Navy Personnel Research and Development Center
San Diego, CA 92152-6800 SR 86-2 March 1986

IMPROVING the RESEARCH TRANSITION PROCESS

Is research being used to solve critical fleet problems?

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NPRDC-SR-86-2 March 1986

IMPROVING THE RESEARCH TRANSITION PROCESS: PROCEEDINGS FROM AN NPRDC/ONR WORKSHOP

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FOREWORD

The issue faced by this workshop was how to ensure that behavioral science research ultimately serves the Navy's primary mission. Given that a basic objective of Navy R&D laboratories is to generate a technology base that is both useful and used, there must always be a close link between R&D products and operational requirements. However, even more than this, there must be a clear understanding of how R&D products can be directed at targets of opportunity in the user organizations and successfully implemented. These areas remain an ongoing challenge for both Navy R&D laboratories and the operational community.

The workshop described by these proceedings was cosponsored by the Navy Personnel Research and Development Center (NAVPERSRANDCEN) and the Office of Naval Research (ONR). It was held in San Diego, California on 23-24 May 1984. The intent was to have a diverse group of researchers, managers, and headquarters managers discuss the issues associated with improving research transition. The issues included both the transition through the 6.1 to 6.4 arenas as well as the transition of mature technologies into user organizations. Although the focus was the manpower, personnel, and training areas, many of the issues are generic to a spectrum of R&D efforts.

The reports, panel discussion, and participants' comments were transcribed from tape recordings. The paper presentations were submitted separately by the authors. Appreciation is expressed to the leaders of the workshop groups, Drs. Penn, Montague, and Broedling, who were all from NAVPERSRANDCEN. Appreciation is also expressed to Dr. Bert King from ONR, who served as the workshop coordinator and provided helpful suggestions on the structure of this report.

JAMES W. TWEEDDALE
Technical Director

EXECUTIVE SUMMARY

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Issues in Research Transitions: A Perspective from Researchers Lyman W. Porter Jone L. Pearce William B. Stevenson	21	The production and utilization systems for scientific research involve two distinct communities, both with well-developed values, norms, customs, and practices. The authors discuss a range of factors that contribute to successful dissemination of products from the science research community to the practitioner community. Several propositions are put forth regarding the transition process and how to improve it.
Shipboard Culture and People Quality David G. Bowers	37	Successful research transitioning is often the result of an outgrowth of a evolutionary research stream. Bowers discusses a long-line of research at the University of Michigan, funded by ONR, that ultimately "downstreamed" into successful applications in the Navy. He supports the argument that there is currently much technology "on the shelf" that could be successfully transitioned to address current Navy problems.
Some Informal Remarks on the M-Form Society William G. Ouchi	51	Cooperative R&D ventures among Japanese companies have contributed to their enormous technology gains. The author of the recent best seller, Theory Z, outlines how structural arrangements can facilitate such cooperative ventures. He clearly demonstrates that the "macro" system within which R&D is conducted plays a central role in contributing to successful large scale research projects.

A PERSPECTIVE ON RESEARCH TRANSITIONS

Dr. James W. Tweeddale
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The issues of research transitions and technology transfer represent a yardstick against which one can evaluate the quality of an organization's management. Tweeddale discusses how "learning the ropes" or an organization's acculturation process plays a central role in the adoption of new technologies. He rejects the opposing concept of a technological imperative where the technology is accepted solely because of its independent merit.

My original plan for this keynote address was to review the literature and focus on a couple of contemporary models such as those used by the Department of Agriculture and NASA. I was then going to summarize some of our experiences at NPRDC and open the floor for discussion. The more I reflected on this topic, the more I felt compelled to address a somewhat broader issue, one which I would like to call, for the moment, organizational acculturation. For the purposes of this morning, I am going to contend that technology transfer cannot be considered in isolation from the organization in which it occurs. Technology transfer is actually the dependent variable, and the organizational culture where it occurs, or more specifically, the process through which that culture develops, is the independent variable.

I'd like to define organizational acculturation as a process of learning the ropes. It is the process that creates a mind set for the employees--what the organization really does, and what is and is not important. This process, I would contend, also occurs in schools and most dramatically when the individual enters his or her first job. It occurs again when one switches about within an organization from headquarters to the field, or when one advances in grade or rank.

"Technology transfer cannot be considered in isolation from the organization in which it occurs."

The process is so commonplace that although we go through it over and over again, it's easy to overlook. I believe, however, that the process can make or break careers. It can make or break relationships among members of organizations, and it can also define the level of achievement of an organization and its individual members.

I'd like to share with you some slides that I prepared a couple of years ago for a presentation involving productivity in the Navy. I think that some of the relationships shown in these tables really get to the issue of acculturation within the Navy.

Table 1 contrasts military and civilian members of Navy organizations and shows important differences on a number of basic cultural factors. For example, the military member enters the system at a basic grade level. You'll find a few exceptions (e.g., the medical community); however, the norm is an agricultural process through which military managers are grown from within.

