stringent adoption of some innovations.*
- *The fact that some innovations get to be so technically elegant that the probability of breakdown is increased.*
- *The question of who should control the adoption decision.*

Dr. William McClelland, HumRRO, discussed the naval training school case problem. He pointed out the importance of determining the comparability of sites that may be candidates for the installation of a particular innovation. He also noted that this case dramatically

illustrates the need for cost-effectiveness analysis, and for adequate provision for selling promising research results.

Dr. Meredith Crawford, George Washington University, also reviewed the naval training school case and stressed the need for agreement between operator and researcher as to how proficiency should be measured and whether performance in a training situation reflects the actual requirements of the job. He also emphasized the importance of cost-effectiveness analysis, and the fact that findings don't get implemented simply by inscribing them in technical reports.

Dr. Arthur Drucker, Army Research Institute, reported his group's analysis of the naval training school and stereoscopic viewing cases. He commented on:

- *The need for user-researcher agreements and commitments at the inception of the research.*
- *The need for "front-end" analysis, including analysis of requirements, cost benefits, risks and alternate solutions.*
- *The need for sensitivity to the total system implications of a particular innovation.*

CASE PROBLEM ANALYSIS [1]

CASE PROBLEM DISCUSSION

DR. GLASER: We'd like to hear from the spokesmen for each of the groups now with regard to their analysis of the prepared cases. Before we do so I'd like to share an observation from my visits to the several groups in which the cases were being discussed. One of the things that struck me was a reaffirmation of an experience most of us have had to the effect that even when you get very knowledgeable people together in any given field to work on what might best be done to deal with a given problem, we find a good deal of honest difference of opinion. These differences often can be enriching and rewarding if they can be integrated constructively.

I was thinking that after Mrs. Ford and Mrs. Rockefeller had their mastectomies and that type of problem got headline attention, the Today Show had a five-day panel of the leading surgeons in the country to discuss the state-of-the-art in treatment of mastectomy. The panel included Dr. Crile of Cleveland Clinic and others who are very well known, such as a top surgeon from Sloan Kettering in New York. The difference of opinion among these eminent specialists tended to leave the potential consumer, so to speak, in a quandary. And yet everybody had something to say that needed to be taken into account. It wasn't until Friday that the other panelists seemed to understand that Dr. Crile, who advocated excising just the tumor in many cases, was not saying that this was the preferred treatment under all conditions. He was saying that if the lymph nodes were not affected, the evidence according to his longitudinal study was that the recovery rate was just as good from the simpler operation as compared to the radical surgery. Where the lymph nodes were affected, he too would opt for a radical mastectomy. But the fact that they started out with a different orientation led to quite a few days of difference before the panelists realized that they were not as far apart as they seemed.

Well, in terms of what to do about some of these case problems, every comment I heard was intelligent and relevant, but often reflected different views as to what was of primary importance. That was one of the reasons for planning a segment of this workshop to deal with actual cases involving utilization difficulties. After all of these theory sessions in the last two days, the thought was to give you a chance to grapple in a concrete way with problem situations.

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[1] The case problems discussed in this session are contained in Appendix E.

Now, may we hear from the spokesman for Group #1. Would you tell us which of the several cases you discussed, and what your recommendations, findings or questions were.

BERT GRIFFIS: (Spokesman for Group #1) We chose the case problem that concerned stereoscopic viewing. The fact that it wasn't used may mean that there were some powerful factors lurking in the background to prevent that, and perhaps some of them were vested interests, such as the pilots who like to fly more to take pictures and even the people who develop the negatives. Someone made the excellent point that people who had been doing this type of research should have had a systems analysis point of view, they should have had a picture of the whole system, and if they had, they would have known about all of these other factors that needed to be taken into account. We felt we didn't know quite as much about the research itself as we might have. Conceivably, if the procedure had been rigorously analyzed it might not have been as valid as presented. Another point made was that if the students were better motivated to go through the training when the stereoscopic slides were being used, greater benefit from the training might have outweighed the greater cost of the stereoscopic approach. One member of the group made the point that since it appeared to be such a clear-cut case, that is the non-stereoscopic data were just as good and cost a lot less, that he would have implemented that by fiat on the basis of cost-benefit. But another person made the point that the people who have the power to implement it by fiat might not have been sold on doing so.

DR. GLASER: Might some other members of that group wish to add anything?

DR. HAVELOCK: I have a suggestion. If we're talking about one case, wouldn't it make sense for the various people who worked on that case all to make their presentations at the same time?

DR. GLASER: Yes, I'm planning to do that. But first, in terms of the other members of the group who participated in this discussion, does anyone wish to add additional points?

BERT GRIFFIS: There were some inputs that I omitted.

DR. GLASER: Go ahead.

BERT GRIFFIS: I think the point was made that if there had been somebody assigned at the beginning of that effort as a sort of technology transfer agent of a liaison with the operational community, and that party or parties had sat down with the intended users and gotten them ready to accept this, the transition might actually have been successful. At the very least you might not have gone to the trouble of doing all that research if you learned there wasn't a ready and willing climate of acceptance for it. But the case was

unclear as presented as to whether anything had been done to pave the way for that transition, and it was also unclear as to whether there had been a meeting, formal or informal, between the users and the researchers to find out why in the world this thing was not being accepted. They must have had some reasons, good or bad, and it would be very instructive to have learned what they were and try to deal with them.

DR. GLASER: Did any other group take up this problem? I thought we might feel free to invite questions from the audience about this but if another group took up the case, we probably should hear from that group next. Further, before we leave this case perhaps Jay Uhlaner or Art Drucker or whoever else in the Army had cognizance of this could tell us in a little more detail what really happened.

BERT GRIFFIS: I have one other point, which was made by someone else too. The visual pleasure of seeing those two-dimensional slides might have been a factor in their clinging to it. Many of the people working with it might have felt that the non-stereoscopic pictures were more difficult to use and to get the data out that they needed.

A MEMBER OF THE AUDIENCE: I have to comment on that. The visual pleasure of the photographic interpreter seems irrelevant. I just can't relate that concern at all to the fact that twice as many planes have to be flown, with twice as many chances to get pilots killed. I don't believe that the pilots who had to fly that extra mission and might get shot down would put a hell of a lot of weight on the trivial consideration of the interpreter's having more visual pleasure.

I would also like to comment that we didn't have the facts as to who comprised the experimental group. If in fact they used untrained students as opposed to trained photo-interpreters, the probability is that it would be easier to train the experimental group using the stereoscopic approach as opposed to training photo-interpreters using two-dimensional photographs. I think that this point has to be known before the case can be analyzed adequately.

DR. DRUCKER: I can supply you with the factual information on that; both groups used trained photo-interpreters.

DR. GLASER: Art, did you wish to add anything to this?

DR. DRUCKER: Well, no, not in the context we've been discussing.

DR. GLASER: Well then, can we hear from the other group that tackled this case?

DR. CLARK: I think we picked this case because I was interested in it. I heard about it some time ago when the study was being conducted and I didn't know what the results were. I think that a number of

good points have been made thus far with which I would agree, with the exception of one. The one was the statement that the results weren't used because they didn't lead to a specific change, such as a change in policy. The fact of the matter is, I think the results were used in making a decision. But what might first appear to be a clear-cut decision in terms of cost-effectiveness really isn't so clear-cut.

I think the point already made about the pilots was very well taken. It certainly wouldn't be worthwhile to fly a larger number of combat missions to get the additional images just for the satisfaction of the photographic worker, if there is that danger involved. But what could have been done at the outset of this study? We would agree with what was already said, that there should perhaps have been more coordination with the customer and a formal agreement made as to what sorts of results were to be provided, and what criteria would be used to determine what it would take to convince the user (decision-maker) to go one way or the other. For example, it might be stipulated that the critical factor in the decision-making hinges on whether one procedure is a certain percentage better than the other in terms of number of targets detected, and if so, we would adopt that procedure.

In this case, perhaps the researcher was trying to impose an idea or finding on the customer rather than the customer approaching the researcher with a problem, which makes it a more difficult situation. But what if we did get with the customer and tried to make a formal agreement and he said, "No, we don't want you to do the research." We addressed the question of whether we should do it anyway. I would be rather interested in other points of view on that.

Further, I thought a very important point brought up by one of the members of the group was that there's more than one user. It's not just the fleet; it's not just the operational command; we also have a responsibility to potential users in the R&D community. That is, if the results of this project have scientific merit; if the results are generalizable and not just something that would pertain only to a specific operational setting; if it's something that is pertinent to the operational community, then we have the responsibility to report it to the scientific community and retain it in a file for eventual use. What actually happened? The results were not used to the extent that the researcher might have liked them to have been used.

What else might have been done? My recommendation here was to say, "Find out where else the results might be applied." We could put the results in the category of potential use and report this to the scientific community. We did talk to some extent about how far we should go in marketing the results or in trying to convince the user. I don't think we should chase the potential user to the

degree that it is taking too much away from our R&D time. For myself, if I ask a researcher to try to get these results implemented, I say, "You've got about a month to do it; after that, get back to doing R&D." We in research can't chase the potential users forever, but you do the best you can. Also, times do change. (I think this study was done some time ago). For example, a previous speaker alluded to the fact that there were great cost-benefits associated with this study. There were, and cost-benefit is a more important consideration today perhaps then it was when this study was done. It might be appropriate to brief this study again--to take it down the road and discuss it further. We found it an interesting problem in research utilization. I wish I could say we have some concrete recommendations as to what can be done, but basically we think you should get with the customer in the first place and try to come up with an agreement. If you can't reach an agreement, perhaps you should proceed anyway if it has scientific merit. But if you do come up with an agreement, I think you should establish criteria as to what the customer's responsibility is when you give him the results; and what it would take from us to convince him that this should be implemented. I think this pertains to a number of cases. I probably left out a lot of the important comments that were brought up in the meeting. Dr. Bryan, you certainly had some good points, would you like to elaborate on them? Or anybody else in the group?

DR. BRYAN: No, I think my points have been brought out.

DR. GLASER: It might be well to clarify a point of information about the facts of this case. What was standard practice, the stereoscopic approach or the other one, or possibly some alternative?

DR. UHLANER: I will be in a better position to make a comment after this discussion, because otherwise I think it kills the purpose of the discussion. But that one I can answer, standard practice was definitely stereoscopic.

DR. GLASER: Then, stereoscopic was standard practice and the other was an innovation, which from the research point of view turned out to be more cost-effective but didn't result in any decision to change. One other question: were all the decision-makers who would have something to say about which of the two methods would be used involved in this study? Did they want this study? In other words, who was the sponsor? Should we save that for later? Does anyone else want to comment here?

DR. UHLANER: Yes, I just want to clarify something that Jim Clark said. He said, and I believe the small group was going along with it, that if this study had merit and there was no user out there, the researcher ought to go ahead and do it anyway. I would disagree with that to a considerable extent, I guess, as it would really hinge on the interpretation of who is a user and who is a producer.

I would say that the R&D community is a user, and the researcher ought to go ahead and do it anyway if the R&D community is willing to fund it and put it in as part of their program. However, I don't think the research ought to be undertaken with the idea that if the researcher scouts around and can't find a user but nevertheless feels pretty sure that it's a good idea, he should go ahead and do it anyway. Under all circumstances it seems to me that what you're seeking is another appropriate user, and the people in the R&D community constitute a class of users. You may well find research that needs to be done because it will contribute to the technology base. This study, or research project, was entirely responsive to R&D and for that matter at that time also to some inter-service user requirements, but the user was the R&D community. The users were the very people involved in the actual intelligence evaluation, so it was very fully staffed--which was a plus, and the design was good, and the research was done properly. The minus was that there was indeed another class of interested parties--I don't know if I would call them users--and that was American industry, who were spending lots and lots of money building these aerial surveillance systems. In fact, the director of the project gave a very sophisticated and extensive briefing to American industry that was brought together for this subject. About six months after that briefing it came to my attention that there were recommendations (from industry) that the project director should be fired because in some way everything he reported was discredited--the data, the approach, and so on. It became very clear that certain elements of industry stood to lose a great deal of money if we opted for the nonstereo system. Industry argued, for example, that you absolutely can't measure heights of mountains unless you have stereo views. Well, how many times do you measure heights of mountains? We pointed out that these were tactical data; that we were not trying to produce relief maps; that the commanders were satisfied. Yet, the final decision-making inputs in this instance were largely in the hands of American industry and I think that sort of puts the problem in perspective. These are the kinds of sophisticated and subtle points that we sometimes aren't aware of when we take a look at the straight interpretation of research data.

DR. GLASER: Are there any other comments on this?

RESPONSE: Yes, I think Dr. Uhlaner may have missed two tactics that might have changed what he has described. One would have been to inform Jack Anderson, and the other to inform Senator Proxmire.

DR. GLASER: Are there any other questions or comments on this case?

DR. UHLANER: I don't think that last comment was trivial--I think there might be some cases where what I have described is an "anticipatable" type of problem, and it's no news that there was a lot of industry money behind this, so when you're thinking of utilization of R&D results you have to think about social system factors that could lead to the implementation of your results. We were aware of

that, and we felt that rather than asking permission from American industry to run objective studies on the comparative value of the two systems, we had an obligation to the taxpayer and the Defense Department.

QUESTION: Granted we have such an obligation. But to what extent did you involve yourselves in, say, mass media or communication that would reveal these special interest pressures?

DR. UHLANER: Oh, no; the thing is that you would lose.

QUESTION: In other words, in effect you're saying that you are willing to give in to industry clout rather than fight openly to save the money for the taxpayer or whatever.

DR. UHLANER: In a very simple answer, yes. You have to think beyond the individual case. If you remove yourself from the system you can only do that once. You might be able to take a problem higher in DoD and that might or might not accomplish something, but going outside the system completely is something even people who were sympathetic with your views regarding a particular case might be upset about. Someone published a book in the last year on what happened to people who resigned from the government over matters of principle. This was an historical study that went back over a considerable number of years looking at various people, at the assistant secretary level and higher, who had done that. Uniformly they found themselves shut out entirely from everything. Beyond that, I think it's somewhat irrelevant to this particular case because the facts were that in dealing with the intelligence community and photo-interpretation, what we're concerned about was classified. You couldn't even admit that the U. S. Government owned a Brownie camera, so that this would have been particularly inappropriate to try to get at through publicity.

DR. HAVELOCK: Would publicity have been necessary before you could turn around the procedures for procuring the types of equipment which R&D recommended?

DR. UHLANER: To the internal community I think it was very widely disseminated. I don't think that was really a problem.

DR. HAVELOCK: But it was protected from communication to key congressmen?

DR. UHLANER: I would have to say yes. That's a general issue we might want to discuss at some point. It may be that the people within the DoD community have a different view of their customers than the academics here, and it's not an issue we have really talked about except in the last few minutes.

DR. GLASER: Let's move on to the next group and their case. What cases did your group take?

DR. HAVELOCK: We took two cases. We started with the REALTRAIN case. One of the problems with this case was--in a sense--that there wasn't a problem. That is, there appeared to be an innovation that was successfully adopted, with some relatively minor qualifications, and the whole matter is proceeding on course. If there was a significant problem it was probably in the area of premature adoption; that is, it was implemented without waiting to see if all the necessary conditions for sustaining it had been achieved. Probably there were two reasons for this. One reason was that there was a product champion who became involved early, got excited early and pushed it. But I think in addition to that there was a great deal of push from the innovation itself. It was highly visible; the fact that the early tests involved a lot of personnel in the field made it impossible to hide this thing until it was ready for a full distribution and application. It was a very attractive thing to a lot of people, particularly at the top, not necessarily at lower levels, and that's where they ran into some problems of implementation.

This case did bring up some interesting problems, some of which we think may be generic to military innovations. One is that there was a resistance by old believers, field commanders who just felt comfortable doing it their own way. Many of those who had done training in the field believed in the old way to do it, so when they got the new techniques what happened in part was that they did half-assed implementation, and that created a self-fulfilling prophecy situation. But in effect, my inference was that this problem is being dealt with; that is, the system is convincingly superior for those who do try it out, and that it gradually is becoming a pervasive method in the Army. We didn't talk about transfer to the Marines or any other service.

Another problem which is connected to this is the problem of stringent adoption. This was a complex innovation which in effect had to be adopted in its entirety. It lacked what Everett Rogers calls "divisibility" of an innovation. It wasn't something where you could pick up this piece and substitute it for that piece and adapt in your own way. It's a very human thing to do; that is, most users like to pick and choose--they want to be in command of the adoption process and it's really an adaptation process. But there are some kinds of high technology innovations where if you're too creative in your adoption you can destroy the whole thing. There are certain key points in any innovative system where when you adapt it instead of adopt it, you screw it all up. With the premature adoption there was a logistics lag; i.e., there were all kinds of things that they didn't have ready, so that there was a risk in massive and early adoption even with a good thing. In fact, if the right equipment didn't come in and people were horsing around with the wrong procedure, it may not have looked like the good thing it really was.

Another kind of issue which we found applied to some extent in the other case we looked at is the tendency of Americans to opt for

the highest technology we can find at the time to do something which may be possible to accomplish with simpler technology. When this innovation got to the application stage, particularly when it got to the point of building a system for tank training rather than just infantry training, which was the original model, the guys then began thinking of lasers and other kinds of esoteric stuff. It got to be so technically elegant that the probability of the system breaking down or screwing up in some way was increased logarithmically. I guess we are still working through that kind of issue. The need to make something perfect or very elegant can be a significant utilization problem One possibility was when the generals insisted that there be immediate application, the researchers might have said, "O.K., if we are going to go ahead with that let's increase our budget for evaluating the thing so we can keep track of this fully as it goes along." The general said you can keep doing what you're doing and that's fine but sorry, we can't give you more money. The results of that evaluation aren't in as yet in terms of whether this is going to create a cybernetic type of feedback loop that will lead to a continuing self-improvement of this new system.

In our discussion the question came up about who should control the adoption decision. In effect, it was controlled in a kind of dialogue process, with the generals obviously making the final decision. The suggestion was made, that is related to our question of cost-effectiveness models; that we don't really have a utility model for decision-making.

(The tape recording of the remainder of the case problem session contained many gaps and unintelligible segments. We have done our best to recreate the session, and apologize for any distortions that we may have injected.)

At this point, Dr. McClelland reported his group's discussion of the Navy case problem. His points included the following:

1. This case illustrates the naivete of laboratory people. For example, they apparently made no real effort to determine the comparability of the two naval training schools that trained for this rate. It would be important to know the extent to which they were equivalent in terms of such variables as talent, technology, leadership climate, morale, and so forth.

2. Little attention was apparently paid to the cost of implementing the heroic procedures for remediating the attrition rate. The researchers got carried away to the point that cost and effort (e.g., working nights) became no object. A cost-effectiveness analysis should routinely be part of the technical research report.