Civilians enter the system at varying pay and grade levels. We often find that civilians enter the Navy, Army, Air Force, and Department of Defense right at the top. We often find no common academic or work experience within the civilian management workforce. There is a potpourri of managers. Each one has the potential of marching to his or her own drummer, if you will, and imposing his or her values upon the structure over which they exercise control. We would hope that most of these values are consistent with the values of the Navy.

With regard to continuing education, there is a subsidized and encouraged set of programs available to military members of the armed forces. In the case of the civilians, we do not find such open encouragement. A notable exception may be the research and development (R&D) community, where we have long-term developmental assignments for researchers. However, by and large, you don't find most of the 230,000 to 240,000 civilians in NAVMAT being encouraged to continue their education. Actually, there are many systemic disincentives for pursuing long-term developmental assignments if you're a civilian.

The cultural process through which a military member establishes an organizational identity in the Navy prepares him or her to understand the big picture. There's a centralized "detailing" process through which an individual is assigned to an operational (or headquarters) command. People are rotated between headquarters, field units, ships, or air squadrons, and are then sent back to headquarters with a diversity of experience. The assignment process cultivates a strong institutional identity. The viewpoint of the military professional transcends the specific job that he or she is currently occupying.

I can think of a number of occasions when I've talked to military officers about this. In fact, I was on the airplane coming back from Washington about a week ago, and I was sitting next to a gentleman who was a retired Navy officer. He was a Naval Academy graduate who had spent over 25 years in various Navy positions. Although he'd been out of the Navy for two decades, he still viewed himself, when talking about his career, as a member of the Navy military force.

In contrast to the military, the organizational impact of continuing education for Navy civilians is that it can lessen personal identification with the institution. In fact, the likelihood of turnover is enhanced because it gives the individual a more marketable knowledge base. The civilian's identity is tied to a specific activity or career field. You find, for instance, at Naval Air Rework Facility (NARF), North Island, a lot of interest within that 6,000 plus civilian work force directed to the health and survival of that facility. You find people organizing and doing things to keep

Table 1

Factors That Influence the Military/Civilian Interface

Factor	Military	Civilian
1. Input	a. Entry at basic pay grade b. Grow managers from within	a. Entry at varying pay grade levels b. No common academic experience/heritage
2. Continuing Education	a. Subsidized b. Encouraged	a. Some subsidized programs available b. Sabbaticals not openly encouraged (often require much individual effort)
3. Impact of Cultural Process	a. Prepare for big picture b. Skill retention high within Navy military force c. Cultivate institutional identity d. The military professional transcends job occupied	a. Turnover likelihood enhanced with education (reflects more marketable knowledge base) b. Identity tied to specific activity or own career field c. No overarching profession
4. Experience	a. Broad experience in many jobs b. More "operations" experience c. Develops military management generalists	a. Experience accrual more focused b. Industry/government experience mix c. Develops specialized expertise
5. Promotion	a. Centralized promotion system b. Centralized fitness reports c. Rank in person d. Performance appraisal system has withstood test of time e. Predictable promotion patterns	a. Decentralized promotion system b. Promotion freezes not uncommon c. Rank in job (except SES) d. Performance appraisal system historically ineffective e. Unpredictable promotion pattern (self or event directed)
6. Affiliative Network	a. Peers (military) b. Ties to Navy	a. Peers (civilian)--less cohesive b. Ties to local community
7. Tour Length	a. Two-three years in one job	a. Indefinite experience in job
8. Retirement	a. Forced retirement intrinsic to system b. "Up and out" mobility c. Institutionalized room at the top	a. Forced retirement not practical b. "Up and stagnate" common late in career c. Late career anomie
9. Pay	a. Early retirement allows for a second career	a. Pay cap discriminates against most senior people

NARF, North Island, green and healthy. They go back to Congress and lobby as a North Island Management Association. There's a lot of identification with the local activity and with trade associations. There is also a tie to the professional community and the local community, but there is no clear attachment to the Navy as an institution separate and apart from the world of NARF, North Island. I'm not picking on North Island, I just live here--North Island is my neighbor. The same situation exists in all other NARFs.

With regard to job experience, the military manager participates in a wide range of jobs. As a result, military officers develop as management generalists. On the other hand, civilian experience accrual is more focused. The civilian manager develops specialized expertise with the result that we have the military generalist contrasted with the civilian specialist.

"The viewpoint of the military professional transcends the specific job that he or she is currently occupying. . . . The civilian's identity is tied to a specific activity or career field."

Promotion systems for the two groups are also quite different. Promotion within the military force structure occurs through a centralized system with centralized fitness reports. Rank is in the person rather than the position. The promotion system has stood the test of time and has generated relatively predictable patterns. Promotion within the civilian structure is decentralized. Promotion freezes have been common, and, with the exception of the Senior Executive Service, rank is in the job rather than the person. The civilian performance appraisal systems are constantly being changed. It seems like we've been wrestling for years with performance appraisal systems that all border on being very operative and very motivating but are normally poorly executed. For civilians, there is an unpredictable promotion pattern that is self-directed rather than centrally directed.

Looking at the affiliative network for the military, it is composed of one's peers and includes strong ties to the Navy. Civilians also have ties to their peers, but it's a much less cohesive group. The network can include peers in the local community as well as in civic, religious, and fraternal organizations.

Tour length and retirement systems are also quite different. Military tours usually last 2-3 years, whereas civilians spend an indefinite time in a given job. For the military, retirement is an "up and out" approach, with an institutionalized arrangement for room at the top. For civilians, forced retirement is not practical. I've referred to civilian retirement as the "up and stagnate" syndrome.

This has been a rather brief thumbnail profile of the acculturation process for the military and for DoD civilians. Nonetheless, I think you can see that differential processes result in two very distinct cultures. Perhaps this can be illustrated best by the role expectations for each group of managers shown in Table 2.

Table 2

Role Expectations for Civilian and Military Managers

Military Manager	Civilian Manager
• Gatekeeper of "fleet interests"	• Subject matter expertise
• Critic of parochial interests	• Authority on organization's past, present, and personalities
• Short-term orientation (tour length)	• Ownership in the organizational present
• Risk minimization	

What does one expect of civilian versus military managers in DoD organizations? One expects the civilian to have expertise in a specific functional domain. For example, if you want to find out something about computer adaptive testing, you go to the civilian expert. He'll talk to you about computer adaptive testing as a state of the art. Normally you wouldn't go to a commanding officer to get detailed information about a technical area. His heritage is the fleet, so he is always looking for relevancy and application to an operational requirement. His concern is whether this area can help the Navy achieve better operational readiness, and his focus is broader than a specific functional domain.

Another difference in role expectations is that the civilian is normally an authority on the organization's past and present. One of the great values of the civilian infrastructure is its corporate memory. For example, in an organization such as NPRDC, there are very few issues that one can address today for which we don't have corporate memory back to 10, 20, 25 years. That's intrinsic to the civilian component of this dual culture.

A critical role for the military is to be the in-house critic of parochial interests. These are the things that would keep local activities green and healthy but may not be consistent with the best interests of the Navy. On the other hand, the military may take a very short-term perspective with regard to an activity. Given a 2-3 year tour, it is often incumbent upon them to produce significant change during their watch while at the same time avoiding high-visibility mistakes. The military culture does not reward taking major risks because a single error can sometimes ruin the officer's career progression. In sum, these are some of the social forces that operate within the military and civilian infrastructures.

"The civilian is normally an authority on the organization's past and present."

I'd now like to move back to the topic I introduced at the beginning--organizational acculturation. I want to focus on how this process occurs in Navy organizations. The concept as it will be used here really addresses the interaction between a stable cultural system and the newcomer or the person transfers in because of a career transition. Acculturation refers to a process. Through this process, the member learns the value system, the norms, and the behaviors required by his or her role in the organization. It does not include all facets of these areas. It includes only the learning of the value systems, norms, and behaviors that are important to retention and advancement.

What are the key values, norms, and behaviors? Well, they derive from the basic goals of the Navy as presented by the military command structure. If I'm a civilian employee of the Navy, I'm going to subscribe to a military command structure. I'm not going to expect to be the commanding officer. I'm going to expect to work as part of a team, a military team. I'm going to render a contribution within that arrangement. I'll probably subscribe to the 600-ship Navy since it's a basic goal of the command structure. Some of the other values involve the means by which the goals are achieved. For example, fiscal planning must recognize the Navy's program, planning, and budgeting system. I'm going to work within the context of that system if I'm going to do my job, or I'm going to work within the context of the established system to evoke change. My responsibility to the Navy chain of command must be followed, and it's not to avoid getting criticism. Rather, these are the kinds of values, norms, and behaviors that are expected within the infrastructure.

How does one learn the values and norms? I contend that it all depends on the degree of prior social learning. For the Naval Academy graduate, acculturation is largely a reaffirmation of much of what was learned at the Naval Academy. My very nonscientific random sample of current and past Naval Academy students, faculty, and administrators suggests to me that work overload and upperclassmen hazing during plebe year develop a strong peer culture. It is a kind of banding together of plebes as a defense against external social forces, and it works as a problem-solving device to culturally adapt the kid next door into the officer and the gentleman.

A strong attachment to one's class remains as long as the Naval Academy graduate draws breath. Class reunions represent an arena where even rank loses some of its privilege. Many feel that the introduction of women into this very brittle, tradition-bound, chauvinistic acculturation process will change the Navy's social infrastructure. For better or worse, only time will tell. That's not the point here. The point is that cultural identity can provide a cognitive orientation that transcends organizational status, short-term goals, and even rank sensitivity.

"Acculturation refers to a process (through which) the member learns the behaviors required by his or her role in the organization."