3. Adequate provision should be made for "selling" promising research results. Resources must be allocated for research

utilization, and such resources should probably include research utilization specialists.

DR. UHLANER: You made a comment that researchers aren't the best people for implementing research results. I would like to ask whether you know of any system where it works more effectively to have different groups for research and utilization. I think you should examine that statement very carefully, because in all the systems I know of there is someone in the research community who really takes the lead in implementation. I don't know of any system that has separate research implementors. If anyone does, and it works well, I'd like to hear about it.

LCDR MAIRS: At the Bureau of Naval Personnel there is a scientific advisor who has a staff consisting of himself and a secretary. That's an absolutely impossible situation. We decided he should have a technical staff of at least 12 people. His task would be to review the research that comes in and assume some sort of quality control function. (I talked to Glenn Bryan about the case load that he has at ONR and I was astounded that it's so high. It's impossible to keep on top of something like 30 to 35 technical reports a year that he might be responsible for going through. I myself have difficulty skimming about 100 journal articles a year and I doubt if I get into detail on more than two or three, yet it has to be done.) At BUPERS if the scientific advisor had an adequate staff, that cut across the major divisions within BUPERS, then we would know that they're the people to go to in order to get something implemented.

I'm sure that no one before this meeting knew that if they had a problem that had something to do with saving money there is an economic analysis section that can take on that kind of task. We need to have such resources available to a majority of the programs. I have been beating on the R&D community to use that kind of help, and I intend to do the same thing with the operators. That is, we need to identify resources that try to service this interface function and can take a project and try to get it implemented.

DR. BERKHOUSE: For thirty years now I have been doing research and I have had my research implemented in some forms where it has been used quite sensibly. I have also witnessed some research that never got implemented at all.

We have three different kinds of people involved in research. The first two are very close together. One is the man who does technological base research. His assignments are such that he isn't really very dedicated to all the fine details of trying to get his research utilized, but he's the most valuable member of the team. The second type is the guy who is good at developing and conducting research that results in a usable product. He's very pragmatic. These two groups overlap, and one individual can be involved in both groups simultaneously, or move from one to the other. Then we have a third

situation, which requires different kinds of people. It calls for primarily officer personnel who should have a good technical background, at least a masters degree, should be interested in research, understand research, but also have their finger on the pulse of the operating organization that is going to use the research. They would be teamed up with scientists, but the scientists would not be permanent members of this group. If you rigidly establish such a group, you're sunk. It has to keep changing in accordance with the needs at the time.

I believe there is a need for this third group. I believe the members of this group should be involved with research before it is begun. They must somehow get busy and perform an evaluation of the initial research requirement and render a judgment at that point as to whether it is likely that it can be utilized. They must also develop a blueprint for the plans to execute the implementation and utilization of the research. They must also constantly review this and be aware of utilization potential as the research goes on, so that two or three years later when the scientist is finished with his research product this group can get busy and program its utilization.

This group must somehow have representation from general staff agency level or major command level. It must also have access to the lower commands that constitute the users. This group must develop a blueprint for what I'm going to call "salesmanship." I don't like the word salesmanship but that is essentially what it is. I have about finished the sermon, but we do need an additional approach to our program from what we have had heretofore. This cannot be rigid; it must be a flexible approach.

DR. GLASER: Do we have any more comments on this case?

COMMENT: We also discussed this case and I think it has been covered so well that I don't have to say much more about it. One point that particularly struck me has already been mentioned. The impression you get is that the reduction in attrition wasn't so spectacular in light of all the resources that were put into it. For example, there were people working nights and I wonder what cost was involved in <u>that</u>.

DR. HAVELOCK: We had a similar observation. What happened to the researchers in this case was not unlike what happened to the engineers in the other case when they were trying to adapt the system for use with tanks. That is, they got carried away and wanted to implement the thing in the most elegant form possible, without considering the cost involved.

DR. CRAWFORD: Our group also took this case. It is a nutritious object of attention because it has so many ramifications, such as the fact that both selection and training treatments were used, and you have two different universes there. For example, it is probably

true that with a very careful selection technique you could find people who would meet a proficiency requirement with very limited training. But then you get into the question of how aptitudes are distributed, and whether you can find the aptitudes that are required for that particular thing.

Among our group there was some skepticism as to whether the attrition could be reduced by that much. That leads to the question first, of how proficiency was measured, and whether there was agreement between operator and researcher that the terminal performance in this course was representative of the actual requirements of the job. That was not stated, but it would be very important in the selling of any training system. Finally, as has already been referred to, the cost in terms of additional training equipment and particularly the additional hours the instructor put in needs to be laid out. If the commander expected someone to do something with that technical report he's got another think coming; he's got to do more than that, but you nevertheless have to get the basic information somewhere, and hopefully it is in the technical report.

QUESTION: Does anyone have knowledge of whether this is an actual case or was created?

DR. GLASER: I have knowledge of it. Parts of the case describe an actual situation. There was in fact a great reduction of attrition in the situation described, but some of the figures cited are fictitious. The case goes back to a World War II situation involving a radio training school.

(Because the discussion of the Navy case problem was incompletely recorded, Dr. Glaser prepared the following summary subsequent to the symposium.)

Additional information needed was:

1. In a situation where the Navy had two schools in the U. S. giving the same type of training, and attrition at one was 55-60% while only 38% at the other, why didn't the research team study the situation at both schools to see if they could account for this difference?

2. Since attrition at the school that requested help rose from 30% to 55% following abolition of the draft, did the researchers "dig into" possible reasons contributing to this change? For example, did the trainees entering the school differ significantly in measurable ways from those who had entered previously? Did the instructional technology change? Was there major turnover of personnel in the management of the school; e.g., Commanding Officer, Executive Officer, instructional staff? Were morale factors clearly different, and, if so, in what ways and for what reasons?

Factors that might be relevant to the question of why there was no evidence of utilization elsewhere of the procedures demonstrated to be successful in this case probably were:

1. The concern and influence of the sponsor of this piece of research (the CO) appeared limited to his own situation. If the researchers had generalizability and wider utilization of their prototype procedures in mind they should have suggested that the request for help be channeled through and supported by the Training Command that had jurisdiction over all training schools. And they should have explored the possibility of studying both schools offering this type of training, not just the one.

2. Since the outcome of this R&D effort was a reduction of attrition from 55% to only 22% and then further to 11% after instituting highly individualized instruction and personal counseling of trainees, that was a dramatic improvement not only in relation to the school which requested the study, but to the other school which still had a 38% failure rate. Did the researchers then--albeit belatedly--try to involve the other school in a similar study and see if the same procedures might result in reducing their attrition rate significantly?

Some things that still might be done in an effort to promote at least cross-validation if not widespread utilization of the R&D which has seemed so successful in one case might be:

1. To prepare a very readable, interesting executive summary report of the problem, procedures, findings, interpretation of the findings, and policy implications.

2. To arrange a briefing for the Training Command about these findings, and submit a request for Training Command sponsorship to replicate the procedures in some other appropriate training situations.

Some general implications from this case problem would seem to include:

1. Don't jump in to respond to a specific request for R&D service without considering who the potential users might be and how you might be able to obtain sponsorship for the study which could influence those potential user categories if the results warranted their attention for possible adoption.

2. Include a cost-benefit analysis as part of the plan for a study of this kind. The most dramatic results seemed to come from highly individualized attention to and special counseling with each student. That is a costly procedure, and not easy to bring about. What in fact were the economic and other costs involved in this case?

3. Don't depend on just publication of a report to influence other potential users. Think through and carry out other more personalized ways of attracting the attention of potential users to the study and its findings, such as through inviting their consultation on interpretation of the findings, participation in briefings, making visits to the demonstration site, involving the CO of the school to work with the researchers in inviting attention through his contacts and chain of command, etc.

DR. BRYAN: I get worried about the research community standing aloof from the bureaucracy and being irritated by having to deal with it. And Ron Havelock mentioned that on some occasions the bureaucracy fades away. My plea would be--and I think I'm in bed with Lee Mairs on this, and that's rare--the bureaucracy often does not fade away. I think things do get done by the bureaucracy, and it is not reasonable for the R&D people to think they have some special way of getting things done. They have to learn what the bureaucracy is and have to be patient with it, have to suffer it, have to work through it, and if you do, it ordinarily works well even though it takes a lot of time and frustration. One of the problems is that when you go to the door of the bureaucracy and knock on the door you find either nobody there or you find some guy who is a staff assistant. He thanks you very much for coming and then you leave it in his lap, but he knows less of what to do about it than you do because the next guy who knocks on the door has a whole new set of things he's going to try to dump on him. I think part of the problem is that the bureaucracy and the R&D people are not sufficiently acquainted with each other. And the R&D people do not feel that the bureaucracy is there for them to use. My feeling is, that is what the bureaucracy is there for, and when we have "used" it properly it tends to serve us rather well.

DR. GLASER: Dr. Rostker is interested enough in the hoped for policy recommendations from this group that he is coming back this afternoon and tomorrow. Here's a decision maker who is in control of funds, and is hoping to get some recommendations that are constructive as to what might be done better in terms of payoff from R&D investment so that he might be in a better position to program funds.

DR. SANDS: Some people missed his banquet address, so we'll play the audio tape tomorrow. I think it's important to take this into your groups.

DR. DRUCKER: We talked about the Navy case and the stereoscopic problem. There are things that were most prominent in our discussions: We felt the need for user commitment in many of the cases that we read, and along with that a need for researcher commitment with respect to utilization. To put it a different way, we called it a user-researcher agreement which ideally is reached at the start of the research. We found such a user-researcher agreement singularly lacking in at least three of the case studies. We also talked about

the need for front-end analysis, including such things as cost-benefit estimates, risk analysis, alternate solution analysis, task analysis, and requirements analysis.

We hit on the need for an awareness of systems with a large S and the implications of changing one part of the large system without paying sufficient attention to what it might do to another part of the system. We need to sharpen our awareness and focus on the total system implication of what we do or are asked to do, as nicely illustrated in the Navy case.

We also need to beware of our tendency to get too sophisticated in our innovations when we do not have to, as illustrated by the Armor School and REALTRAIN cases. There is a need to institutionalize our change procedures.

DR. CRAWFORD: The requirement to follow the Armed Forces Vocational Aptitude Data is still there and we need to get as much validation data as possible.

DR. SMITH: One last comment on the REALTRAIN case: For some years now the Navy's 6.2 programs quoted the work on laser and holographic techniques used in training devices at the Navy Training Equipment Center. Thus, the effort by the Army in the use of lasers that was labeled as excessive was in fact an instance of the utilization of Navy-developed R&D technology in an Army setting.

SELECTED CONCEPT PAPERS

SUMMARY

In this session two concept papers were presented that had been prepared for the symposium to highlight issues in research utilization.

The first presentation was by Merlin Malehorn, Office of the Director, Naval Education and Training, and was based on his paper entitled "Bridge Building." The focus of the presentation was on efforts by the Education and Training Command of the Navy to facilitate utilization. He noted that:

- *Research utilization is too complex a process to be reduceable to a paper model or regulation.*
- *Operators do not do a good job of stating requirements, tending to be too global, to ask for things that already exist, and to specify solutions rather than problems.*
- *The process of formulating requirements is complex and requires ongoing dialogue between users and producers.*
- *There is need for careful planning of end products and their implementation, beginning early in the research program and frequently iterated.*
- *A technical report is not an adequate end product in most instances.*
- *Users fail to take advantage of opportunities for prototype development.*

The second presentation, by Melvin Schwartz, Navy Personnel R&D Center, was based on the paper, "The Utilization of People-Related Research and Development: A Case History of the Shipboard Facilities Maintenance Demonstration Study," by Corder and Schwartz. He discussed a research project designed to improve shipboard facilities maintenance while reducing manning levels, and commented on factors which appear to affect utilization of results. He stressed the importance of developing ad hoc teams of sponsors, users, study participants and researchers for such purposes as establishing the study objective, preparing specific operational requirements, developing the study approach, determining logistics support requirements, designing evaluation procedures, communicating findings, and planning system implementation.

SELECTED CONCEPT PAPERS

DR. SANDS: I would like to introduce Mr. Merle Malehorn, the Deputy Director of Education and Training Programs Division, Office of the Director of Naval Education and Training.

"BRIDGE BUILDING"

Mr. Merlin K. Malehorn
Deputy Director, Education & Training Programs Division
Office of the Director of Naval Education and Training

In view of some of the comments that have been made here let me say that I am bureaucracy and so are you. In fact, I am a mission sponsor for education and training and that also makes me a mission sponsor for some parts of Navy R&D as related to the training enterprise. I don't know what that classifies me, maybe a middleman, or an R&D manager or a user or whatever. I thought I was a user for a while, but now I'm not sure that is true. And I am not sure that I really know who the user is, the more I think about it. Are we talking about the school, are we talking about the echelon that determines what the school shall do, or are we talking about those of us who set requirements for what the school shall provide? I have a problem defining the user--and I guess I even have problems knowing what we mean by researcher. The real title of my paper is something else.

I have invented a new unit or a new name or a new activity: robelings. Robelings are the activities that one engages in to try to get the user to do something with the research or product you have created. I did that because in many cases it seems that we are trying to sell the Brooklyn Bridge. What I want to do this afternoon is tell you some of the things we are trying to do in the Education and Training Command of the Navy to improve our own posture, in terms of defining our requirements, in terms of improving the dialogue with the R&D community itself, and in terms of improving the dialogue between the two communities. In that sense we also are trying to move research results into utilization in some way.

I have a sort of self-conceived model, probably pretty naive, and I have not drawn it out as a model because I do not like to use that term for things that need to be done. We in the Education and Training community started a year ago pursuing a variety of

activities that fit in my undisclosed model and have a list of other things that can be done, but we are interested in engaging in them as activities rather than as part of a model.

I have a tendency not to like models. Both the Army and the Air Force have commented that they have regulations that deal with this information transfer process or whatever you want to call it. We have one in the Navy too, it's the CNET Instruction 3910.1A, and it doesn't work so we don't talk about it. The reason it doesn't work is that it is too stylistic and formalistic and constraining. My experience in trying to promote this business in the last year or two indicates to me that it must be too complex a process to really be susceptible to relatively simple description on a piece of paper. If what appears on the paper is perceived as too complex, people don't use it. So, we are engaging in a series of activities.

What I will discuss then or describe for you briefly is not everything we do but some of the things we do. I will wander at random through a variety of subjects or categories--we will talk about various pieces, and some other things also. I will not follow the paper I have submitted in advance of this meeting, so you had better read that too. In the Navy when we have tried to get together those of us who are users, those of us who are researchers, and those of us who are some kind of go-between, the thrust of the discussion has been, "Gee, you users ought to state your requirements." We keep trying to do that. I wish it were that simple. So one of the activities we are engaging in is to try to improve upon the manner in which we state our requirements. However, my general evaluation has been that we who are users tend to want our programs immediately and we are not willing to wait for research per se to be done in the sense the researcher thinks of the term research. We want a reading skill program and we want it tomorrow. Kids are flunking out of boot camp because they can't read, at least we think that's the problem.

We also tend sometimes to want "global fixes," like our requirement to reduce the attrition rate. That is hardly a definitive requirement. I think we all know the attrition rate is too high, though we're not too sure of what it should be. We think it can be too low as well, unless we make all our entry level selection criteria adequate. Thus, we think there probably is some necessary lower level of attrition.

In any event, we tend to be very global in our statements, or else we tend to be very microscopic, like, "How about putting programmed instruction into OCS," which from the operators' standpoint is an important problem, but from the research standpoint I suspect is trivial, although I don't really know.

Another thing we tend to do is to ask for things that are really studies rather than research, and here my problem tends to be different as a manager. If in all good conscience we ask the training school level or command level and others like that to identify their research

requirements, we find that they are not really accustomed to that type of thinking. I think it would be unfair to ask everybody at all levels to be schooled in the rather nice definitions of what constitutes research, development, test and evaluation. So they come in with sets of problems, and many of those really at best necessitate a "study" of some kind, and maybe all they really require is consultation. What tends to happen with us is that the problems that really require research are sort of thrown in the corner. We don't really attend to them; management is not sensitive to them to the same degree that they are sensitive to consultation needs. Ultimately, therefore, we have negative feedback, and before you know it, school level people are not talking to us because we have not really attacked their problems.

Another thing the operators tend to do is ask you to develop an application of something that already exists. For example, we got from Second Fleet a requirement for an EW environment simulator. It turns out that the thing is on the shelf, you can buy it; no development is required. Nonetheless, it was an operational requirement as far as he was concerned. What we had to do was tell him he was talking to the wrong community. It wasn't an R&D problem, he needed to talk to the procurement people. Fortunately, we got the thing into the hands of the procurement people and something was done about it. The point is that we who are on the operational side tend to talk about applications that already exist rather than developmental kinds of work. We also tend to tell you the solution rather than the problem.

We've had an inquiry from one of our commands that runs correspondence courses; they want us to set up an evaluation program and motivation program that will make people who request correspondence courses complete them. My question back to that command is, "Why do you assume that correspondence courses per se are a good solution to the problem to start with?" I have taken a lot of them and I find them to be horrible solutions to the learning business.

My point here is that it is relatively simple to say that the operator ought to state his requirements. It does not happen that easily; it's a never-ending process of dialogue, even within the operator-user community.

One of the things in the Navy that mission sponsors are supposed to have are long-range plans, and given those long-range plans, the R&D community can bang their existing R&D programs against those plans and try to see if there is some kind of fit. We do not have a long-range plan. We have been casting about within the Education and Training community for three years now, trying to get one created, and it is not easy. One of the problems is that there is a tendency to want to write a description of the organization as it now exists rather than what it ought to be perhaps 20 years from now. Again, it's a learning process and it takes a lot of patience.

The CNET command a year or so ago went out and obtained a long list of operational requirements, which I have changed to operational objectives because to us operational requirements means a formal paper. They massaged them in some way or another and came up with three pages of this kind of thing. Part of my job was to integrate and synthesize the requirements. The point is that one of the ways of getting at needs or capability requirements is to try in some way to exercise professional judgment and integrate them. We are recycling this process and I must talk about some problems this causes. One of the problems is that it was not done by systematic analysis. It was an opinion survey and it is difficult to get from that to a systematic analysis of where you really ought to be because you're getting opinions from people who really don't know what you might be capable of doing. Another problem is that a survey does not tell you of the net changes required. Generally, all they say is that we want to be able to do so and so. But you don't know where you are now so you don't have any kind of baseline, and you don't know when you've gotten there because the statements are about motherhood. Without a systematic analysis and integration, you can be trapped into doing things forever and ever and never get there.