Based upon what I have observed in my 20-some years within the Navy military structure, I wish I could create the ideal management control system for our organization. It would work on a time horizon of adequate length to build an acculturation that promotes genuine ownership of something that I might call "Navy corporate health." This ownership would transcend the traditional cultural boundaries, that is, the uniformed and non-uniformed boundaries. It would also operate at every threshold in the Navy. The 1978 implementation of the Civil Service Reform Act created an opportunity to do something with the newly designated Senior Executive Service (SES)

member. It created an opportunity to develop a management that has a clear, shared culture consistent with Navy goals. I believe the thoughtful and deliberate system of SES rotation is creating an acculturation process through which SES members are being forced to revisit their own status within the broader cultural framework.

I vividly remember my own organizational socializational in an interview with the Deputy Chief of Naval Material prior to my selection and rotation to my NPRDC job. He said quite bluntly, and I remember it very vividly, that if I knew what I wanted and could go ahead and do it, the NPRDC job would be a rewarding experience. But, if I wasn't sure and would look to others for direction, I probably wouldn't last too long. I recall another incident about a year ago when I was wrestling with the NPRDC organization. I was making changes in the organization and burned a lot of midnight oil. It brought me to the threshold of a major decision. I went back to Washington, D.C., and sought advice from Bob Hillyer, who was then the Director of Navy Labs. Bob is unusually kind and patient and normally very helpful. However, this time he was firm in his refusal to give me any advice. He thought that there was no need to rely on his judgment. He expressed confidence that I could make up my own mind and that my decision probably would be the best. So, I suffered for the next 2 or 3 weeks, and I learned an awful lot about how to run a laboratory. I decided at that point that I really wanted to be a part of an organization that would essentially maintain simultaneous loose and tight control. I was, in fact, so well culturally affixed by that experience that nowadays I view functional decentralization within the framework of a properly constituted cultural process to be the only answer to productive management in the Navy of the future.

I wish we had more time to devote to decentralization because the issues relate to value system congruence, professional identity among managers, and aberrant cultural situations where lower organizational members are out of sync with the higher levels. But, I really want to move on to a major point.

The point is that most organizations attach different importance to different values and norms. Some of these norms are pivotal. They lead to something that Prof. Ed Schein would call creative individualism or creative proactivity. Under most circumstances it is reasonable to assume that an organization's membership will accept pivotal organizational values and align those values with their own value system. These norms should help organizational members open and close performance gaps. I find opening performance gaps--gaps that separate the organization and what it is from the organization and what it should be, is critical for the long-term survival and effectiveness of the Navy.

"I view functional decentralization within the framework of a properly constituted cultural process to be the only answer to productive management in the Navy of the future."

Performance enhancement, in an organizational sense, is the process of identifying and eliciting ownership of organizational improvement. It encompasses all the cultural issues addressed earlier. It requires the members to have psychological ownership in the organizational mission and, for the field activity, is probably more significantly focused upon the civilian infrastructure than the military. For an organization, as large and diverse as the Navy, it involves managing change through a set of cultural

values, which operate in the lives of it's people, in a manner that promotes opening and closing of performance gaps.

It should be a goal of every manager to stress pivotal values, especially those that provide the organization with an improved ability to seize opportunities. The values should help to promote (in the minds of an organization's membership) "windows of opportunity" (performance gaps) for new technology to be integrated into the mainstream of organizational activity. The real problem in bureaucratic organizations has been intolerance to change. There are some exceptions to that, and I think we're seeing some things happening in the private sector that reflect a greater affinity for change. But, there really is not a single solution.

"The real problem in bureaucratic organizations has been intolerance to change."

I hope that, maybe in the next couple of days, we'll gain insight into how to deal with intolerance to change. I know that the solution is not the traditional flurry of programs we introduce just to make sure that we're always on the safe side and have our "bases" covered. I think of a very unique analogue that Norman Augustine put together when he was dealing with armed services procurement regulations. He looked at the 20-year cycle in which the procurement regulations grew from a 250-page document into a 20-volume document. He drew an analogy between that change and the life cycle of a yellow nuts edge weed, which, as it grew, had its germination through a rapid growth curve to a point at which it ultimately led to its own demise. He essentially overlaid the curves and showed that they matched. The analogy illustrated the folly associated with traditionally mechanistic control systems in organizations, they have the potential to die under their own weight.

This is one of the basic problems with the "cover your bases" tradition. If we look in retrospect upon some of the things we tried to do in the productivity arena, we have good examples of its limitations. There was inadequate focus on generating ownership of "organizational health." Essentially, there was a flurry of programs without strong transcending themes that were articulated and reinforced. What happens, I believe, in the cover your bases approach, is possible rejection of all values of the organization. Many members find it too hard to buy in. If I have to subscribe to those 20 volumes of regulations, many of which I don't understand, it's going to be too hard for me. Or, it could lead to a kind of conformity where there's a passive acceptance of 20 volumes; kind of a "Yes man, yes sir, I'll do it--whatever you say boss, you've got it;" reflex. But when it comes to creative productivity, when it comes to creative individualism, when it comes to the individual really perceiving himself as an integral part of the organization, those kinds of proactive values won't emerge where we have the 20-volume, cover your bases approach.

I don't argue that there is no good in some of the bureaucratic rules which are good but not critical to organizational health. It's good, for example, to subscribe to certain dress codes. I think of

the IBM stereotype. Those norms are relevant, but not pivotal. I believe that the acculturation process occurs across a wide range of behaviors, but, the rewards and punishments in most organizations--for compliance or noncompliance--vary with the importance of the norm. These differences in impact allow varying degrees of freedom for the organizational member who must accept pivotal values and can remain carefully or guardedly independent with respect to the others.

I've spoken for some time now about the process of organizational acculturation and how distinct military and civilian cultures emerge within our Navy organizations. What I'd like to do now is to integrate this area with the basic theme of this conference--the transition of research into organizations. More specifically, I'd like to focus on the issue of how the Navy acculturation process relates to technology transfer and the management of change. The framework we have to keep in mind is that we are dealing with two sets of managers, managers with very different orientations, given their respective cultural adaptation. Let's look at the profile of these two groups in Table 3.

As we can see from Table 3, there is a quasicultural arrangement between the military and civilian manager. The military manager has a strong orientation to the fleet and the chain of command, whereas the civilian has a strong orientation to the local activity or career field. The military manager's, goals are constrained by tour length, mobility is centrally directed, and motivation is directed at achieving promotion through good fitness reports. The civilian manager's, goals coincide with personal interests, mobility is self-directed, and growth opportunities may be seen within a "keep what you have" orientation.

The civilian often sees the military decision process as dysfunctional and incremental. Faced with needs for a rapid career progression, the military manager sees the civilian decision process as slow and parochial. The military manager views himself as having ownership of the command decision and as the controlling official of the organization. On the other hand, the civilian manager views himself as a staff resource or perhaps as part of a caste system.

"The military manager has a strong orientation to the fleet and the chain of command; whereas, the civilian has a strong orientation to the local activity or career field."

Given this differential profile of managers in a Navy organization, it is clear that each group must play a different role in the introduction of change. Looking at some basic facts, change always involves risks. There's always a possibility of failure. There must be tolerance for error. In fact, change often disturbs the distribution of power, and there's little tolerance for that. It creates conflict: It requires ownership of the whole organization's health. Hence, successful change is contingent upon the various factors in the organizational environment. To transition R&D into an organization, you must have acceptance that change is necessary, that the R&D solution is the correct option, and that resources and support are available to institutionalize the change. My next table contrasts the differing responsibilities of the military and civilian managers in the acceptance of change.

Table 3

A "Thumbnail" Profile of Career Civilian and Military Managers

	Characteristic	Military Manager	Career Civilian Manager
1.	Orientation and loyalties	a. Fleet operations b. Chain of command	a. Local activity b. Career field
2.	Goals	a. Coincide with tour length	a. Coincide with personal interests
3.	Mobility	a. Institutional b. Centrally directed	a. Varies with individual b. Self directed
4.	Motivation	a. Fitness report b. Promotion potential	a. Keep what you have b. Pursue growth opportunities as they surface
5.	Decision processes	a. Military decisions often perceived by civilians to be dysfunctional and incremental	a. Civilian decisions perceived by military to be slow and parochial
6.	Perception of self	a. Having ownership of command decision responsibility b. Controlling official	a. A staff resource b. Part of a caste system

As can be seen in Table 4, I feel that the civilian managers have primary responsibility in ensuring that the change is directed to an important problem. Likewise, the civilian manager must assess the quality of the information on which the change is being based. He or she must look at the technological maturity of the new method, and the extent to which the chosen alternative has been tested and evaluated before delivery. The military managers clearly have responsibility for the resources to implement change. They must establish policy within the budget framework.

The creation of a climate that supports change is the responsibility of both military and civilian managers. This climate must support reasonable risk and encourage individuals to identify with the organizational goals. To some extent, all of the change factors are probably the responsibility of both sets of managers. However, what I'm saying is that each group has predominate responsibilities for different segments of the change process.

Let's look now at the role of the researcher in the change process. In our business, that is, in the Navy lab business, the new researcher with a freshly received Ph.D. comes to work in his academic specialty believing that knowledge is power. He soon learns that knowledge is nothing. The ability to sell

Table 4

Key Responsibilities of Military and Civilian Managers
During the Change Process

Responsibility	Responsible Managers
• Relationship of change to existing and recognized problems	• Civilian
• Quality of information on which change is based	• Civilian
• "Maturity" of new methodology	• Civilian
• Availability of resources to implement change	• Military
• Supportive organizational climate - Organization/individual goal congruity - Organizational risk taking	• Military and civilian

knowledge to others is power. Only by selling an application of knowledge to a highly specific local situation can the researcher obtain respect for what he knows. Where education has taught that knowledge is power, organizational acculturation teaches how change is really accomplished in a bureaucratic organization.