The next problem is a tendency to cast about for something new and different, something that has not been tried for five years. I went through some of the R&D projects that I was aware of in the Navy and, just using what rules I could create, I said here are some things we may be able to accomplish by a given time. There are about three pages of these. Several months ago we got together some of the user people and some of the research people and we looked at these, asking ourselves whether the dates are any good, whether the terms have any meaning, whether we need to add to it. I must say that was unproductive. All we did was get off into discussions to the effect that we need long-range objectives that will stand forever, such as improving upon surface warfare training. I agree that we do need to improve surface warfare training. The only thing is, that does not give me any kind of handle on what to try to manage to get done.

One of the things we did was to take one of these ideas and go through a planning exercise to actually see what would be involved in getting to a desired capability by a given date--to see what would be involved in driving the system. I have tried to phase the work in terms of operational capability available, in production and commencing implementation. The idea would be to lay out the activity necessary in R&D and on the operational side in order to get to a given capability by a given date. Well, that has problems. It raises questions along these lines: How do you get to the objectives? Who are the players? How do you go from that list into a plan of action? What are the milestones for implementation? Are the dates any good? Are there real requirements in this particular case or do they simply reflect what the R&D projects are and therefore it's a case of R&D driving the requirements?

I don't think the process of setting requirements is simplified by having the operators do it rather than the researchers. I think there is a need for a continuing dialogue in the process of setting requirements; it's much too simplistic to assume that we operators can sit down and magically create requirements.

This brings up some other problems. When we begin to go into the requirements business we find it necessary to engage increasingly in a whole lot of things that can be termed front-end or early-on analysis; such things as cost-benefit analysis. I have some problems with that concept, because it seems to me that we do not relate it to readiness. We relate it to dollars, but it may be that I have to pay a lot of dollars to get the last increment of personnel readiness squeezed out of the training system, and that increment may be critical. I grant you that I do not know how to measure units of proficiency or even units of readiness, but I don't think that cost-benefit analysis should be allowed to override the need to do that. That is not to say we should not do cost-benefit analysis. We need to analyze the requirement; we need to look for alternative solutions. Too many times the solution is picked for us, particularly in the 6.4 program which we use to build prototypes. The solution is given to us by some mission sponsor. You can say how about going to low-cost trainers, but you don't want to do that even if you can show him in dollars that that's the way to go. He's a big boy. So you probably say, go up in the bureaucracy. That doesn't do you much good because he is the end of the line for all practical purposes.

Another problem is that there is a need for task analysis once you figure out what you are going to try to accomplish, and there is need for such things as utility analysis and economic analysis and feasibility analysis. I don't know what all these terms mean but we keep doing them and people keep asking us for them. I'm never sure what the terminologies are in terms of how they differ.

Another thing we have gotten into is a need to do ADP risk analysis when computers and computer software are involved in our projects, because we cannot spend R&D dollars to buy ADP software unless there is an ADP risk development analysis, so we can get involved in that.

So there is a real problem in the front-end piece of the business, in establishing requirements.

We are at the present time cycling both the statement of operational objectives and the calendar date objectives back through the system again in two different ways with an overlapping set of players to try to combine the two. We are not going to get them completely combined but we are now in the second stages of the cycle to get them together. The first stage was to do them separately. Now we are going to try to hold them together. Gradually--I figure

in another three or four years--we might have a fair statement of some of the capabilities that we in the Education and Training Command of the Navy want to try to get to, with some reasonably definitive statements and some fairly good dates that are rational, not pulled out of the air.

Another thing we are doing increasingly is implementation planning, and I will talk about this from several different angles. It has seemed to us that in many cases (and I think of that Navy case problem example that we were looking at this morning) the research gets done and it gets captured in a technical report--maybe a year or two later --and that is often the end of it. There is an assumption that somehow or another it's going to get picked up. Well, even if it does get picked up and there is enthusiasm within the training community, you are fighting a two to three year resources cycle. We need to plan right now for promising research that will be available for implementation commencing in 1980. The resources must be planned now because we will be going into POM 80 this fall, and if they are not in POM 80 they aren't going to be in budget 80, they aren't going to be in fiscal 80 without traumatic reprogramming and traumatic reprogramming within the Navy Education and Training Program in the Training Command hardly ever exists. It can't be done; there is not that kind of flexibility.

This spring we started to pick a couple of projects that look like they are coming out and could be implemented, and are trying to lay out a plan of action and milestones to implement the results of those projects starting in Fiscal Year 80. I should point out that we are not talking just about resources. Those aspects of implementation that involve acquisition of resources focus on FY 80, but there are a lot of other actions that also are necessary.

For example, the training command has to write triple R's this fall if it wants the resources in POM 80. When we get our plan of action and milestones written in both of these, there will be a whole long sequence of steps that have to be taken and written again each year.

The idea here is to get the research people together with the ultimate user, who happens in this case to be the staff members of the Chief of Naval Technical Training. They really govern what goes on in the schools, about which we are talking. But to get them together and lay out a fairly specific plan for implementation in terms that the training people understand becomes a learning process for the researcher, not for the training people. The training people understand the business of acquiring O&M and getting more instructor billets and changing curricula and media selection and getting the Chief of Naval Education and Training Support to budget for simulators, and so forth. So it becomes a learning process for the researchers.

Interestingly enough, we have a working group set up on each one of those projects and each working group is headed by a member of the

research community. So they will be forced to learn whether they like it or not, I suppose you could say. We are seeing how it evolves, and whether it works. So far it's rather promising, although we expect lots of problems on the low end of the learning curve on both sides. But if it works we will begin to try to expand this process and apply it in other areas where it seems to be an appropriate process. We think we are probably going to have a meeting with the Chief of Naval Education and Training Support, who is a different command and who handles the computer and instructional system development program for what we call our Class A schools and controls a lot of other support things such as media development, media acquisition--these kinds of things. We think we will probably take the research community and go meet with his staff next time and identify some more projects. The key here was that we brought the research community and the training program coordinators together. It was not guys up at my level and it wasn't people at the Chief Education and Training level, it was the worker bees!

Well, that creates lots of problems for us. What projects are we going to talk about? You can't talk about all of them. We briefed on about six down there that we were just not ready to talk about, although some of them are ready for implementation. Who are the players that have to be involved in each case? It tends to be a unique set in each instance, which gets me back to one of my earlier points--that it is very difficult for me to conceive of a documented model that's going to address everything, such as what kind of qualifications the players have to have. Not every researcher is capable of doing this kind of thing, not every training program coordinator has got the patience to do it. So there is a personnel selection problem. What kind of people are you going to get involved in this kind of dialogue? We have a problem because it creates additional work load for everybody--for the TPC as well as the researchers. It either slows down work or makes people work overtime or makes something else drop out, and you sort of have to assume that everything else has got priority or they wouldn't be doing it now.

In some cases there is a question of whether we know enough about the project or trust the findings enough and that becomes another problem in evaluating whether to go with it. That brings up still another question that we have not pursued, but it might be another technique. We ought to have a fleet project team or a user buddy for every project, and let him sit in on the thing all the way. I've got problems with that, but on the other hand, it is interesting enough that we are going to be looking at it for a while to see to what extent it may be useful.

Another thing we have not yet started doing, partly because of a work load problem and partly because I don't think we are quite ready for it, is what I'm calling end-product analysis. This is trying to get at the problem that technical reports are not an

adequate document from the user standpoint and are really not the end product that is needed. Suppose I have a subproject that is just about completed out of one of our 6.3 projects. It has a little self-administering task that can be done aboard ship and has a wide range of possible application. Our problem is that what we have at the moment is a technical report plus sets of illustrative materials. Is that enough for us to decide what to do with it? The answer from the training manager's standpoint is by no means yes.

I have listed some of the other kinds of things that we as training managers need to know to be able to implement this thing and make it part of the institution. What other applications of the R&D findings or product do we plan to make? What is it going to cost to do it? How much time will it take to print it? How much to staff it? What command are we going to assign to do it (in this case probably the Chief of Naval Education and Training Support, who has a budget for it or can divert something else to it)? How do we use it aboard ship? Well, the resource requirements request is the documentation we go through in order to get bucks. Then there is a whole set of implementing directives that will probably be necessary and by that I don't necessarily mean what we in the Navy call instructions but simply the papers that need to get out to make all management levels aware that this is their responsibility. It may simply be a piece of paper; for example, that says the Chief of Naval Education and Training supports this, and that your responsibilities include these things as first priorities. There is a whole range of those kinds of management actions.

I could go on about getting these kinds of things built into ISD models and into the costing models and into Mil Standard 1379 Alpha which involves some kind of supporting analytic process so that the contractor knows what to buy and the kind of end product that we as users need. What I am suggesting is that we begin by trying to concentrate upon end-product analysis. Let's start talking early in the project about what kind of end products are really needed in order to implement the findings of this project, if they come out good enough to be implementable. I have not laid this on anyone yet, so those of you who work for me, either directly or indirectly, at some point will be asked to undertake some evaluation like this and see whether we can do it or not and see whether it is useful.

Now that gets to another thing we are trying to do and that is to increasingly build into our projects, wherever it is appropriate, an applications planning phase. It is not always appropriate and you don't always do it at the end. In fact if you want to talk resources you really need to do it three years ahead of time, as I have indicated. It might be that it's a continuing process and you do it on a best guess basis at the very beginning and then refine it as you go. But we are increasingly trying to talk about application planning. Again it's an educational process for the researcher and not every researcher is adept at this kind of thing, so it becomes

an organizational problem, a personnel problem, and other problems of that type. On the other hand, it opens the gate for the researcher to pull in the user training people to talk about "What if this works, what is it I will need to give you, and how would you put it into operation?" So it is another means of bringing these two parties together to communicate. And that gets me to the point that many of our projects require a management plan. Too often management plans simply address the principal commands who are going to be the players in watching a thing grow. I think we need to improve upon the management plan and indicate what kinds of products are necessary as part of the development process. That is another subject that is hanging up in the air, and Bob Smith and I will try to talk about it and see if we can improve the management plan part of our projects.

Another thing we are doing, and this is sort of a classic case, is a big project on job performance aiding. We are calling it test evaluation, even though it's in 6.3. What we are really doing here is taking the system view of job performance aids. We are trying to take a big enough chunk out of the Navy to find out what we have to change in the personnel system and the training system and the maintenance system in order for the Navy to take advantage of job performance technology that already exists elsewhere. We are not going to create any more technology. We think there are all kinds of it around, even though from the research standpoint there is a lot more that needs doing. What we are trying to do is identify the change in the total system that will be necessary in order to help the Navy take full advantage of this. Of course there are a lot of interfaces and at the present time we are busy developing strategies between us and the users and the research people to get the whole Navy user community built into this in the right way so that when it comes down the pike and is as promising as it looks, they will be ready to implement it. It has tremendous implications in terms of procurement of technical data and in terms of the way people are distributed and I am sure that I do not have to tell most of you what the implications are. What I am suggesting here is that we become a little more sophisticated about planning research and looking at it in terms of the total system, instead of just a research project with a technical report as the product.

That gets me to the point that one of the things we may want to try to do when we are a little more sophisticated is to take a project and, as a pilot planning exercise, start at the capability end and sort of plan backwards and really lay out all the steps that are necessary to reach that capability.

You will note that this differs from POM 80 planning, where we are talking about something that is already in process, something we know will be coming, something we know to be promising, and there we are focusing around resource planning. Here I am talking about the whole business of user-researcher interface, and how they

have to feed each other, and what has to be done all the way along to build the implementing resources. It is vague at the moment, but it is hoped that at some later time, when we are more sophisticated, we will be able to handle the planning for some projects in this way.

We in the Navy have an experimental training policy board. We created the board a couple of years ago, and to get a board to work is another bureaucratic problem. It started out on the basis that the research community needs to have access to our schools in order to get the advice of subject matter experts on content and a variety of other things, such as space to put the computer terminal in. We had more requests than we were able to handle in a lot of cases, so the board was set up to try to prioritize those requirements. The role of the board is expanding and the board is now beginning to assume the role of actually looking at some projects to assess their merits in terms of user needs, cost versus likely payoff, etc. Again, this is a good opportunity for dialogue between the two communities.

I think that will necessitate some gradual change in the mix of people who are on the board. What I find promising, given that we have had two years to make it work, is that at least it now is a viable and workable entity. They have problems, but at least it is working.

We have commented off and on among us that the R&D system is not designed for us. I don't know if the system is designed for us or not, but we should learn to use it anyway. I don't have much trouble in making it work if I can get the people to do the things they need to do. I find the bureaucracy frustrating, but also fascinating and challenging. The same thing is true of the documentation process. There are all kinds of ways of getting your stuff visible--of getting decision makers to look at it. Within the Navy we have a capability that the Chief of Naval Material operates for us. The research community regularly goes up the chain of command through the Material system. The Navy Personnel Research and Development Center is commanded through the Chief of Naval Material organizationally, so that is why I address the Material process. The opportunity is wide open for the research community to propose any kind of training or personnel systems that they think could be made to work. We do not see many such proposals. I don't know if that is a problem with the researchers with whom we work--that they are not adept at massaging the system or at writing papers or what--but we don't see anywhere near all the system proposals that I, at least, would like to see. Maybe you think they will be turned down, and you don't like that. I know that happens sometimes on the training device side and it upsets the people who wrote the proposal. You don't always win.

I would certainly like to see the researchers do a lot more thinking about advanced systems and make those kinds of proposals to us. There is a set of documents called Science and Technology Objectives that

the Chief of Naval Operations, through Bob Smith, sends around. They deal with our area of work, and I wonder to what extent the user community of the Navy Training Command has really put a concentrated effort into getting those things through the system. My personal impression is that within the Education and Training Command in the Navy there is very little attention to those documents. Yet they represent one of the ways the Chief of Naval Operations communicates to the Chief of Naval Research and to the Chief of Naval Material about some of his priority problems. They can be used along with many other sources of information by those two principal R&D agents to determine what the 6.1 and 6.2 programs ought to look like. That is our fault; we are not communicating.

Annually we do JRDOD, which is a big secret document (although our piece of it is not) that doesn't get reviewed thoroughly, and yet it has an impact on the joint arena and on what goes on in R&D. DoD periodically puts out Mission summaries and asks for comments. I have yet to see any of them come out of the Training Command, although they have a set.

Hank Taylor lately has been running training and personnel technology conferences. Again, I do not see much attendance there by users, who tend to think of them as being by researchers for researchers.

Per dollar, our programs get more intensive review than any other R&D programs that exist, and yet we on the user side tend to look at the reviews for researchers.

One other thing we users do not do is take advantage of the capabilities within the Navy for prototype development. About the only place we make prototypes is in the area of training devices. It is very hard to get the training community to address itself to the need for prototype development.

We have continuing problems with the length of Navy boot camp. In the last ten years it has ranged from 7 or 8 weeks up to 11 or 12 weeks. The length is indeterminable. We have recently been driven to put it down to eight weeks and it looks like OSD is talking about seven weeks and somebody just this last POM cycle said why can't it be six weeks, so I guess we will have to answer that problem. In going down from nine weeks to eight weeks we had TAEG do a study of boot camp. TAEG did such a study and to some extent has redesigned boot camp. Instead, why couldn't we have done sort of a zero base look at boot camp training from the R&D standpoint--and that is what I mean by prototype development--and really set up what it ought to be. I'm not saying what it would become, but at least we would have a boot camp that had some additional rationality to its content and approach.

In summary, I have talked about different definitions of products, about several dimensions of the need for better processes of planning for application, about the user doing a better job of trying to

address what he is getting and what he needs, and about the need for more attention both to proposals and requirements within the "systems" context.

And that's it.

DR. SANDS: The next speaker will be Mr. M. A. Schwartz, NPRDC.

UTILIZATION OF PEOPLE-RELATED RESEARCH AND DEVELOPMENT: A CASE HISTORY OF THE SHIPBOARD FACILITIES MAINTENANCE DEMONSTRATION STUDY

Mr. Melvin A. Schwartz
Personnel Research Psychologist
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The case history we are going to discuss today is part of the Shipboard Manning and Automation Program which is being conducted out at David Taylor Naval Ship Research and Development Center in Annapolis. The title of the paper on which my remarks are based is called, "The Utilization of People-Related Research and Development: A Case History of the Shipboard Facilities Maintenance Demonstration Study."

In my talk today, I am going to cover four basic areas:

1. An historical background of the program.

2. A brief description of a study that we conducted and are in fact still conducting.

3. A brief discussion of the problems that we experienced in conducting the initial phases of the research, and also the problems which have implications for the later utilization and acceptance of results.

4. We will end with a parochial review of positive and negative factors which we believe to affect the utilization of results.

Back in 1972, in light of the cost of personnel and the shortage of manpower due to the all volunteer force structure, Admiral Zumwalt, then CNO, issued an action memorandum directing that laboratories and various Navy organizations become concerned with reducing manpower in the fleet. A committee was appointed, and a joint fleet laboratory program was established, with DTNSRC designated the lead laboratory. Participants in the program included the Navy Personnel Research and Development Center Destroyer Development Group, and we had inputs from the Navy Ship Engineering Center and from the Chief of Naval Material

Combat System Advisory Group. The objective of the total program was to reduce manning while maintaining or improving operational effectiveness and shipboard readiness.

The general approach was to conduct a set of pilot studies. We started off by doing a pilot study on reduced bridge manning, where we introduced all kinds of new equipment, procedures, work space layouts, and manning alternatives to see if we could reduce the number of people on the bridge. The study was conducted using both mockups and quite a few operational ships. It was conducted with the assistance of the Destroyer Development Group. Ships were deployed with alternative configurations of equipment sets, which were designed to save manhours, and we designed alternate procedures.

The results of the study were generally positive. We found that by automating certain equipment and functions we could reduce the number of men standing watch on a destroyer class ship or an FF 1052 class ship from 12 people in the pilot house and related areas to about 5. When the results of that study were initially disseminated, many operators expressed considerable resistance to the implications of those findings. A typical response was, "If what you say is true and you can reduce, say, seven people times three watch stations, you are going to take 21 people off my ship, and I'm already having trouble getting done my damage control, my facilities maintenance, and a bunch of other shipboard functions."

Upon hearing these objections raised by operators, the scope of our program was expanded to include many other functional areas. Facilities maintenance was one of them. It is sort of punching into a big bowl of jelly. You have solved bridge manning problems and out pops a damage control problem or facilities maintenance problem. The facilities maintenance area was assigned to me, and I have become known as "Mr. Clean" for the Navy. It is a study, and it does respond to a user need. Facilities maintenance includes those actions performed by ship's force necessary to maintain conditioning, cleanliness and appearance of exterior and interior ship spaces, hull and hull fittings, but not including below the water line. To be more specific, it includes painting, chipping, scraping, peeling, waxing, washing, buffing and all those tasks that your wives do at home or your husband or boyfriends or whatever. We did not do an extensive cost-benefits analysis, but upon trying to get a handle on how big the manpower expenditure problem was, we looked at the average annual personnel costs from a manpower costing document and used as a hypothetical population 125 FF1052 class ships.