Let me share a couple of examples with you. A new technical person is hired to introduce linear programming into a production department is told by his immediate supervisor to lay off because if he succeeds, he'll make the supervisors and the old engineers look bad. Thus, the "new hire" learns that he had a naive opinion about the push of technology. He usually resigns himself, after a couple of years of failure, to the fact that the organization's value system is not congruent with that of his academic community. Looking back over 10 to 15 years, what seems to happen in the early stages of the scientist's or the researcher's managerial career is either a postponement of professional development while acculturation takes place or rebellion against organizational acculturation.

"The ability to sell knowledge to others is power."

The new researcher must first learn to be a good staff man, a good junior analyst, and perhaps a good low-level administrator. He must prove his loyalty by accepting this career path graciously before he is trusted enough for a position of power. If he has not lost his education by then, he can begin to apply some general principles while he attains positional power. What can be done about this situation? I wrestled with this right up until 2:00 this morning. What can be

done? Are these problems symptomatic? Are they part of our own organizations? Do they relate to technology transfer?

My answer is yes they do. And something can be done. First, we can become aware of our acculturation process. Too few of our military or civilian managers know what's going on at the bottom of their organization where all the high-priced talent that the organization depends on is actually employed. I'd say that this is true at almost any level in any organization, and is certainly true in the private sector. Smart, honest, hard-working organizational seniors preoccupied with day-to-day management issues add to an acculturated inertia through which acceptance of nonchange is perpetrated.

I suspect that the value system of these senior people determine whether the organization has an appetite for change and tolerance for error, both of which are important to technology transfer. Awareness of their culture determining practices should make possible more rational choices, as to what to encourage and what to de-emphasize. The focus should always be the pivotal values rather than peripheral ones. Attention must also be directed to the delicate problems with new employees or with rotated ones in the early days, when acculturation pressures are at maximum. We must continually ask whether new organizational members are learning values that will contribute to the long-term survival of the organization. Is acculturation supporting adaptation or extinction?

The issues of technology transfer, probably more succinctly than any other issue, are a yardstick for the quality of an organization's management. Organizations that demonstrate an ability to systematically direct new technology at targets of opportunity have understood the social forces that counter innovation and gained control over them. The analysis and control of social forces represents a substantial agenda for future discussion. Hopefully, we'll learn more about these forces here at this meeting.

"Too few . . . managers know what's going on at the bottom of their organization where all the high-priced talent that the organization depends on is actually employed."

I'd like to end my talk by going back to the first point I made this morning: Technology transfer cannot be considered in isolation from the organization in which it occurs. In essence, my perspective on research transition is that it is not the result of technological imperative. Rather, successful transition occurs through the interaction of the characteristics of the new technology with the characteristics of the organization. The organizational culture must support and accept the technology--regardless of its independent merit.

Within the DoD environment, acceptance of change is complicated by the existence of a dual culture. However, the problems are not insurmountable. Researchers and technology transfer specialists must work with the forces that resist or support constructive change. Similarly, managers must promote cultures that seek improved technologies and support their implementation. The creation of such an organizational pull will surely maximize the benefits to be accrued from research.

I'd like to open the floor for some discussion, some reaction, some comments, and some feedback concerning some of the issues I've addressed. What I've tried to do is to deal with technology transfer within the context of ourselves as managers in different organizations with their own specific value systems.

COMMENTS FROM THE AUDIENCE

Comment: I was fascinated and really delighted while listening to your talk. It made me think of a whole bunch of things. If I can, I'd like to mention one or two here. I was struck as you were talking with the similarity between your remarks and remarks that I made at several companies that I've dealt with in the past. These include companies like Proctor and Gamble, IBM, and Hewlett Packard. They are all innovative companies because they have one important characteristic: They all have a very strong organizational culture. They always worry about the fact that they may be falling into a rut. They see it whenever they try to hire a senior person and bring him in because he represents a set of skills and knowledge that they need and don't have. They try to integrate that person and almost never succeed at it, and they worry some more about the problem. So, I guess, my first reaction is that the nature of the problem we're talking about is a characteristic of any really successful organization.

These successful organizations, of necessity, have relatively homogeneous, cohesive cultures internally and therefore must struggle with the problem. They have some very clearly structured ways to deal with the problem. These include bringing in outsiders to force their ideas upon insiders at several points in the development of the career of a manager. They also do this same thing at several points in a major decision process. I think, and I may be wrong on this, that these companies do this much more frequently than the Navy does. This doesn't have to be the case.

"The organizational culture must support and accept the technology--regardless of its independent merit."

For example, the Navy could bring a steady stream of speakers into the Academy who have had relatively little contact with the Navy. These people could offer the prospective officers different points of view. In the private sector, a company that was designing a big expansion program ought to get Ralph Nader to come in. Everyone would say, "Not Ralph Nader," but that's why he would be there. He would offer another point of view. There's a lot of other people with important views that you don't even realize are there.

The only other thing that I wanted to mention now is the other big issue of having both a professional and organizational identity. Becoming cosmopolitan and local at the same time is the way sociologists talked about this problem in the 50s. In the language that you've used, it is being both attached to the organization and attached to the profession at the same time. A specific case I think about is Bell Labs. It is perhaps one of the closer civilian examples to the nature of the problems you're talking about. Many people, I think, would say they handled the problem very successfully; although I think from the inside they would probably see it as having been very hectic. But, one of the things they did with great regularity was to import outsiders to be residents in the lab for a period of a year, two years, or as much as three years. They also exported insiders to be residents in universities and outside companies for periods of a year and 2 years. That was a very inefficient thing to do from the standpoint of what it costs as opposed to what you get out of it

economically in the short run. It was very expensive, and many people would say nobody could afford that except a monopoly like the Bell Labs. On the other hand, if you look at the long-range success they had with technology transfer, it strikes me that that was a very important component. So, I guess the general point I want to make is that there are several private firms that have a problem similar to the problems you described and that they have found ways to help alleviate the problems.

Dr. Tweeddale: I really appreciate that. I find that the process of introspection is painful. If you're really serious about wanting to render a contribution in an organization, you have to deal with a lot of traditional forms and structure. You have social pressures to preserve that form and structure. Thus, you identify a need for change only by addressing how, when, and through what mechanism to raise the issues. Also, there's a tendency very often to look at the problem as one that can be fixed by allocating resources. There seems to be a tendency at some places in the organization to say, "Well, if that problem exists, let me throw money at it or people at it or something. Let me write a memo." It kind of infers that the problem is out there, and I'm going to write a memo and get those guys to fix it. It isn't that simple.

I find that if the organization of which I'm a part is going to change, I must change with it. I must become better too. I guess the answer is to consider myself a part of the present problem and have a sensitivity and maturity to treat people within that organization as equal. It's an issue that is not really dealt with in a traditionally military structure where rank is supreme. I mean if the Admiral is in charge, he's in charge!

Comment: You talked about the dual pressures that would fall upon the individual who is a professional in a strong working organizational structure. This is an issue that NPRDC, as an organizational unit, is expected to resolve by manifesting both professional skills and organizational loyalty. As an outside observer, one thing I would say in looking at NPRDC is that you are, in essence, the proper unit. That is, the face that the Navy has you present to the outside world is that you are supposed to be students of a whole range of things in the behavioral and social sciences. It's kind of like the role of a product manager at Proctor and Gamble who has to straddle two or three roles. Likewise, it is like the role of a marketing director at IBM or Hewlett-Packard who is inevitably going to be suspected by the corps of people within the company as really being a turncoat and trying to sell external values inside. He's also going to be suspected by the outside professional community as really being a local and not very sophisticated in his field. Like those managerial roles, NPRDC also serves in a boundary role. Inevitably, it can be a very uncomfortable position.

". . . Proctor and Gamble, IBM, and Hewlett Packard are all innovative companies because they have one important characteristic: They all have a very strong organizational culture."

Comment: There was an article in last Sunday's Washington Post that's very relevant to your theme on acculturation. It talks about how the military does all the acquisition even though the civilians must often use the new technology. It also suggests that civilians should play a much stronger role in the acquisition process. I think that's a mistake, but I think we're going to have to articulate this issue in terms of the utility of technology and the sense of the ownership that comes from an integrated community as opposed to the bifurcation that occurs when the two groups don't work closely together. We would get much worse, in my opinion,

if all of our acquisition activities were headed by civilians, but I believe that's an issue that's emerging. The theme that you presented, in terms of looking at the cultural impact, is really relevant. I think that's going to be an important issue in some 2 or 3 years.

Comment: It's interesting that as you move toward the technology transfer, the continuum from 6.1 toward 6.3 and 6.4., a problem emerges because so much of the Navy's basic science R&D is performed in the academic community. I would think that the recent experiences that we had would in some way affect creative objectivity on the part of students, and yet they're doing very good basic science. However, as you transition and get toward the 6.4 part of the continuum, you must become very specific with respect to the application of technology in a military force structure. If we look at research transition from the academic setting into, say, advanced development, we must now be looking at issues of culture and trends. A careful and thoughtful deliberate integration requires attention to these social forces.

A couple of weeks ago, I participated in a review that the Director of Navy Labs put together for basically all the technical directors in the Navy Labs to review their independent research and independent exploratory development programs. These programs involve funds that the technical directors have direct control over. For 2 days the technical directors got up and basically talked about their independent research and development programs. One of the criticisms that was levied especially by individuals that have just recently come into the Navy R&D structure was the point that much of the Navy's own organic basic R&D is somewhat disconnected from Navy needs. While it wasn't all that way, in some cases, there were very specific arguments going on.

"I find that if the organization of which I'm a part is going to change, I must change with it."