We found that they are spending roughly $240,000 per ship per year in just manhour dollars for getting that work done. That comes to an equivalent of 27 men on a ship manned by over 200 people, working full time on nothing but these tasks. That is not to say that they do only that, since the way the functions are currently administered aboard ship they will grab whoever is available, usually the non-rated seaman. Life cycle costing for that same population of 125

destroyers conservatively is in excess of 3 billion dollars. If there were only 125 ships in the fleet we could possibly live with that life-cycle cost, but there are well over 400 ships in the fleet.

An initial analysis of the problem in the manpower area indicated there were many impromptu organizations established to do it. Departments had their own areas of responsibility for cleaning. It was not a systematic approach to the problem. The people doing the jobs did not have adequate training. You may wonder what training you need to swing a swab or vacuum a floor. You do need training. Certainly they were not motivated to do that kind of work. They joined the Navy because they saw a T.V. flick with a guy with earphones on his head watching a scope. Swinging a swab was not their idea of a career in the Navy. There were not standard work procedures and management techniques, there were no systematic work schedules. Now the Navy has developed a thing called the PMS, the Planned Maintenance System, which has been used to some degree with success.

Through the Planned Maintenance System, maintenance of operational equipment such as radar, sonars, motors, gun shooting things and propulsion things have been addressed in a systematic fashion. We now have routine and periodic procedures for maintaining them. We also have an extensive reporting system, yet there is nothing like that for facilities maintenance in the fleet today. The work procedures that they use are inappropriate, or outdated. A lot of cosmetic painting goes on. People don't know the difference between rust and red lead. People don't know that it is not right to put paint on without washing the surface. People don't know that sometimes you do not need to paint, but could just wash the surface.

Equipment and materials, standard Navy issue items, has not seemed to keep pace with modern technology in the janitorial services business. The Royal Navy has come to grips with the problem and so has our hotel industry and all our janitorial maintenance facilities all over this country in the civilian sector, yet nobody in the Navy heretofore has ever addressed this problem from the same standpoint, at least not as one problem.

Especially on older ships, the spaces are simply not designed for maintainability. It is hard to clean mazes of overhead wireways and do a deck that has so many beams coming out of it, and no false bulkheads in it. The problem of maintainability is clear to the Navy now, and people are addressing the problem of redesign for ease of maintenance. The cumulative result of all of these problems put together is that manpower is significantly wasted, material is wasted, ships deteriorate, and there is a lowered morale and work motivation, not only for the people doing the jobs but for the people living and working in the spaces that those people are supposed to be doing their jobs in.

These problems have been hanging around for at least a hundred years. Part of the problem is due to the fact that nobody ever addressed

them all at once. Who cares if the use of disposable mess gear means that dishes don't have to be washed...when you compare that with the need for a new ship in the Navy. If you pulled together the entire maintenance job, you might have a different perspective. Another reason for the inaction is that operational criteria have never been defined in the maintenance arena. How clean is clean, or how corroded is corroded, depends on who is viewing the situation. Even if appropriate criteria were developed and addressed, the resources have never been pulled together to conduct a longitudinal study. And that is part of the bureaucratic problem.

Lastly, the Navy has a "can do" spirit, and they do remarkably well with it. Tradition has been one of the major obstacles to getting the facilities maintenance problems addressed. The Navy had the manpower to do these jobs and in certain situations they were not required to man the guns or man watch stations and so they cleaned the ship. But the situation has changed. There is no reason to suppose that the problems are going to go away either. The design trends in new ships indicate that there is going to be increased sophistication in automation. That means decreased crew size as per the bridge manning studies. But at the same time, ships are being increased in size, and there is a decrease in the non-rated watch standers that are going to be available for this kind of work. Personnel problems have increased since we have an all-volunteer force structure. People have a higher expectation of quality of life and they are going to express their objections to facilities maintenance.

The objective of our study was to demonstrate a reduction in facilities maintenance (FM) manhour expenditures while improving the condition, cleanliness and appearance of shipboard spaces. The approach we took in our first phase of the study was to analyze the facilities maintenance problems and future facilities maintenance requirements. We did a space analysis of about 30 or 40 percent of the shipboard spaces aboard a destroyer and determined what the cleaning and surface preparation and corrosion control requirements really were. We generated candidate concepts in each of three or four concept areas, such as manpower, equipment and materials, and training. We screened the various labor-saving devices, materials and procedures, and developed physical representation of these. It was not that we wanted to bring aboard a particular piece of equipment to solve a problem. We wanted to know if the idea of using that piece of equipment would help in reducing the manhour requirements in getting the jobs done more efficiently.

We designed an experiment and selected variables of interest including cleanliness and appearance of the spaces. We developed a rating scale and a skill and knowledge test to determine the knowledgeability of people doing the jobs. We used an attitude and motivation questionnaire, and a number of other briefing and

debriefing questionnaires which got at the shipboard personnel attitudes. We installed the physical representations aboard an operational ship, deployed the ship for about a year, analyzed the data, and reported our findings. In short, we wanted to determine empirically whether innovations in each of our concept areas contributed something of value to manpower requirements, cleanliness and appearance levels, attitudes of the crew, and crew skill and knowledge. We also wanted to determine, within each concept area, which of the concepts seemed to hold the biggest bang for the buck, and also later on in the program to determine the optimally effective mix of concepts and specifics (specific equipment, materials, procedures, and training systems).

Now I would like to talk about the results of our Phase I. We had many problems in conducting fleet research. It was a sheltered field study; we had the ship on a not-to-interfere basis; even boarding the ship was a problem, but we will get to some of these problems later. The results, in fact, indicated that approximately 42 percent of the manhours can be saved in comparison with documented manhour expenditures and ship manning documents for the class. And that does not include surface preparation and painting, which we did not address. We set up an eight man team to do virtually all of the facilities maintenance tasks for all common use spaces plus the normal spaces assigned to the first division. More spaces were assigned per person, yet the cleanliness and appearance rating forms indicated that there was a decided improvement in cleanliness and appearance. The skill and knowledge of members of the team, as measured by our ad hoc skill and knowledge test, increased very significantly both in a statistical and practical sense. There was no apparent effect on morale and motivation due to the FM innovations.

One of the limitations in our research was that only 40 percent of the ships' spaces were involved and we did not really have the total system involved. We did not consider a function which takes up about 25 percent of all the facilities maintenance manhours; i.e., surface preparation, corrosion control and painting. We did not do any bilge cleaning, and only first division personnel were involved in the study. During the research implementation phase we encountered many problems which gave us heartburn in collecting the data and certainly would interfere with later acceptance and utilization of any of the positive findings of the program.

There was organizational resistance to change. Some people believe that you don't really need new material and equipment or training programs. They believe that leadership and accountability will take care of all of your problems. I think this has been demonstrated not to be the case, that you do need more than accountability. We had difficulties in boarding the ship, which was deployed all over South Africa. We had difficulty in getting out the reports. We felt that it was best to communicate results to operators and users in their own language by their own people. However, the Destroyer

Development Group, which is part of this program, consisted of only an operator and a consumer, and because of rotation of personnel through the office, it took quite a while for them to publish their study. Well, operators are less likely to read a laboratory report than they are to read a report from another operator. I don't really like the demarcation, but nevertheless it does exist.

In continuing the research effort, there was threat of a funding cut. We thought we were going to get cut off without ever being able to get into Phase II. We did not have a requirements document, and this came back to haunt us later on when the funding was taken away temporarily. We went looking for sponsors to continue the research program. Sponsor responsibilities for continuing the research are fractionated because there are equipments involved that have to be service-approved, and that is done by the Naval Ships Engineering Command. I'm sure you're familiar with the problem of fractionation of responsibilities.

Despite the problems, we finally got our money and are now continuing into Phase II. I would like not to make a value judgment at this point in our work, except to say that i think some of the results are being accepted prematurely when we don't have adequate evidence. The FFG 7 is a brand new ship being built in Bath, Maine. Their manpower man used to work on the project with me. He helped develop some of the innovations. In fact, during the entire study and implementation program, we got the whole fleet involved. We asked them to help select the equipment, procedures and materials all the way through. In the FFG 7 project office, there is now a guy who is to work the project with us. One ship is putting our whole project on their ship and in turn will give us data on how well the innovations work.

PMS306, a newly established office for fleet maintenance, became very interested and asked if there was anything they could help us with. We brief them and keep them informed of all the developments in the program, and perhaps sometime in the future they will become very involved. CINCPACFLT read the Destroyer Development Group report and became interested. They wanted to do it right now, and again we suggested they wait until we finish our research. It will be two or three years till we get all the data in and analyzed, so they decided to do a study just like ours.

Going into Phase II we want to do the same thing on an expanded level. We want to develop new procedures for an entire ship class, actually more than one ship class, this time. We like to believe that the concepts that we are evaluating will be just as valid for an LST or an aircraft carrier as for the destroyer class ships. We are also developing a large management information system, where the contractor will go in and analyze facilities maintenance requirements and develop a work management distribution system very much like the one we used in the first phase of this study.

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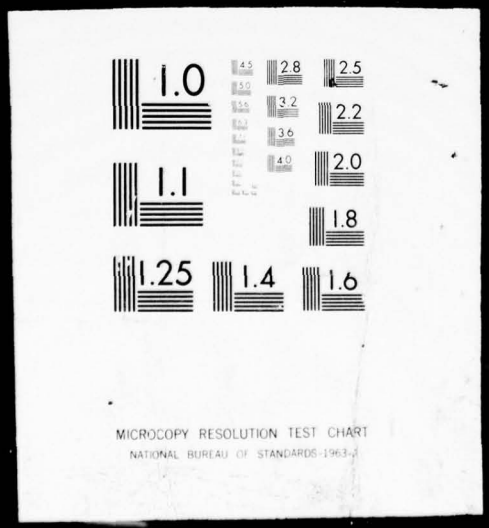

We will also be preparing technical manuals. I failed to mention that we have also developed 13 audiovisual training modules, things like how to strip a deck, how to clean a head, safety in facilities maintenance, the use of chemicals, etc., and we feel that this is at least partly responsible for the improvement in skill and knowledge as well as in the cleanliness and appearance of the shipboard spaces.

We are also going to develop more modules in the area of corrosion control and surface preparation. We are always looking at labor-saving devices and equipment and materials, and we are tooling up now to purchase those for the test-ship population in the next phase of our study. We are going to do an entire ship, and consider all the interactions among the various department and divisions aboard ship. And we plan to do a cost-benefit trade-off analysis to show where the biggest bang was. The approach will be essentially the same as it was in Phase I.

In terms of a retrospective analysis, and again I have to think it's a little parochial, but if we had to do it over again we would look in the R&D planning phase for the following features:

1. Ensure widespread need recognition, and we really never had any problem with this.

2. Establish ad hoc teams of potential sponsors, users, study participants and researchers. The team responsibilities would include the generation, coordination and dissemination of a specific operational requirement document, something that would give us a charter and license to operate, backed up with money. The team would also establish the study objective jointly, each participating at his own level of capability and in his own area of concern. But everyone's views should be jointly considered.

3. Develop the study approach. The researcher cannot afford to remain in an ivory tower; he has to deal with the realities of collecting data aboard a ship that is floating around in the ocean, and also get the plan of logistic support for the study.

Now, the planning for the logistic support of the study bears little relationship to the ultimate logistic support that will be required for utilization of the system, and both should be addressed. The support requirements must be considered in early planning, we feel, in order to ensure utilization later on. You should acquire a competent and motivated research staff and adequate facilities. We have been fortunate in this respect. You should jointly develop the study design, the innovations to be evaluated, and the test procedures and schedules, and seek change advocates at all levels to avoid the not-invented-here syndrome. I think we have had a

reasonable degree of success, although we did have problems. There were one or two people, some on the facilities maintenance team and some at team-manager level, that felt accountability was the only answer. This really impeded progress for a while, but there was one guy on the team who really ate this stuff up. He got into doing the job, showing people on the team how to do the job. That, coupled with the fact that these people did not have to stand watches and only had to work half a day, helped them to tolerate this program for a considerable length of time until it got to be too much. Three months of it is about all you can have. And that has implications for the design of our next team concept. Maybe we should consider a permanent team, a rotatable pool of people, as they do in mess cooking in the fleet today. We are going to play with that concept in this next phase.

You must begin with the early research planning phase. Even though you do not know anything about how the innovations are going to work out, you have to begin to plan your transition requirements.

In Phase B, development and testing, inputs from the users and industry and system development people should be considered. Joint installation of systems and joint data collection effort should be arranged wherever practicable. The study should use the people in the fleet if they have the time and are willing to cooperate. If they are part of the program, you will have more success in completing the study, and if the results are positive, you will find it a lot easier to put the systems aboard ship.

You have to be prepared to compromise your experimental design. You have to keep the sponsors, users and potential transition organization advised of progress and intermediate developments and findings. Audiovisual programs can be very helpful. The researcher should follow through with organizations to be involved in the transition. We should specify the requirements for utilizing the research results in as much detail as practicable. Include requirements for approval of logistic support requirements, and requirements for additional studies, such as studies of reliability of equipment and study of safety and costs.

Finally, an essential step is communication of your study findings. Researchers, sponsors and users should participate in the planning for fleet implementation. When you are reporting your study findings, it helps to target your communications at relatively homogeneous audiences. The development agencies, and these are all the commands that are concerned with training and equipment utilization, logistics, and safety, should consult together to develop a follow-up plan for utilizing the results. You may want to read our document entitled Facilities Maintenance Demonstration Study for a better understanding of the study.

I think that's all I have to say.

DISCUSSION

COMMENT FROM THE AUDIENCE: I'd like to comment on your heavy emphasis on coordinating and planning. I get concerned that maybe sometimes we only add to the length of the research and thereby confuse the issue even more when we over-extend this coordination. I am in full agreement with you that we ought to have the appropriate people involved, but I had a feeling here that we were going in the direction of overkill.

MR. SCHWARTZ: You have to understand from my own point of view, that this was an exciting problem to work on in that the solutions were so crystal clear and nobody could really argue with what the approach was. It was easy to convince people that they had a problem and they needed a reasonable attack on it. I admit, however, that the more you get into committee planning efforts, the more lengthy and complex the whole approach may become and that will extend your research time. That may even be what keeps you from doing it.

COMMENT: The trade-off here seems like a good one. That is to say, people don't like to clean ships; it's not something you will get a lot of support for; it's a chore. I doubt that this application has been overdone, and that is a virtue. And this retrospective plan that you have, while comprehensive, has a better chance of achieving results than if you did not get people involved.

DR. SANDS: Are there any other questions on either paper?

QUESTION: A quick question on the first paper. Did you ever define products? It would seem to me appropriate for your purposes to make clear how your definition differs or relates to the way the GAO defines products.

MR. MALEHORN: My understanding is that the GAO defines a product in terms of technical reports. We would say that it really depends upon the project itself and what its implications are. I'm not sure I could even say there is any minimum standard. When we were trying to develop a response to the GAO report, we spent a couple of hours talking about units of measurement. Otherwise you don't have any type of standard. So, I think a product, from the standpoint of implementation, could be a whole range of things and it just depends on the particular project and what its implications are. The issue of what is a product really is kind of critical for us as a community. We say "utilization" and "research utilization" when we really mean product utilization. So you must be very clear on what product means in order to develop a viable strategy and system that the Congress and everybody else can understand and accept.

COMMENT: I don't understand. If you knew that a report of the findings of a study were to be its product, and you wanted to get those findings utilized, wouldn't you refer to that as research utilization?

MR. MALEHORN: Well, if the report is a product, then you go a very different way; you get a report on whether or not you had report utilization. If, on the other hand, it happens to be an instructional unit, you have a different criterion for utilization. It sounds trivial at first, but it is not. I think you want to prepare a list which includes various possible types of contributions.

POLICY RECOMMENDATIONS FOR IMPROVED RESEARCH UTILIZATION

SUMMARY

For purposes of this session small groups met by military branch to develop policy recommendations for improved utilization of human resources RDT&E, and then reported their recommendations in plenary session.

The Air Force group, chaired by COL Ralph Hoggatt, Air Force Human Resources Laboratory, made the following recommendations:

- *A research utilization system should be formal and should be documented.*
- *Effective RU requires an intimate and continuing process of interaction between user and producer.*
- *The "contract" between researchers and users should be comprehensive and definitive, specifying such things as objectives of the research, products, uses, users, logistics requirements, cost estimates, and risks.*
- *There should be an ad hoc committee to monitor the R&D project.*
- *Cost-benefit analysis is essential.*
- *The applications function is a full-time job.*
- *There must be high-level endorsement of findings and recommendations.*
- *A plan for marketing the product is essential.*
- *There must be evaluation of the product by the user as well as research community.*

Judah Drob, Department of Labor, recommended that the conferees urge DoD to appoint someone at a high level to be responsible for: stimulating action by each of the services in the area of utilization, promoting interchange of RU experiences among the services, and encouraging the institutionalization of RU. He suggested that such an appointee should be asked to:

- *Obtain appointment of counterparts in the services.*
- *Convene conferences to promote utilization.*
- *Urge assignment of utilization specialists in research and user organizations.*
- *Organize linking units.*
- *Develop storage and retrieval capabilities.*
- *Promote understanding of RDT&E and research utilization.*

Dr. Arthur Drucker, Army Research Institute, reported the following recommendations by the Army group:

- *There is need for a coherent system for accumulating and prioritizing research requirements.*

- *Such prioritizing should not be the function of the researcher.*
- *All potential consumers should be involved early.*
- *The research program should be responsive primarily to guidance documents.*
- *There is need for users to develop an understanding of the research process and of what can be expected by way of research products.*

Bert Griffis, Rehabilitation Services Administration, offered a set of whimsical prescriptions for improved utilization.

Dr. Robert Smith, Office of the Chief of Naval Operations, reporting for the Navy group, suggested that the Navy human resources RDT&E program is both relevant and cost-effective. He reported the following recommendations for becoming even more effective in utilization:

- *There is need for early and continual joint planning for utilization, including identification of people to be kept informed, generation of cost-benefit data, identification of end products and specification of implementation requirements.*
- *Resources for utilization should be increased.*
- *Application officers should be assigned to key user agencies.*
- *The R&D community should provide technical assistance to the user community.*
- *Technical reports should have executive summaries that contain cost-benefit information and indicate expected users and uses of the report.*
- *There should be an annual report of utilization.*
- *There should be a system for tracking utilization.*

In the ensuing discussion Dr. Rostker expressed dissatisfaction with the recommendations, suggesting that they were largely a recapitulation of existing procedures. Dr. Uhlaner commented that the issues we are struggling with are long-standing and complex, and not likely to be amenable to standardized solutions. He further suggested that progress will be largely a function of the skill and dedication of people, and that the military system is well endowed with this resource on both the user and researcher side. CAPT Clarkin emphasized the need for a lessening of the isolation of the respective communities, while maintaining a responsible autonomy.

Dr. Sands concluded with the hope that the symposium will have contributed to the dedication of people to build the kinds of linkages that have been suggested throughout the conference in the interest of improved utilization of people-related RDT&E.

POLICY RECOMMENDATIONS FOR IMPROVED RESEARCH UTILIZATION

THE CHARGE TO THE CONFEREES

DR. SANDS: I would like to talk about what it is we intend to do for the remainder of the day, and what it is we are generally expecting for tomorrow. As was indicated earlier, Dr. Rostker will be attending the 8:00 a.m. meeting and he will remain through the morning session. He is doing that for the purpose of providing opportunity to continue the dialogue, and I'm certain from talking with him that he wants to encourage dialogue.

With reference to the 1545 group meetings, we are going to ask certain members of the faculty to sit in with the Army and the Air Force since these groups are rather small.

I think we have come to a point where I would like to reflect on what it is we have done this week. First of all, Admiral Metcalf highlighted many of the issues in research utilization. These issues were problem-oriented. That discussion was followed by an assessment of our track record, so to speak, based primarily on the view from GAO and the interpretation, documentation and reply by DDR&E as reviewed by Colonel Taylor.

Then, at the banquet on the evening of the first day, we had Dr. Rostker's address, originally intended to be the keynote address, which we have revisited today. Dr. Rostker, as I see it, was attempting to underline the current expectations for people-related RDT&E. Are these expectations being fulfilled? And if they are not being fulfilled, what appears to be over the horizon? What are some of the major thrusts that may impact on the management of RDT&E in the near future?

We also had a state-of-the-art session, where we heard and discussed perspectives from a number of federal agencies and other institutions; and there was an attempt to relate those experiences to the literature. We met in our respective military service groups for purposes of certifying many of the shortfalls, needs, problems and issues that had been mentioned by Admiral Metcalf and Colonel Taylor. Today we considered a number of case problems, with an attempt to identify specific utilization strategies that might be applied to improve the use of the particular innovative products described in those studies. This afternoon we heard, from Merle Malehorn, what seemed to have been a process methodology that appears to make a lot of sense to me, followed by a case study portraying a number of successful instances of utilization strategies.

Now we are at a point in this meeting where I'm feeling a little anxious, not because the group has been reduced in number, because I expected that to happen. I also expect that the interaction and the various influences that have happened as a result of it, have carried over here in this room, in a form that is useful. And I expected that a core of people like the ones who are here now would be depended upon to formulate some tentative conclusions as to what seems to be needed in the best interests of improved research utilization. That is what I hope we will accomplish this afternoon. Please take whatever length of time is necessary to formulate some major conclusions, and the implications of those conclusions if they were acted upon. I hope you will get to a point where tomorrow morning we can make some clear and sound recommendations that might have impact on policy formulation. I am hoping that the kind of recommendations that are generated on the basis of what has happened this week will provide the type of dialogue that Dr. Rostker will be yearning to hear in the morning, and will be prepared to critique and respond to. I am not sure if I am being clear as to what the charge is at this particular time. Ed, why don't you give five words on what it is you think we ought to be prepared to do in the morning.

DR. GLASER: As we listened to Dr. Rostker talk, I think a number of people in the research community felt that his stance was, in a sense, attacking and adversarial. I think there is an opportunity here to have a dialogue with someone who is in a major policy position to influence appropriations and other actions in the Navy. I think you will find a receptive attitude tomorrow morning. A constructive question to consider is what can we do together to get the people at this conference and Dr. Rostker to understand each other better and get on the same track. You have people here, such as Bob Smith, Glenn Bryan, and others, who are in a position to exert major influence in the situation. I think if we can focus on what can be done constructively to facilitate the bridging between good R&D and what Congress, the public and the operating forces would like to see as payoff from this investment, we'll have made major progress. At the same time, we perhaps need to educate all concerned that in R&D there is a certain amount of "drilling." By this I mean that you hope to hit oil and may in fact do so much of the time, but no matter how good a geologist you are, there inevitably will be, and are, some dry holes. That is part of the inherent risk in R&D. It is not a sure thing.

There are lessons to be learned even from efforts that do not work out well; e.g., we at least learn not to drill in the same place under the same conditions next time. So, in my mind, the five key words in Dr. Sands' charge are: COME UP WITH HELPFUL RECOMMENDATIONS --to facilitate the utilization of that which is worth the promotional effort. That implies that you don't go out and try to market or waste your energy and resources in pushing for the utilization of every R&D output. A certain number of things that you try will not turn out to be useful. But a kind of policy question that you

conceivably might raise is how long do you drill or how many feet do you go down before you say, "Well, this doesn't look very promising." A pilot study may be a good way to go before you invest large amounts of money, if it is possible to get some kind of indication of potential payoff through a pilot effort. You then can refine your approach and proceed if it looks worthwhile.

Finally, a legitimate and nondefensive point that should be made to GAO and Dr. Rostker is that knowledge, as Dr. Donald Pelz at the University of Michigan has observed, can be used in more diverse ways than the term "utilization" ordinarily implies. It can be used to help formulate policy, to solve problems, or to implement programs. Modes of use can vary from "instrumental," such as assisting a specific action or decision, to "conceptual," such as affecting a decision maker's understanding or thinking about an issue. Thus, some of the subtler ways in which R&D findings are utilized may not be easy for GAO or anyone else to trace neatly and definitively.

POLICY RECOMMENDATIONS

DR. GLASER: Well, I think we might say welcome to the survivors of this 3 1/2 day meeting. We appreciate your staying aboard. Let us now turn directly to hear from each of the three Service groups. I wonder if Colonel Hoggatt, the representative for the Air Force group, could come up first and let us know what you folks would recommend.

AIR FORCE

COL R. S. Hoggatt, USAF
Commanding Officer, Applications Office
Air Force Human Resources Laboratory
Brooks Air Force Base

What I intend to say does not constitute a step-by-step process, but I think it is a distillation of some of our topics and of our thinking. Our views can be organized into seven topical areas:

1. The first area has to do with the matter of communication between the researcher and operator. Regardless of whether the problem or requirement is research-generated or operator-generated, there should be an iterative process between the two until you get the problem so clearly identified and defined that you can write a "request for personnel research" (or RPR as the Air Force calls it), which then gets it into the system.

2. The RPR itself is really an estimate of what you intend to do, and includes such things as: the budget expectations; that is, how much money you expect to use in the research; the objectives of the research; the intended uses and concepts for use of the research; the major prospective users and how it is going to be used. A situational description on how the problem came up would be helpful, plus a cost estimate or indication that a cost analysis should or should not be made.

3. The research plan should include the detailed plans and programming of the research and should be done by the research community itself. It should contain a delineation of the logistical backup necessary to support it, including the long-range costs three years down the pike. It should serve as a contract or charter between the research community and the operational community. The research plan should also indicate the technical forecast risks that may be involved, whether or not results useful to the operational community are expected, and some idea about where there may be slips in this whole process. These steps are pretty well systematized within the Air Force Regulation AF-80-51.

4. We felt that one of the things that came out of this symposium was the necessity for an ad hoc committee to oversee the research. It might include the researcher manager, an applications person, a facilitator, a user and a technologist. Such a committee would serve a liaison role with the other commands. In the Air Force we are really pretty separated, but the Air Training Command model would be a good one to follow.

5. The research activity per se includes the collecting of data, with monitoring by the ad hoc committee. The sponsors of the research should be continually advised or updated each time a significant event occurs. In the Systems Command we have a document called the "Mazes." Each time a significant event occurs within a research it is documented there. We intend to formalize this in a forthcoming update of 80-51. This will be given to the research requester on a periodic basis every three months. During this time one of the steps you may have to take is a possible redirection of the research because some things you found out in the data collection may suggest a need for refinements or changes. You are concerned during this time with quality control and we felt possibly a coalition of the researcher and the operator would be a good idea. However, if you have enough communications and you understand each other's problems, this isn't absolutely necessary, but it was mentioned.

6. In the research results step you analyze and evaluate the data, formulate recommendations, generate a report and complete your cost-benefit analysis.

7. The Air Force system needs to be upgraded in the applications area. We aren't particularly strong here. You cannot do it on a part-time basis. In the applications process there needs to be some high-level endorsement of your findings and recommendations. There also should be involvement in your research projects. There needs to be a plan for briefings, and for marketing the research. In this phase you identify spinoffs and additional products. You get in touch with transfer agents. You have the user evaluate the product, and you evaluate it too, so it doesn't just get pushed off into a corner someplace and completely disappear after you have spent the time and money at the request of somebody to do this. You then work out some way of transferring the funding from the research area to the O&M area. This can be shown as a six-section pie, with an applications piece in the middle. That offers a good learning tool for what we think should be done.

DISCUSSION

DR. ROCKWAY: The major points we are trying to make here are that we think a research utilization system should be formal and it should be documented. Particularly in a military environment you need written agreements to preserve some continuity, because the people that you are dealing with frequently are very mobile. Formal documentation tends to preserve the continuity. We don't feel that the steps that we have identified here are rigid. In fact, there has to be an awful lot of flexibility in the research process. Our concept is that at different stages throughout the project the research needs to be supported by different levels, so that we can bounce around from the guy who actually may be implementing it and explore other areas for potential use as well.

ADDITIONAL COMMENT FROM THE AUDIENCE: One of your recommendations to facilitate utilization is that you do a joint evaluation of the R&D effort between the researcher and the user. This fits completely with our experience, as well as with the RU literature concerning procedures that make for successful implementation.

DEPARTMENT OF LABOR PERSPECTIVE

MR. JUDAH DROB: I hope you understand the humble spirit in which I read this proposal that I wrote -- We urge DoD to designate some person at a high level to be responsible exclusively for: (1) stimulating action by each of the services to maximize use in planning and in operation of relevant RDT&E and of knowledge derived from other sources, including operating data, best practice and RDT&E performed by others, (2) maximizing interchange among the services of utilization plans and experience, and (3) advocating the building of institutional means for systematic knowledge transfer and utilization.

We urge this appointment as a first step to signify to all concerned, including the committees of Congress, that DoD means business in promoting utilization of RDT&E. Once such an appointment is made, we urge the designated person to consider the following program of action:

1. Obtain appointment by each of the services of a high-level counterpart person, the three to work closely with the DoD designee in planning further action.

2. Convene one or more conferences of representative RDT&E producers, managers, users and top policy makers to plan for and promote utilization.

3. Urge assignment of specialists in utilization to this role in each RTD&E lab, and in the appropriate place in user organizations.

4. Organize linking units for the purpose of assisting public officials and civilian jurisdictions to seek out and use knowledge, techniques, equipment, etc., developed for service organizations.

5. Develop practical means for storage and retrieval of RDT&E findings and products, stimulate and resort to this data base as a first step in problem solving, and arrange for synthesis and analysis of work in related areas for easy reference by potential users.

6. Advance understanding of the capabilities and limitations of RDT&E, stimulate further development of techniques of statistical, cost-benefit, and process analysis, and conduct RDT&E on the processes of utilization as they are developed in DoD and the services.

DISCUSSION

CAPT CLARKIN: The central concept of what you are proposing bothers me because it seems very much like the ad hoc-ism that we observed in DoD in general. My contention is that the responsibility for implementing appropriate and relevant RDT&E already exists within the managers who are occupying positions throughout the organization. My fear is that if you do establish the ad hoc utilization position that you are addressing, these managers would be encapsulated and isolated in the same fashion that you find the management and performance of R&D as it is carried out at present. The analogy would be the establishment of the human goals concept as isolated from the rest of the functional organization. I think that to the extent it has been isolated, it has been ineffective.

MR. DROB: That certainly is a very valid point of view, but I think those of us who have been engaged in the utilization community have

felt that nothing really happened until specific people had the responsibility. I think the question of how they tie in with their organizations is critical. And certainly they should not be seen as outsiders; they should be performing a function that is relevant, but again I don't know your milieu well enough to engage in any kind of debate with you.

CAPT CLARKIN: I can assure you that if the chief executives of the organizations are involved and concerned, the hearts and minds of the troops will follow.

MR. DROB: Except that my experience with higher executives is that they never have enough time to do all the things that their hearts and minds are involved in and they need arms which will spend full time at expressing their interests. And that is why I started with the notion that if somebody is sufficiently visible and sufficiently important, then people in the ranks will have to understand that this is a high priority for the top managers. Again, I would not for a minute think that I knew more than Capt. Clarkin with regard to what is required to facilitate utilization in the military.

DR. UHLANER: I would like, from the Army point of view, to very much disagree with Judah Drob's proposal, and add a word to Jim Clarkin's point by saying that I think the proposal is based a good deal on ignorance of how the Defense Department relates to the services, and what their authority is. The point is, if there were a DoD which brought together all the services in one operating entity, with authority to run its own DoD personnel system, that suggestion might be practicable. But, rather, what you do have is a policy-making body at DoD levels which really gives only guidance in generalities to the separate services. Therefore, the user, in terms of final authority in most instances, except for the stimulation of policy by the DoD level, resides at a lower level, namely, the services. Your proposal, Judah, is aimed at strengthening the RU function at the point where authority for the actual operation of personnel and training resides. That kind of individual would be in the respective services, not in DoD. DoD has no authority in terms of the operation, other than guidance.

Thus, I would strongly echo Jim's point. With ignorance it looks like a great thing to go as high up as you can, except that when you go up too high and there is really no functional authority, you are essentially joining a policy-making group that deals only in generalities.

MR. DROB: Is this kind of approach applicable at the service level? Might that be a possibility? What I was concerned with initially was making visible the concern that Dr. Rostker expressed for an increased awareness and activity in the utilization area, and it seemed to me that this was one to do it.

ARMY

DR. DRUCKER: Army R&D has been wrestling for over 10 years with the problem of how to improve research utilization. In this discussion we will be talking primarily about 6.3 research.

From time to time in this development over the last 10 years, several conditions have occurred to us that would have to be satisfied and many of them we have touched upon this week. Let's call them assumptions. For example, we recognize a need for an orderly system to accumulate and prioritize research requirements. Particularly, we are anxious that such prioritization not be done by the researcher--a role that seems to have fallen to us all too frequently over the past 10 years--a role we did not particularly want. We wanted to be executors of the program and not policy makers. We wanted programs consistent with budgetary considerations, budget allocations, recognition of the 6.1.2.3 constraints, and the review procedures of budgets and the budget cycles. We wanted to involve the consumer earlier, and hopefully we wanted to involve all the potential consumers who would be ultimately involved in the utilization process. And very importantly, we wanted our total programs to be consistent with guidance documents--for example, guidance documents from DoD, from the Army, and our own five-year plan--as well as with the consumer needs. But we wanted the program primarily to respond to these guidance documents, and also to specific research requirements. First the guidance, then the requirements. We wanted to establish that our programs are not driven exclusively or primarily by the user requirement, which did happen over a fairly long span of years. In general, we wanted to establish formally that Army consumers and laboratories have some common understanding of the nature of the research process, what products are to be expected from research effort, and in what time frame.

The fact that we have changed our procedures from year to year would give testimony to the fact of dissatisfaction with this arrangement. Here are the things that I think are worth mentioning from AR-8 entitled "Personnel Performance and Training Program."

We have in it a topic of generation of RDT&E needs and objectives. The set established for the requirements people in this AR is given in terms of the ARI five-year plan for advanced development. Our boss, the DCSPER, asks for these requirements in terms of human resource needs, but consistent with the five-year plan and other guidance documents. The responsibility for the annual review and approval is vested not with the research community, but with the DCSPER himself, our military boss, for both the 6.1 and 6.2 programs as one entity, and for the 6.3 as a second. His sign-off is on the formal documents.

Another important paragraph deals with preparing the advanced development plan and executing the program. We talk about such

things as identification of the DoD project line reference to the particular HRN or the requirement. We talk about meetings between the sponsor representative and the principal investigator from the developing agency. Mentioned there specifically is the requirement for arranging for military support by the sponsor, and a request for semiannual status advice by the sponsor if he so desires. We have an appendix which tells him exactly how to do that. The sponsor responsibility for implementation is also spelled out. This is specifically with direct involvement of the developing agency. Finally, in chapter 3 there is mention of an in-process review which can be at the request of the sponsor. This is a formal review reserved for those instances where you have some issue that needs resolution and neither the sponsor nor the developing agency can handle it. It is then brought before the DCSPER, who attempts a resolution. The regulation does encourage a series of informal interactions between the investigators, the developing agencies, and the sponsor representatives. That's at the working level and with no particular formal documentation.

To ensure direct application of RDT&E findings to the military mission, a paragraph is given over to interpretation and assistance in utilization of findings. This is entitled "Relationship of the Implementing Agency and the Developing Agency in Utilization Activities." The implementing agency may request from the developing agency additional assistance concerned with such things as detailed planning, contract planning, selecting a contractor, or even writing the proposal for the contract.

I mention these items because they are specifically in the AR. It is down to that kind of detail. Then there is a section on additional findings determined to have Army-wide application. The developer supplements the RDT&E report with such things as methods by which the findings were incorporated in the military system and recommendations for additional implementation; methods to adapt findings further into the implementing documents; measures recommended to gain acceptance and promote actual practice of findings within the community and recommendations for additional RDT&E. We are encouraged to disseminate RDT&E reports widely. In addition, ARI has instituted what it calls the RDT&E utilization report, which is a synopsis containing useful findings from contract reports and how the product or finding was utilized by the operational community and/or the research community. The sponsor has the obligation to report on his utilization.

DISCUSSION

QUESTION: Is your sponsor always your user?

DR. DRUCKER: No, not necessarily.

QUESTION: Why should the sponsor report instead of the user?

DR. DRUCKER: I have been using the terms interchangeably here. Actually, we talk more in terms of the sponsor representative during the stage of research execution, and the user during utilization. When results of a sponsored RDT&E or significant phase of a DA or DoD project are available, the sponsor, after a suitable interval of time for consideraton or trial, will complete and submit to ARI a report of utilization using a suggested format. An appendix talks about the product; paragraph 4 of that appendix actually gives a litany of the types of products that might be involved in the report. For example, specific products might be changes to a program of instruction or changes to a policy or to an Army regulation; or a new or revised test or training circular or DA pamphlet; or a revised operational instruction or decision or doctrine; or input to management decisions.

The GAO in their recent report cited these as products or uses. The scope or impact of change implied by the product is also included on the form that the sponsor must fill out. Does the product have Army-wide implications, for instance? Does it affect all of infantry? What sort of improvement in operations does it entail? The example given effects 40 percent improvement in the effectiveness of combat arms during night operation. And finally, very significantly, if the product is not used the sponsor must say why not, or whether it is possible that it will be used at some future date. We think that this program will satisfy a majority of the GAO research management recommendations. They are not completely satisfied, however. For example, they say that what we urgently need are criteria to identify results intended for implementation as opposed to those intended to serve the needs of knowledge generating or technological base efforts. We are working on this. I will conclude with that and ask Jay Uhlaner if he would like to add anything to what I have said.

DR. UHLANER: The sponsor is usually at a higher level of headquarters, so the TRADOC might be sponsor, but the users might be all the staff elements of TRADOC, or, for that matter, users might be elements of other commands. But the responsibility for all of the formal decision aspects would be with the headquarters sponsor; it would be almost impossible to go out and talk to all the different sub-elements and get some kind of agreement and consensus action otherwise. So the headquarters sponsor has that responsibility.

Years ago in this research we very frequently had multiple sponsors and we would list them, and we found something very curious, which I am sure everybody else who has worked in this has experienced. What you found was the researcher was right in the middle between these multiple sponsors; we evolved a system of a principal sponsor and then finally a single, high-level sponsor for given programs. We found that worked best; this principal sponsor has to argue it out with all the other users with or without us present. That seems to work a lot better.

QUESTION: Has this arrangement facilitated utilization?

DR. UHLANER: Very much so. The changes that are in this AR, in many respects are relatively minor. There is one major one from our point of view, but not from the Army's point of view, in that we have more documents to feed the five-year plan. But I think that the rest of the Army is now not particularly interested in that aspect. Essentially, in the 10 years that it has been operating, I would say it has definitely facilitated the utilization of the product. I think it did more than that. It also made it possible to have a more balanced program. What isn't written into the regulation is that we normally in our review cycles don't speak to one set of sponsors at a time. Instead, we have the DCSPER convene all the sponsors. What happens is that they have three days and nights to sort it out. They then come to some kind of resolution in terms of relative priorities. Then you get down to business.

There is a principle here that you should not be dealing individually with one sponsor at a time as far as the programmatic part of it is concerned, because they all have many more requirements than you possibly have resources. At least that is our experience.

QUESTION: Not all your research projects are documented through this route, is that correct? All of them have a sponsor who has a responsibility to work with ARI, correct?

DR. DRUCKER: Are you referring to 6.3?

RESPONSE: Yes, we sort of face the same concern. It seems that some parts of the R&D have to be technology based and thus expect to be put into this tight a mold.

Another basic question, let's say the GAO did the same exercise five years from now and they used the same procedure, looking at technical reports and most of your technical reports were done under 6.1 and 6.2. It wouldn't look much different, would it?

DR. DRUCKER: I believe what they just did was an unhappy sampling when they found only 28 of our products and our reports reflecting 6.3, subject to these particular procedures. In actuality, I think that they would find a higher percent of this kind of product. I think my answer to you is that if we did nothing, the answer would be yes, they would find the same problems. Something does have to be done.

COMMENT: My point is that working for the Department of Defense, we can define a whole spectrum of users.

DR. DRUCKER: I briefly mentioned the responses to guidance documents which have to do with the future of the establishment, that is one

point. The other is that within the military establishment, the Chief of Staff or the CNO is as much responsible for the research as he is for the troops. This is quite unique in comparison with other federal agencies, where the U. S. Office of Education or NIE, for example, doesn't have any troops. So the change process is a little bit different where NIE is trying to influence the local school system. Within the military establishment, we all work for the same people. I think we can learn about the change agent, but the way he operates within his system is a little different. So trying to tie these points together, in my thinking we in the military have a chance to operate within a long-term time spectrum reflecting the guidance documents. And thus, the user is not just concerned with today's problem, but rather the anticipated problems for the next 5, 10 or 15 years. And we can look to an overall concern if the Chief of Staff or the CNO.

QUESTION: During the past few years ARI has been implementing the policy of collocating their research with the user commands. Has this immediate contact between the researchers and the users resulted in increased utilization?

DR. DRUCKER: I would say definitely, yes. In all stages of the program cycle, it has obvious social-psychological advantages as well as benefits to the utilization of the products. As far as utilization is concerned, our people there at the installations serve in a direct role, much more direct than would be possible if we operated from headquarters alone.

QUESTION: Do those field units tend to be service organizations for the local command, or do they still do research?

DR. DRUCKER: In part, that is what I call helping to pay the rent; to help them with their local problems as well as conduct their portion of the overall long-range research program. But we are much more permissive in the amount of time they are allowed to spend at that sort of thing. Maybe "allowed to spend" is not right, but it all works out well.

DR. GLASER: In connection with a point you just made, there is a lot of effort here to provide what industry would call technical assistance. That is, you spoke about the developer and researcher being available to the sponsor to carry through. In industry you will often find that when the research group develops something, generally one of the key persons who has been involved in this development within the research department now moves over to manufacturing for a period of time to help with the implementation process if the manufacturing department wants any help.

Bert Griffis has some comments he'd like to make.

REHABILITATION SERVICES ADMINISTRATION PERSPECTIVE

BERT GRIFFIS: I do have seven comments carefully distilled from close attention to all that has transpired. I do appreciate the invitation to attend and after three days I feel better educated, if not saturated. My seven comments (with tongue in cheek) are:

1. If it ain't broke, don't fix it. I can tell you I have had many occasions in my life to regret not having left well enough alone, and this may be another one of them.

2. Try to find out what is already being done well, then carefully package and document it and diffuse it more widely for somewhat more general use. To have come this far we must have been doing some things right. For this idea, I am indebted to Professor Ronald Lippit of the University of Michigan.

3. Offer handsome rewards for thorough, precise explications and airings of all sticky, embarrassing problems. This will completely destroy whatever establishment you have and enable you to start over in a thoroughly innovative fashion. According to Ed Glaser, the Vietnamese almost beat us, in part, by employing this principle.

4. Do not be afraid to be a bit subjective. Avoid being overobjective, lest it make a fool of you. Remember the story told by Kierkegaard of an inmate who escaped from an asylum and started walking to town. On the way he began to wonder, "How am I going to prove that I am sane? Let's see, I must come up with something indubitably true. I must state it precisely and that will prove my sanity." So he picked up a large, round stone, turned it over carefully in his hand, observed it for a while, then exclaimed, "I have it! The earth is round." So he put the stone in his hip pocket, and resumed his way toward the town. And with each step he took, the stone hit his fanny, reminding him that the earth isn't <u>that</u> round; so that as he entered the town he was repeating over and over to himself with every step, "The earth is round, the earth is round, the earth is round."

5. Beware of systems and models, bearing in mind what all good philosophers have said, I mean, that all systems are probably premature, and remembering also what the incomparable Santayana said, namely, that chaos may be at the bottom of it all.

6. Do not expect to change the opinion of any man, for you probably can't do it. Both Jefferson and Franklin held this as a first principle and refused to argue with men of fixed opinion, knowing it to be a waste of time. Instead they framed our constitution in such a way that all fixed opinions can express

themselves as best they can and in the process do as little harm and as much good as possible.

7. Do not forget for a moment what the existentialists have said, namely, that all of us are under sentence of death and have only reprieves of varying length. In other words, recognize the human factor on all occasions and you will be amazed at the response you get. What I mean, somewhat in the fashion of Thoreau, is this quote, "If you will advance confidently toward your dreams you will meet with a success undreamed of in common hours."

NAVY

DR. SMITH: The Navy Human Resources R&D program is both relevant and cost effective. It is relevant to Navy requirements posed by the Chief of Naval Operations. Remember that Hank Taylor reported that his revision of the GAO figures cited a 75 percent utilization rate of those things that were intended for use. The engineers whom I work with in my office think that is an absolutely fantastic success rate compared to what they see in terms of utilization in their fields. However, I pressed them for data, and they don't have any. Back in the office I have some rather rough estimates of the potential cost savings or cost avoidance of the 6.3 program, with which I am most familiar. This adds up to well over 1.5 billion dollars for a proposed program of about 16 million dollars for FY78. This does not count fuel savings as a result of our work in simulation, nor increases in operational readiness, nor the prospect of saving several lives a year.

Now I see our problem as becoming even more effective in utilization so that the Navy has an opportunity to reap the full measure of the potential benefits that are involved in our R&D program. In other words, our group was very fortunate (in our meeting yesterday to prepare this report); we were through before we left the room. So we didn't really have to do it all like the Air Force did. Nevertheless, from that meeting we got some excellent ideas for doing things better.

1. First, we feel there is a need for early and continual joint planning for utilization between the user and researcher groups. Under this specific point we might include identification of all the people who need to be kept informed about the research; identification of all the end products required for effective utilization; development of solid data about the costs and benefits of the utilization of each product; and identification of procurement and O&M funds and billets that might be needed for implementation, so that these can be put in the POM process.

2. Our second major suggestion is that we need to increase the resources devoted to utilization. We need to establish guidance to the R&D community as to the importance of utilization and the legitimacy of this purpose. We need to assign application officers to key user agencies with the aim of assisting in utilization. These duties would include: the review of R&D reports to identify those that are promising; liaison with the R&D community; and the performance of quality control on both R&D and implementation.

3. The next point is that we need to provide for technical advisory service, from the R&D community to the user community, to deal with short-term problems and technology transfer. This is especially important in getting the second, third and fourth utilization out of existing R&D. Specifically, it was suggested that some limited amount of R&D funds, such as five or six percent, be used for this purpose, and that greater use of the Navy scientific assistance program for this purpose be explored.

4. Our fourth point is with regard to the submission of operational requirements from potential users and sponsors as called for in OPNAV Instruction 5000.42A. This emphasizes weapon systems planning, and provides adequate procedures for passing requirements to the R&D community. We have found that the system is responsive to the special needs of our kind of R&D.

5. Next, the technical report should contain an executive summary that clearly identifies the anticipated user or users and the expected use to be made of the report. It should also contain cost-benefit information, and the body of the report should show the methodology used in obtaining that information. It is recognized that the R&D community may be a user of R&D, especially as a project moves from research to exploratory and advanced development. Here is a specific example: In our human factors engineering program over the past few years we have been doing work which evaluates and improves the training capability of a device called the Air Combat Maneuvering Range. The Air Force has one just like it called the Air Combat Maneuvering Instrumentation. What I am engaged in right now is making sure that the lessons that we learned from that effort are applied in a new program; namely, to develop a sea air combat maneuvering range. That is one example of how the R&D community can serve us.

6. The next point is that there should be an annual report of utilization, the purposes of which are to document the use of R&D and to encourage additional utilization. This report is envisioned as containing descriptions of the R&D that was used, descriptions of the R&D that is ready for use, and abstracts of reports of possibly wide interest.

7. Finally, following the recommendations of the GAO, there should be a monitoring system for tracking utilization from a high headquarters level. Those are our seven points.

DISCUSSION

COMMENT: The last recommendation sounds vaguely like the published reports called Advanced Technological Concepts and Technological Possibilities. Am I wrong in that comparison?

DR. SMITH: You may be referring to what is now known as the Advanced Systems Concepts, which convey the basic concepts on which the R&D programs operate. There is a requirements "pull" process, in which the sponsor generates a requirement, and a technology "push" process, by which the R&D community says, "Based on our development of technology, here is a thing we think that we can develop for you that will be useful. Are you, Mr. Sponsor, interested?" What I have in mind is monitoring what happens to it after it is developed, and monitoring the way it acutally gets put into use.

It has been my experience that the Advanced Systems Concepts are looked upon as a very poor way of pushing technology prospects into the fleet. The success record is not that good. There is a marketing problem associated with this. Those that have been successful have generally been successful because there has been a long-term process of marketing in order to enter the POM cycle at the proper time. I don't hear a lot of this business of marketing coming through this meeting, and I don't think it can be over-emphasized.

DR. CRAWFORD: Having spent some time in the marketing process, I can assure you that some of the concepts of marketing are embodied in these proposals, but not in those terms.

One of the points under the development of utilization plans was the identification of all those people who need to be kept informed as to the progress of work, and this invariably means several varieties of people at different levels in an organization. There is the individual at the higher headquarters who will need to give concept approval; there are other kinds of staff people who will need to work out the administrative details; and down below in the training world, there are some working-level instructors who need to be trained to make the thing work or else it will never fly.

I think another point on your operational requirements generation should be brought out; namely, it is perfectly possible for a researcher to develop an operational requirement. It must be sent for approval by the proper official, however, in order to become an operational requirement in reality.

DR. SMITH: This is correct.

QUESTION: So if he sees a use for some bit of research he can write an operational requirement and get it approved.

DR. SMITH: That's right.

DR. SANDS: Dr. Rostker graciously has accepted our invitation for him to return before closing to express his reactions to what he has heard here.

DR. ROSTKER: I'm afraid, at least from where I sit, this still sounds like the first day of the meeting. This last session, I understood, was to present policy recommendations. What I have heard from the Army, and certainly from the Navy, was a dissertation on present procedures and why they are working, and that is where I came in. I know that in the Navy, for instance, there is a fair amount of dissatisfaction with the present procedures.

In the Navy Secretariat we are in the process of staffing an instruction 5000, which is supposed to provide further procedures for giving oversight to the human resources and medical R&D areas. It's now a hodge-podge of lack of control, of lack of single purpose direction. I think that is one of the problems that we have in the Navy that we must solve. So I am dissatisfied when I hear that the present procedures are just right--though I really can't speak for the Army or the Air Force.

I think there is a lack of candidness in the areas that I am familiar with as to how we are doing. I would have hoped that at the end of the sessions here we would have had more positive policy recommendations as to where we should be going and what we should be doing, rather than just a reading off of present procedures. So I for one am not very optimistic.

DR. MALOY: I, too, thought there has been too much preoccupation with policies as they are today, in contrast to where we might be going. I suppose my own feeling is this: I don't speak for all the operators, but I do take my share of responsibility for the fact that the operators haven't done their part in this, and I think that we have been reluctant. I do believe there is no single way or single procedure for improving utilization, rather there probably are a whole bunch of different ways. We ought not to be satisfied with directives alone, thinking that they will bring about what we want brought about as such; they won't. What we ought to be looking for are still more imaginative kinds of public forums where policies can be raised and debated as issues on the floor.

DR. UHLANER: I would like to comment that we are not dealing with a new problem, but one that is quite old. We are dealing with a problem where different approaches have already been experimented with and, I would have to add, at least in the case of the Army, that many of those have failed. To be sure, over the years some of the approaches, such as the establishment of field units, starting

back from a time when FCRCs got established, have seemed to be a move in the right direction. Much of what we are talking about, however, is really not a simple procedural matter. The problem is not very different from what you have in a contract of marriage. You work at it for a lifetime. You either make it work or it doesn't. I see much of the user-manager-researcher relationship as being of that nature. I think any one of those procedures are very cold, and it may take years of trial and back-and-forth refinement effort to translate procedure into an operational modus operandi for achieving what we're seeking. I also think that if we attack only utilization, it will not be very meaningful. You cannot take it out of context. Sometimes you have the most beautiful utilization of a product, but it may be accomplished at the expense of good research.

The message I would like to leave is that I think we are in an experimentation mode and I am not convinced that what might work effectively under one set of conditions in one place might necessarily be the optimum in another place. So in the final analysis we are really very much dependent on the skill, the talent, the capability, the dedication, the good faith, and the integrity of the people who are links in this system meaning at all levels--the users and the operators. And I think you will find more of this kind of dedicated, able person at all levels of the system--including the users, the managers, and the researchers--than you normally find in almost any other part of our American Society. They all seem to stay with their responsibilities, and are dedicated to meeting the objectives that I have mentioned earlier. When you have that kind of good start, then I think you can work around the procedures. You are right, Dr. Rostker, I think procedure itself is merely a starting point, and within a procedure there would almost be a case history, and one would have to go into it and say that this one worked in this decade, but didn't in that. I for one would have to say that we probably are not really dealing with a science but more with an art.

COMMENT: As one of the local, unsuccessful members of the Navy working group, I would like to say that the part in our report that was a little disappointing is that I think we did not address what was just referred to in the previous discussion as analogous to marriage. I think one of the things that makes a marriage successful is that the parties are clearly identifiable by name in the contract. You don't have the kind of accountability in the R&D process that tracks the initiator of the request for research, and the development agent, through the continuation of that process, and holds people by name or by agency accountable for implementation.

It seems to me that one of the gains of this conference is putting the problem of achieving greater utilization of validated knowledge in a much sharper focus than I think has been true in the past. If that is so and there is a sincere dedication to achieving better means for moving toward that objective, that gives us some ground

for some realistic hope that considerable improvement will be made--not just in a three-day conference, but as you keep working at the problem.

COMMENT: Most of the policy recommendations I've heard center around management processes, probably because 9 out of 10 people in this room are managers. My own experience as a researcher has been that if research gets used, it is not because of some action taken by managers. I can't think of a single instance in my own career in which that happened--where some manager took action that resulted in the operational use of a product that I or my company produced. I can, however, think of several instances where management either prevented or made it very difficult to move to the utilization phase. The use of research, if it happens at all, normally happens because of the initiative taken by the researchers and the immediate consumers of that research, and by their direct dedication to the mutually recognized problem. It is not going to happen through reporting procedures. It is not going to happen through policy-making bodies or committees. It is only going to happen if you can get the line troops--the people who are carrying out the research and the immediate consumers of that research--together, with several things happening.

One thing that has to be present is a clear recognition of what the operational problem is. I do not mean the general global problem of increasing operational effectiveness. It has to be a good deal more specific than that. It has to be a problem that is recognized by the operator as being a high-priority problem. It cannot be a trivial problem, even though it may be of interest to the researcher.

Second, the problem has to have a feasible R&D solution. There are a great many operational problems that are of immediate concern to the operational community in which they call for R&D but which will not be solved by any kind of R&D, very often because the problem stems from management policies. If the researcher can't do anything about them, he shouldn't get involved.

The third thing is that, given that you have an operationally important problem and a feasible R&D approach to it, the user has got to have a valid notion of what the product of the research is going to be. There has to be agreement very early in the game, perhaps not at the proposal stage, but at least in the problem definition stage, where the researcher says, "Okay, we understand what the problem is and we think we can produce a solution. If we are successful in doing this, will you really use it?" So there has to be some anticipation or even commitment on the part of the user that he is going to adopt that solution if it is successful.

And the final requirement, which I have heard mentioned only by the Army, is that many users do not recognize that they have to contribute resources in order to get the R&D done. If you talk with them in the very beginning of the project and you say, "I think we can solve

that problem if you can come up with such and so," and they say, "Great, go to it, we will support you," then you are off to a good start. The researchers can go to work developing a sound experimental design and come back six months later and say we want to test 7,000 of your troops, or we want to intervene in this training process, and so on. With the kind of initial user anticipation and commitment I have referred to, the user is less likely to say: "We never heard about that." He has to know in advance what he is going to contribute.

None of this happens at the management level, it all happens at the level of working researchers and the immediate impact operational users. And if any change in the research utilization process is going to have a real effect, those changes have to occur at that level.

COMMENT: Somehow or another the researcher does not seem to play a role in this. Who is to decide whether a given problem is trivial or important for R&D investment? Very often it is the researcher who comes up with a plan or an idea that at a given moment may seem trivial to those who are to be the users because they can't see its implications. If a researcher would give up at that point and only accept those problems that are given to him by the user, there is a question as to whether we would be doing any significant research. The researcher sometimes may have a brilliant insight into the utility of a piece of research--an insight that is not shared by the potential user. The process should be able to accommodate consideration of such ideas, because one of the purposes of research is to be creative and develop hypotheses that others have not thought about, particularly in the 6.2 area.

CAPT CLARKIN: When the service and the R&D community were giving their separate reports, there was discontent on the faces of both. If you listen to what was being said, it was a cry for help, a cry for assistance that the world of technology and science can provide to them. There is a need for interdependence, a lessening of the isolation of the several communities, all of whom view each other pejoratively. We must recognize the need for autonomy within the R&D community just as one must recognize the need for autonomy within the operational community, but we have to modify that by the process of negotiation and compromise to be a responsible autonomy. My hope is that we are going to recognize that we are not only distant from the operational community geographically, but we have a massive technological distance and that distance can only be overcome by interaction, interdependence, communication, representation, sensitivity--and I don't mean just in a philosophical context, I mean largely in the marketing context as it was addressed before.

Most of what I have heard was in the area of improvements in form. I believe the profit is to be made with one-on-one interaction, rather than changes in form.

DR. GLASER: A key point in the literature on research utilization is that if you want to achieve change, if you want to get anywhere with spread of an innovation, the single most important ingredient is interaction between researchers and all the other stakeholders or gatekeepers who can influence utilization.

I think part of the discussion here has been on the question of how can we--by interpersonal contact, by focusing on common goals, by integrating the contributions of the user, the researcher, and all the people in-between and at various levels--do a still better job than we have been doing at solving significant problems through R&D and better utilization of promising findings or products. Perhaps as we look back each year and count up our score on what we have done for the money that has been spent to support R&D contributions toward the solution of significant problems as well as toward significant enhancement of knowledge through basic research, we will find that we are doing more than perhaps Dr. Rostker recognizes. And I think if he takes a look at this scoreboard from year to year and gives it time, he will find more progress is being made than is apparent on the surface.

DR. SANDS: In terms of attempting to assess from my own subjective point of view what it is we have done here, and the importance of it, I don't have a comment for you at this time. I would like to say that I was delighted to have as many of you attend and participate very actively as you did, and at the very beginning I think we indicated that the challenge of how to improve research utilization is at hand. It still is at hand, I think. Out of the proceedings, out of the major conclusions that will be extracted from the tapes we have taken here, the extractions of literary guidance that we received from Bert Griffis, the discussions we have had from Admiral Metcalf, Captain Clarkin, Dr. Rostker and the faculty that participated very actively, I'm hoping that we will at least be able to extract the essence of hope. I would like to believe that all of us will carry away from this meeting somewhat of a dedication to do all we can to begin to build more important linkages and establish many of the types of channels of communication that were indicated. We need to do this in the interest of improving research utilization. With that I would like to thank all of you.

SYNTHESIS

In the course of the three-and-a-half day 1977 National Symposium on Utilization of People-Related Research, Development, Test and Evaluation (RDT&E) a great many obstacles to the utilization of human resources R&D were identified and many recommendations for improved utilization were expressed by the participants. Some were voiced by one person, others by several, and some appeared to represent a general consensus. Often conflicting views were expressed. The following distillation represents an effort to capture the essence of the recommendations. The recommendations are organized into seven major categories. Inevitably, the categories are not mutually exclusive, and some duplication of ideas may occur between categories.

COMMITMENT TO IMPROVED UTILIZATION

There is a need for serious commitment to the area of research utilization. This commitment must be based not only on the conviction that there is a critical need for improved utilization but on the recognition that the problems are long-standing and complex, and are not likely to be amenable to simple or standardized solutions. The problem of utilization needs to be addressed in the context of the whole process of program development and resource development. It needs to be conceptualized from a number of different perspectives, since different approaches are likely to be required for different R&D program categories, different types of consumers, different kinds of products, and so forth. No single prescription, such as "do better research", will solve the problem.

This commitment must embrace policy, planning, resources, accountability, the need for mechanisms to institutionalize the process of utilization, and the dedication of people. More "horsepower" must be applied to the applications effort. Thus, for example, cognizance for human resources RDT&E utilization should be assigned at high levels in the appropriate agencies, funding and staffing should be increased, and utilization should be regarded as a function that warrants full-time, trained specialists. Institutional mechanisms for facilitating utilization must be developed and supported with resources and implementing policy. Finally, support should be allocated for additional research on research utilization in order to enhance our understanding of principles of effective utilization.

INTERACTION BETWEEN RESEARCH AND USER COMMUNITIES

At present the R&D and user communities tend to be aloof and disdainful of each other. One of the key means to improve research

utilization will be to find ways to lessen the isolation of the respective communities while at the same time allowing each to maintain a responsible autonomy. Personal contact is critical to improved RU.

One important mechanism for "demilitarizing" the boundary between the research and user communities is mutual education. There is a great need for cross-education of researchers and users as part of an intensive process of getting acquainted. For example, users need to be better informed about the R&D process (including the distinctions among research, exploratory development, advanced development, systems design, systems analysis, etc.). They also need to be aware of how they can influence the programming of R&D resources. Sponsors need a better understanding as to what are reasonable expectations for human resources R&D products, the proportions of investment that are likely to pay off in the various R&D program categories, the risks involved in R&D project investment, and the time frames in which to expect results. Conversely, the research community needs to understand the power structure and the decision-making apparatus of the military bureaucracy, and needs to improve its understanding of the operational environment. Researchers also need to be sensitized to the concept of accountability and what it may imply with respect to the importance of utilization.

There was strong consensus that effective RU requires an intimate and continuing process of interaction between producer and user. For this to happen, more attention must be devoted to ways of facilitating informal, one-on-one interaction, and there must also be formal mechanisms for creating early, active and sustained involvement of potential users in the R&D process. This interaction must begin early enough to ensure a common understanding of the R&D requirement at the inception of the project and continue long enough to ensure a smooth transition of the product to operational use.

Various strategies should be attempted for improving communication between researchers and users. For example, a formal utilization plan should be jointly developed by an ad hoc team of research and user representatives for each research project. Throughout the R&D process, a strenuous effort should be made to make the potential user a believer in the product through participation on advisory committees, site visits, briefings, and formal and informal project reviews.

Technical assistance by the research community to the user community in the implementation of R&D products is another utilization strategy that should be more fully exploited. Particular attention needs to be devoted to mechanisms for providing such assistance, and to logistics and funding implications. Another strategy that has proven useful for promoting closer relationships between research activities and customer agencies is collocation of field detachments with research laboratories and/or R&D representatives or units with operating commands.

RESPONSIBILITY FOR FUNCTIONS AFFECTING UTILIZATION

Responsibility for the utilization function has typically been distributed to everyone, and consequently has often been discharged well by no one. While in a general sense utilization is everyone's job, in a more particular sense an effort should be made to allocate responsibility in such a way as to make use of the specialized competence of each of the participants.

There is need for a program to establish human and organizational links between research and practice. This implies the establishment of an explicit applications function within research and user organizations and the programming of special billets for utilization specialists, who would serve as linking agents between producers and users.

R&D REQUIREMENTS

One of the principal factors that may influence the degree to which research products are utilized is the extent to which they address operational requirements and policy issues. This issue was one of the major bones of contention among the symposium participants. Dr. Rostker contended that much R&D fails to meet this test and is consequently neither relevant nor useful, and concluded that domination of the decision-making process in the planning, programming and budgeting of applied R&D should be taken out of the hands of researchers and transferred to customers at the policy-making level. User representatives tended to endorse the view that researchers want to "do their own thing" and are unresponsive to user needs. Researchers, on the other hand, tended to feel that a high proportion of R&D products are useful, that often the expectations and stated requirements of the user are inappropriate, and that customer control of the R&D process would stultify it.

There did appear to be some consensus, however, that the process of formulating adequate R&D requirements is complex and requires ongoing dialogue between users and producers. Further, there is need for more effective procedures for eliciting, sharpening and monitoring customer requirements. By the same token, research organizations must be responsive and flexible enough in their work programs to be able to meet the short-term and long-term needs of the customer, through a spectrum of activities from technology base research to technical assistance, and from pilot studies to long-term programmatic research.

UTILIZATION PLANNING

RADM Metcalf pointed to the failure to consistently and effectively plan for implementation as the essence of the utilization problem. There is a need for better methods of managing R&D planning, including

the explicit assignment of responsibility for implementation planning. The process of planning for the utilization of R&D products needs to be systematized and employed consistently. Every R&D proposal should include a utilization plan, and that plan should be reviewed and iterated frequently. The plan should be as comprehensive and definitive as possible, specifying such things as: the user requirements to which the project is responsive, anticipated products, expected applications and implications of the projected product or findings, potential users and strategies for reaching them and eliciting their interest and participation, logistics support requirements, evaluation procedures, implementation steps, plans for rendering technical assistance to aid the adoption process, costs, benefits, risks, alternate solutions and assignment of responsibilities for the various functions. In short, there must be early and continual joint planning for utilization.

ACCOUNTABILITY

There have been a series of major factors or events (such as the April 1977 GAO report) that have intensified pressure for accountability with respect to utilization of people-related research. This suggests the need for systematic and critical review and assessment of projects and their products. Such reviews should be conducted both on an in-house basis and through the ad hoc participation of appropriate user representatives. It also suggests that the application of cost-benefit analysis to R&D activities should become standard operating procedure.

Effort should be devoted to the development of meaningful criteria for measuring the success of an R&D activity as well as the success of its utilization component. For a given project, early agreement should be reached between researchers and users as to what criteria will be used for evaluating the product and assessing its impact. Evaluation of R&D products should be conducted and reported by users as well as researchers.

Finally, the pressure for increased accountability suggests the need for a coherent system for tracking and monitoring of R&D utilization.

REPORTING AND DISSEMINATION

While a technical report is not an adequate end product in most instances, and disseminating reports does not equate to utilization, nevertheless, careful attention to presentation of results and a strong focus on dissemination of usable results contribute significantly to the prospect that a product will be utilized. A quality report requires time and effort, particularly if it is to be readily understandable to the target audiences. The report should contain

an executive summary that includes explicit implications and recommendations for application or action, identifies categories of potential users, and conveys cost-benefit information. Inviting potential users to review the draft report is likely not only to improve the report but to enhance their interest in utilizing the product. Similarly, user participation in briefings is often an effective marketing tactic.

Attention should also be paid to transformation activities, such as the translation of technical reports into practitioner documents and the preparation of abstracts and research briefs. The use of brief summaries of research reports, issued in advance of the final report, is one mechanism for making results more timely to meet user requirements.

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APPENDIX A

LIST OF ATTENDEES

APPENDIX A

LIST OF ATTENDEES
TO THE
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APPENDIX B

SYMPOSIUM AGENDA

APPENDIX B

NATIONAL SYMPOSIUM OF THE MILITARY SERVICES ON UTILIZATION OF PEOPLE-RELATED RESEARCH, DEVELOPMENT, TEST AND EVALUATION (RDT&E)

AGENDA

TUESDAY, 14 June 1977

General Session--Madrid Room

Introduction to Symposium Administrative Remarks	Dr. Franklin F. Sands General Chairman
Welcoming Remarks and Introduction of Keynote Speaker	CAPT James J. Clarkin Commanding Officer Navy Personnel R&D Center, San Diego
Keynote Speaker	RADM Joseph Metcalf, III Asst Chief of Naval Personnel for Financial Management & Management Information
RDT&E Utilization: A Perspective from the Office of DDR&E	COL H. L. Taylor Office of the Director Defense Research and Engineering
Open Discussion	
Introduction of Faculty; Group Interaction Guidance	Dr. Edward M. Glaser Faculty Chairman

Military Service Group Sessions

Military service group meetings

Group

U.S. Air Force & Faculty Members
Dr. Herbert Clark, Chairman

U.S. Army & Faculty Members
Dr. Arthur Drucker, Chairman

U.S. Navy & Faculty Members
Dr. Robert Smith, Chairman

U.S. Navy/Marine Corps & Faculty Members
Dr. Glenn Bryan, Chairman

Current situation and needs assessment regarding Research Utilization (RU) in the Army, Navy, Air Force, and Marine Corps. The representatives from each branch of the service will break out into their respective groups to discuss current gaps and shortfalls related to cross-validation, diffusion and utilization of promising RDT&E findings. The kinds of questions each group might address are:

1. How are decisions made by those who administer RDT&E funds regarding which project or study proposals to support from the limited financial resources available?

2. Do we have any data on approximately what percentage of military RDT&E projects or studies turn out to be of potentially significant value to the operating commands or offices of the military services? What are the criteria--how do we know?

   What has been our recent experience in attempting to use Human Resources RDT&E products/findings?

3. Of the RDT&E projects or studies that do seem to have potential application, approximately what percentage in fact get implemented or tried out by a significant number of the various categories of potential users? How do we know? What is the evidence? (For example, the Navy and Army's mess management aids can be used by (a) training activities, (b) forces in the field, (c) other branches of the service, and (d) civilian industry through technology transfer.)

4. What are perceived to be the main reasons for less-than-optimal utilization of promising RDT&E findings, and how might the obstacles be reduced?

   What are the barriers to research utilization?

   (a) In RDT&E producers
   (b) In potential users
   (c) In RDT&E sponsors
   (d) In RDT&E policies, practices and/or policies

5. Is there significant opportunity for enhancing the transfer of certain military RDT&E findings to the private sector? If so, how might this be accomplished?

6. Prognosis

   a. What can be done in the short run to improve utilization?

   b. What long-run changes are necessary to improve utilization?

   c. What might constitute a <u>useful</u> model of the utilization process to guide us? Can we do effective applications planning? What are the critical factors involved in applications planning? Who should develop such a model?

Plenary Session--Madrid Room

Summary of reports from each of the military services (Group Chairman). Each report will be open to questions of clarification on problems, needs, and opportunities for improving RDT&E utilization.	Discussant: Dr. Julius E. Uhlaner Technical Director ARI & Chief Psychologist U.S. Army
Introduction of Banquet Speaker	Dr. James J. Regan Technical Director Navy Personnel R&D Center, San Diego
Banquet--Madrid Ballroom	Speaker: Dr. Bernard D. Rostker Principal Deputy Asst Secretary of the Navy for Manpower & Reserve Affairs

WEDNESDAY, 15 June 1977

Reflections from the Operational Community	Chairman: COL Whaley
The State-of-the-Art in research utilization within other federal agencies: strategies and problems, with special linkage to the problems identified the preceding day by the military services.	Dr. Edward Glaser
Perspective	
National Institute of Mental Health (NIMH)	Dr. Howard Davis Chief, Mental Health Services Development Branch
Department of Labor (DOL)	Mr. Judah Drob Chief, Division of R&D Utilization Employment & Training Administration
Human Resources Research Organization (HumRRO)	Dr. Meredith Crawford George Washington University
Rehabilitation Services Administration Department of Health, Education, and Welfare (RSA-HEW)	Mr. Bertrun Griffis Asst Chief, Division of Program Support

Center for Research on Utilization of Scientific Knowledge (CRUSK); National Institute of Education (NIE)	Dr. Ronald Havelock The Institute for Social Research The University of Michigan
General discussion on how experiences and strategies of other federal agencies might be applicable to the military	Dr. Edward Glaser
Overall Research Utilization Perspective	Dr. Thomas Backer Senior Staff Associate HIRI and Dr. William McClelland President, Human Resources Research Organization
Administrative and Technical Guidance for Case Problem Analyses scheduled for 16 June	Dr. Franklin F. Sands Dr. Edward Glaser
Technology Transfer Panel Discussion, Open Discussion and Summary	Dr. Edward Glaser

Mr. Allen Sjoholm, Moderator
Science Advisor
San Diego Technology Action Center

Mr. Robert C. Crawford
Director of Intergovernmental Programs
National Science Foundation

Mr. Del DelaBarre
President, California Innovation Group

Mr. Charles F. Miller
Technology Applications
Lawrence Livermore Laboratory

Mr. George Lindsteadt
Director, Technology Transfer Consortium

Mr. Gerald Miller
Technology Transfer Coordinator
State of Oregon

Mr. John Lockwood
Deputy City Manager
City of San Diego

Some Issues

1. **How to improve the Technology Transfer Planning Process in order to better match local government environment with available technology.**

2. **How to achieve early recognition of local needs? What are the primary needs of the cities, counties, and states?**

3. **What are some successful technology transfer examples? What have local governments learned through these examples?**

4. **What is the best way to achieve a two-way Technology Transfer operation between cities, states, and federal laboratories? How to improve the exchange of information.**

Open Discussion/Summary

THURSDAY, 16 June 1977

Small Group Sessions

Case Problem Analysis/Small Group Interaction

Assemble into groups to analyze case problems describing seemingly valuable RDT&E project outcomes that have not been optimally utilized. Break into groups to formulate ideas about (1) what might have been done differently from the beginning in each case to facilitate utilization; (2) what can be done now. Each group would work on several cases, but the membership of each group would consist of a cross-section of the symposium participants. Each group would have at least one representative from each branch of the service.

Plenary Session--Toledo Room

Each group will present its findings to the entire assemblage. Discussion at this point limited to questions for clarification.	Dr. Edward Glaser
"Bridge Building"	Mr. Merlin K. Malehorn Deputy Director Education & Training Programs Division Office of the Director Naval Education and Training

"Utilization of People-Related Research and Development: A Case History of Shipboard Facilities Maintenance Demonstration Study"	Mr. M. A. Schwartz Navy Personnel R&D Center, San Diego
Open discussion and analysis of group findings; faculty panel analysis and summary	Dr. Edward Glaser

Military Service Group Sessions

Each branch of the military will meet to develop policy recommendations for improved research utilization in its branch.	Group Chairmen

FRIDAY, 17 June 1977

Plenary Session--Toledo Room

Convene general session to hear policy recommendations for improved research utilization in each branch.	Dr. Edward Glaser
Open discussion of policy recommendations.	
Closing comments.	Dr. Franklin F. Sands
Symposium evaluation.	

END OF SYMPOSIUM

APPENDIX C

SYMPOSIUM WORKPLAN

APPENDIX C

Symposium Workplan

14 June

1. Have participants from each branch of the service meet in separate small groups (joined by faculty members and other participants not attached to any of the military services) to identify current gaps, shortfalls and barriers related to cross-validation, diffusion and utilization of promising RDT&E findings.

2. Reconvene in plenary session to hear reports from each group, and attempt an integrated summary of problems, needs and opportunities for improving RDT&E utilization (RU).

15 June

3. Hear Observations about military problems and opportunities as summarized in No. 2 above from heads of research utilization branches in 4-5 other federal agencies--as well as problems encountered in their particular situations, how they have dealt with those problems, and with what results.

4. Relate all of the above to the literature regarding factors that inhibit or facilitate utilization of promising RDT&E.

5. Discuss transfer of relevant findings and developments from federally supported RDT&E to the problems of cities, states, and the private sector.

6. Summarize what has been discussed/learned for application to military research utilization needs, problems and opportunities.

16 June

7. Undertake small group analysis of case problems of RDT&E project outcomes that have not been optimally utilized. Formulate strategies for improving utilization.

8. Reassemble into plenary session to review and critique strategies prepared by each group.

17 June

9. Invite each branch of the military to meet together to develop policy recommendations for improvement of RU in their branch.

10. Convene general session to hear, discuss, critique and sharpen policy recommendations.

11. Evaluate Symposium.

Adjourn

APPENDIX D

SYMPOSIUM STEERING COMMITTEE

APPENDIX D

SYMPOSIUM STEERING COMMITTEE

GENERAL CHAIRMAN

Dr. Franklin Sands
Navy Personnel Research and Development Center

TECHNICAL ADVISOR

Dr. James Regan
Navy Personnel Research and Development Center

SYMPOSIUM FACULTY

Dr. Edward Glaser, Chairman
President, Human Interaction Research Institute

MEMBERS

Dr. Howard Davis
National Institute of Mental Health (HEW)
Dr. Meredith Crawford
George Washington University
Mr. Judah Drob
Department of Labor
Mr. Bertrum Griffis
Rehabilitation Services Administration (HEW)
Dr. Ronald Havelock
Center for Research on Utilization of Scientific Knowledge, University of Michigan
Dr. William McClelland
President, Human Resources Research Organization
Dr. Thomas Backer
Human Interaction Research Institute

MILITARY SERVICE GROUP CHAIRMEN

Dr. Herbert Clark
U. S. Air Force
Dr. Arthur Drucker
U. S. Army
Dr. Robert Smith
U. S. Navy (Training Technology)
Dr. Glenn Bryan
U. S. Navy/Marine Corps

APPENDIX E

CASE PROBLEMS

APPENDIX E

ARMY CASE STUDY--THE VALUE OF STEREOSCOPIC VIEWING IN IMAGE INTERPRETATION

Objective of the research was to assess the usefulness of stereoscopic viewing within serial surveillance systems in terms of quality of information obtained and the rate at which it is extracted. Both tactical and strategic types of interpretations were used in setting up performance measures which were administered to two matched groups of image interpreters. For each measure, stereo pairs were provided to one of the two groups and nonstereo photographs to the other. Data were analyzed by comparing mean scores through t-tests and analysis of variance.

Stereo viewing and nonstereo viewing of the tactical and strategic photographs were found to be equivalent in terms of the quality of information provided and confidence expressed by interpreters in the information they extracted. Accuracy and number of targets identified under the two methods of viewing were similar; that is, no statistically significant differences were found.

This research had been suggested by Army researchers after they had been called in by the Air Force to consult on a similar problem. Findings in the Army research then suggested strongly that the value of stereo viewing should not be taken for granted, and, in fact, led Army researchers to suggest that the need for the stereo capability should be clearly demonstrated before new display equipment with stereo capability is developed for use of interpreters in detecting and identifying militarily significant objects. Several other research efforts by other organizations corroborated these findings.

But Army researchers found a strong existing conviction in favor of stereo and a system already highly geared up for obtaining and interpreting stereo imagery. The research had little impact on decisions to build more stereo capability, despite consistent replication of the above and the conduct of several projects on overlapping imagery (60% is needed for stereo) that indicated conditions of nonoverlap (except the small percent needed to ensure 100% coverage) to be superior in time to interpret and no different in terms of accuracy or completeness of interpretation.

The practical aspects of stereo coverage argue strongly against it. In addition to the extra 30 to 40% in time required for stereo viewing by the interpreter mentioned above, there are several severe systems costs involved. It takes twice as many photographs (and processing) to cover a given area using stereo. Dollar cost as a function of the number of systems using stereo is readily derived. It also means that twice as many reconnaissance missions need to be flown (again one can compute dollar costs) and twice as many planes and lives risked.

And still systems users have persisted in using stereo.

ARMY CASE STUDY - REALTRAIN

REALTRAIN is an improved, low-cost training and evaluation technique for use in Army tactical training exercises for combat units. Realistic, two-sided free-play tactical training employing recognized principles of learning is achieved through simulated combat engagements.

Originally this research sought to develop a method for evaluating individual tactical performance under simulated battlefield conditions. It was felt necessary first to construct job situations that would demand that a man act as he would be expected to act on a battlefield. It was, in retrospect, not surprising that the environment developed for testing became a powerful vehicle for training. The rationale which provided the basis for the initial development of methods for simulating the combat environment with a high degree of psychological fidelity led directly to the REALTRAIN method for tactical training.

Before a research organization recommends implementation of a new training method it is accepted practice to determine empirically whether the new method works and how well it works (the degree to which training objectives are achieved, the nature of the skill acquisition curve) and to compare the new method with the method it was designed to replace. This was not done with REALTRAIN. The decision was made by the Training and Doctrine Command (TRADOC) to implement the method before the standard validation procedures had been conducted.

The reasons for TRADOC's decision were (1) the heavy cost of conducting an evaluation of a new unit training technique in the field, (2) the rapid and enthusiastic acceptance of the method by troops and commanders, (3) the overwhelming face validity, and (4) the fact that no technique for realistic tactical training had previously existed.

The REALTRAIN training method was implemented by a TRADOC Mobile Training Team (MTT) during the period 3 November 1975 to 5 March 1976 at four divisional training sites throughout the U.S. Army Europe (USAREUR). The implementation in USAREUR afforded an opportunity to conduct research which could be used to improve tactical training and evaluation techniques further in an engagement simulation context, specifically providing a valuable empirical base and data source for the analysis of tactical performance by participants in the exercise, participant and controller reactions to this new method, and the cost of conducting such exercises.

That implementation by TRADOC involved a cost of several millions. REALTRAIN is still not being effectively utilized today for a number of reasons:

1) REALTRAIN has entailed very significant--even revolutionary--changes from the ways of past training and it was almost too big a challenge to do it well.

2. One specific resource requirement that has given heartburn has been the requirement for controllers who are required for conduct of an exercise, though controllers learn as much as the trainees.

3. Young, inexperienced officers don't like to conduct exercises and lose badly, as many of them do, even though the learning experiences are invaluable. By the same token, to be a participant casualty through inappropriate performance in the exercise is also stigmatic. To help solve the young officer problem, a leader board game has been devised to get the officers better prepared for the exercises.

4. Logistical requirements are overwhelming--training ammo is expensive, tactical radios to support control of the exercise are hard to get.

TRADOC officials have been much aware that initial successful utilization of REALTRAIN may rest critically upon keeping researchers involved in the handing-off process to help solve some of the problems of utilization. The purpose of a new program is to do just that--have researchers assist in preparing a method for implementation and observe problems of utilization and help make refinements, periodically return to reassess utilization procedures.

Comment: Normally the early grabbing of a research product for implementation before the completion of research is considered in the nature of eating the bean sprouts, intended for planting to ease famine. In this instance, however, researchers did not consider that harm had been done to the ultimate utilization of this product, especially in view of the fact that implementation aided research.

CASE PROBLEM (NAVY) FOR
NATIONAL SYMPOSIUM OF THE MILITARY SERVICES
ON UTILIZATION OF PEOPLE-RELATED RDT&E

A naval training school that prepares enlisted personnel through a nine-month course for performance in a critical shipboard rate was experiencing a sustained serious problem of a high incidence of student failure. Tests for progressive levels of performance proficiency are (and always have been, a standard practice) administered every two weeks after the first three months of training. The final exam is designed to measure the level of performance required on shipboard.

In years past, about 30% of those who entered the school failed to complete the training and perform satisfactorily on the final exam. Since abolition of the draft, the failure rate has risen to 55%-60%. A personnel research group was asked by the CO of the school to study the problem and see if the failure rate could be significantly reduced.

The research team conducted a comprehensive comparative study of those who succeeded and those who failed. They compared the two groups on a battery of psychological tests and biographical data. They also undertook personal depth interviews with those who ranked in the upper 25% of the group who passed the course, and with the lower 25% of those who failed. They interviewed all instructors for their perception of the problem, and made a careful study of the curriculum and instructional methods, as well as procedures for assigning trainees to the school.

On the basis of their findings, the researchers were able to make a number of important suggestions for change and refinement of the selection criteria for admission to this school, for streamlining the instructional technology, and for attending to several important morale factors.

When all of these recommended changes were instituted, the failure rate at this school dropped to 22%. By this time, the research team was convinced that, with the improved selection and training program that had been worked out, theoretically no one should fail. They then instituted a highly individualized study of those who were still failing. This included individual psychological counseling, enlistment of the school's instructors in after-hours individual tutoring, and ombudsman-like follow-up with each student to see whether identified needs and problems were being met. As a consequence, the failure rate was further reduced from 22% to 11%.

The research team published the study both as a technical report and as a journal article. In these reports, they concluded that they had developed a very promising paradigm both for studying this type of problem and for applying remedial action. They felt that it certainly could be applied to the other school in the country

that also trained for this rate,* and that the procedures were clearly worth cross-validation efforts by other naval training schools that were experiencing appreciable failure rates. However, a year after publication of their report, there was no evidence of spread, spinoff or spillover in connection with the failure problems of other training schools.

The research team feels discouraged about the lack of utilization of a procedure which has had dramatically demonstrated success and which would seem promising and applicable for many other training school situations.

If the CO of the R&D laboratory that conducted the study wanted you to serve as a utilization consultant to review this situation, determine why there had been no spread, spillover or spinoff from this promising R&D demonstration, and whether utilization strategies might not be initiated, what would you do, and why--for what reasons?

a. What additional information would you need?

b. What factors would you inquire into as possibly relevant to the question of why no evidence of utilization of these procedures elsewhere?

c. What would you do or recommend be considered now to promote utilization of the procedures developed in this study? Why?

d. What would you conclude from this case problem that might have general implication for utilization of R&D products/findings?

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* The average failure rate at the other school was about 38% at the time the school that requested the study was experiencing 55%-60%.

ARMY CASE STUDY--ARMOR SCHOOL

The Armor School, in conjunction with Naval Training Equipment Center (NTEC), contracted with General Dynamics to develop a Miniature Armor Battlefield (MAB). The MAB had radio-controlled tanks on a miniature (6') field, with TV sensors in the tanks and hit/kill sensors; it was intended for the simulation of platoon vs. platoon engagements. Development cost was approximately $1 million.

The Armor School asked HumRRO to evaluate the system and to work out training procedures. The research group had been working on a simplified version of the system which eliminated some problems encountered with the TV sensors on the General Dynamics device. The evaluation was performed with a 24-hour field exercise as the performance criterion; the system was shown to be effective for training tank crews. A follow-up in Europe using commanders' ratings as a criterion resulted in higher ratings for the system than for conventional training techniques.

The Armor School recommended that the MAB and another research product, the Armor Combat Decisions Game (CDG), be developed by TRADOC. Regulations were published governing the use of these training devices. NTEC was to have action on obtaining the devices, in simplified form, per recommendations of HumRRO. NTEC tried, however, to improve the tank model further but encountered problems with miniaturization of electronic components. A contractor could not be found to build the devices to specifications; a later attempt by the Training and Doctrine Command, Deputy Chief of Staff for Training to get the devices built through Naval Training Device Center (NTDC) failed as well.

At present the CDG is in use by the Canadian Army in their own version, successfully. The MAB has not yet been produced as a training device. Another product, a map board which was part of project RECON for Armor training, was given to NTDC, formerly NTEC, for development. It is currently confined in use to the Ohio National Guard.

ARMY CASE STUDY--ASVAB

In February 1966, the Assistant Secretary of Defense for Manpower and Reserve Affairs requested research on a common aptitude battery that could be used by all the services in the high school testing program. The Army was designated lead service to determine to what extent the aptitude tests of the several services were interchangeable and to develop an appropriate test battery. The Armed Services Vocational Aptitude Battery (ASVAB), consisting of a common core of abbreviated forms of tests found to be interchangeable, was a first product of this endeavor and was put into use to test potential recruits in the last year of high school.

As the original research called only for the development of tests for the high school program, only those tests common across all services were considered. Thus, the service with the smallest set drove the system. From School Year 1968/1969 ASVAB Form 1 was used in high school testing; in 1972 Forms 2 and 3 were developed for high school testing, and they also became the operational batteries of the Air Force and Marine Corps. Army bowed out as Executive Agent for ASVAB research and Air Force took over.

In the middle of 1974, the ASD (M&RA) decided that as of 1 January 1976 there would be a single classification battery, ASVAB, to serve the primary selection and classification purposes of all the services, as well as for high school testing. The new requirement represented an important change of concept. To produce one selection and classification battery to serve needs of all services, the service with the largest set of requirements drove the system, and thus, a 13-test battery was necessary.

The battery was fielded 1 January 1976, but with the short lead time available, it was done with no validation, a fact which some Army observers believe contributed heavily to the large attrition rates in TRADOC schools. In addition, norms have had to be adjusted and are still being questioned in the Army, Navy and Marine Corps.

This case study depicts the development of a product for which sponsor interest, enthusiasm and impatience are factors that have to be dealt with to delay (rather than hasten) utilization, so that the product will have a reasonable chance to be effective in operation.

APPENDIX F

EVALUATION

APPENDIX F

END-OF-SYMPOSIUM EVALUATION SHEET RESPONSES

Symposium evaluation sheets were completed and submitted by 98% (64) of the attendees (excluding host and support personnel) who participated in all sessions of the symposium. The following table displays the responses in each of the nine areas which were rated. The scale ranges from five to zero (5 being the most positive rating). The number in each box shows the number of attendees who gave that rating and the circle distinguishes the most frequent rating in each area.

AREAS	ANSWER OPTIONS Clear----------Not Clear[a] Good----------Not Good[b] Helpful----------Not Helpful[c]					
	5	4	3	2	1	0
1. Symposium Objectives	14	(25)	13	9	3	0
2. Organization of Symposium	11	(24)	22	5	2	0
3. Value of Small Group Sessions	7	(24)	16	10	5	1
4. Value of Plenary Sessions	6	(26)	21	7	2	1
5. Value of RU Agency Heads Discussion Session	5	(22)	15	9	3	2
6. Value of Session Integrating Symposium Discussion With RU Literature	0	15	(24)	6	6	1
7. Value of Case Problem Session	5	13	(18)	10	5	1
8. Value of Policy Recommendations Session	3	(17)	14	10	11	1
	More than met my expectations		Met my expectations		Less than met my expectations	
9. Overall Rating of Symposium	5	(21)	17	14	2	2

a. Rating used for question 1.
b. Rating used for question 2.
c. Rating used for questions 3 through 8.

Note: The number of responses does not add up to 64 for each question since not all respondents answered all questions.

The final item on the evaluation sheet was a request for suggestions for improvement. The following is a summary of the ideas included in these suggestions.

Several concerned the overall climate of the symposium. Three people stressed that the emphasis should have been on the issues involved rather than a defense of present policy and denial of the problem. One person described his view of the symposium climate: "The attitude which seemed to prevail was characterized by one individual who stated that 'any specific recommendations for change would constitute a violation of the chain of command.'" With that sort of mind-set the predictable bureaucratic outcome occurred (i.e., several platitudes, a recommendation for an additional report and a recommendation for further study).

Four people suggested that there should have been more small group interaction. One specified that this should be uninterrupted (e.g., no floating members).

There seemed to be a general feeling that the objectives were too broad and therefore prohibited closure. As one person put it, "I simply believe that the objective was not achieved because problem definition and explanation used so much time that the closure exercise was unobtainable in the time allowed. I believe that the individuals in attendance could have been brought to closer grips with the basic issue had there been time and emphasis on the problem resolution." Another suggested a "less ambitious goal--policy recommendation was beyond ken of most of those present."

The message of eight attendees was clearly that more users should have been involved since "they are an essential element of any solution to the utilization problem."

Three people stressed that the symposium should have invited individuals who have the ability to implement not just make recommendations.

In general, the suggestions seemed to describe the need for more action rather than theorizing, and the attendees seemed to agree that symposia are necessary to help attack the RU problem.

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Commanding Officer, Naval Underwater Systems Center
Commanding Officer, Navy Manpower and Material Analysis Center, Atlantic
Commanding Officer, Navy Manpower and Material Analysis Center, Pacific
Officer in Charge, Annapolis Laboratory, David W. Taylor Naval Ship Research and Development Center
Officer in Charge, Dahlgren Laboratory, Naval Surface Weapons Center
Officer in Charge, New London Laboratory, Naval Underwater Systems Center
Assistant Secretary of Defense (Manpower, Reserve Affairs and Logistics)
Under Secretary of Defense for Research and Engineering
President, Naval War College (Code E114)
Superintendent, Naval Academy
Superintendent, Naval Postgraduate School
Superintendent, U.S. Military Academy
Superintendent, U.S. Coast Guard Academy
Superintendent, Merchant Marine Academy
Director, Naval Research Laboratory
Director, Training Analysis and Evaluation Group (TAEG)
Director of Civilian Personnel Office
Director, Department of Defense Computer Institute
Navy Science Assistance Program Members (Lab Coordinators, Science Advisors, and NSAP Lab Reps) (26)
Human Goals Office, Newport
Headquarters, Department of the Army, Office of the Deputy Chief of Staff for Personnel
Army Research Institute for the Behavioral and Social Sciences
Director, Army Human Engineering Laboratory
Personnel Research Division, Air Force Human Resources Laboratory (AFSC), Brooks Air Force Base
Occupational and Manpower Research Division, Air Force Human Resources Laboratory (AFSC), Brooks Air Force Base
Technical Library, Air Force Human Resources Laboratory (AFSC), Brooks Air Force Base
Technical Training Division, Air Force Human Resources Laboratory, Lowry Air Force Base
Flying Training Division, Air Force Human Resources Laboratory, Williams Air Force Base
Advanced Systems Division, Air Force Human Resources Laboratory, Wright-Patterson Air Force Base
Program Manager, Life Sciences Directorate, Air Force Office of Scientific Research (AFSC)
Coast Guard Headquarters (G-P-1/62)
Military Assistant for Training and Personnel Technology, Office of the Under Secretary of Defense for Research and Engineering
Director for Acquisition Planning, OASD(MRA&L)
Center for Naval Analyses
National Research Council
National Science Foundation
Library Operations Section, Library of Congress
Defense Documentation Center (12)


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