At those briefings, the question of relevance was critical, even when it came to looking at the full spectrum of R&D being conducted in the laboratories. It's also became apparent in looking at the issue of transition that one of the things that comes up is the amount of technology on a ship that's not being used. It is technology that has been developed but basically has not been correctly implemented, and the question is, why? Is it a problem with the technology itself or is it a problem with our institutional organizational arrangements? Those were the questions that were raised and not really well dealt with.

I feel that as we move into the future, I think that not only the Navy but other segments of government are going to have to very directly deal with the issue of how to more effectively manage change. How to cope with some of these forces that we're talking about. I think there's an agenda here for additional R&D, but there's not a single solution to the problem. There are those that would like to say, "Well, you know, I can fix that. I'll write a memo and get the problem solved."

Comment: On the topic of acculturation, in terms of just at the laboratory level itself, not headquarters, I've long thought that there is more need for some mechanisms to acculturate new research scientists on how to work in the Navy or the military environment. They need to be taught a lot of things that they don't learn quickly enough or systematically enough. On the other hand, I've also been somewhat reluctant to maybe go full bore in terms of the cold shower treatment.

Tell the researcher that this is not the ivory tower anymore and that you've got a whole different set of things to deal with. I'd be reluctant in the sense of doing some things that might be too much of a shock because there are some benefits in keeping those people sort of in the ivory tower mentality.

I think about an article that Brian Spence wrote around 1975. He talked about the need organizations have for certain types of people. It doesn't necessarily have to be civilians but they tend to be. They are the people who have not bought into the organization. They may work in it their entire lives, but they haven't bought in. They're purposely there to take potshots at the organization and keep reminding the organization where it's at. They're real good at identifying the gap Jim spoke about. I hear them all the time in our hallways. They say, "You wouldn't believe what I saw down at so and so the other day." It's cynicism but it's healthy. If it's just nasty then it's not constructive. So, there's a middle ground. You don't want to acculturate all your scientists so that they're the Navy organization man with the values of the Academy graduate because you'll lose that critical capacity. There's a balance there, and I'll be darned if I know where it is. You try to move very cautiously so that you don't err too much in one direction. It's an area that we don't know too much about, and it's more trial and error than anything at this point.

Comment: There are those that view these social forces that you speak to as basically a set of checks and balances. I think in terms of looking at the Marxist economist. I think that you can always have an opportunity to test a notion against a tradition and along a dimension of continuing possibilities. Once you understand what the extremes are, then you understand what the boundaries are, and you understand what level of discretionary freedom you have. I think a point that has been made on a number of occasions is that the thing that you really need to test to make sure you understand is what are the boundary conditions in which we have discretionary freedom. You then make sure that as you deal with important issues you deal in the context of those public boundaries. There are organizational members presently reacting to that point of view. If you understand who they are and how they react, you better understand what their position is relative to a given point. I think that this assists in the process of establishing an organizational identity and organizational culture. One of the things I greatly value from the time I spent back in Washington, the 40 years I was there, was the time I spent in NAVMAT. We used to have staff meetings, which the Chief of Naval Material and a lot of other key NAVMAT people attended. We could listen to them react to issues, which may or may not have had immediate relevance to a topic with which you had concern. However, sometime in the future, the issue would be important. By listening to them react and deal with these issues, you understood basically where they stood. From understanding where they stood, you understood where you stood and you understood what level of freedom you had to assert yourself in the organization. That's the thing I think we really need to look at.

". . . as we move into the future, . . . the Navy (is) going to have to very directly deal with the issue of how to more effectively manage change."

"You don't want to acculturate all your scientists so that they're the Navy organization man . . . because you'll lose that critical capacity."

The beauty of that arrangement was that it permitted creative proactivity; it created a climate through which one could be positively assertive. Because once you understood the position of the key players, you understand what discretionary latitude you had. You could operate within those boundaries with a full measure of discretionary freedom. This illustration suggests that you don't need to go back and dig into the books looking for guides to create proactive cultures. Many examples exist in our current organizations. Climates for risk taking have been established. There will also be a degree of intolerance, a kind of a level of ambiguity. Because, even if you have a climate for risk taking within certain well-defined boundaries, there will still be a norm that says don't screw up.

Comment: There's a great article entitled, "You Can't Run a Laboratory Like a Ship." It's an excellent article, and it's very true because researchers make lousy sailors. But, I think that the dual executive role that Jim and I play, and the others in the lab play, has come a long way from the stories I've read. I'd have to bow to some of the institutional knowledge in this room in terms of the way the labs were run by commanding officers coming off a battleship years ago. I think there's much more freedom today, and I think we understand the issues better. Unfortunately, budgets make you take a hard look at the relevance of everything.

Comment: I put it in a broader perspective, the national culture. This culture has created a freezing or reduction in the willingness to share information and transfer technology. You mentioned the problem of the civilian academic community. I think we're beginning to see a buildup of resistance to accepting defense department funds because of the security that's being imposed. We've had exchange scientists come over from other countries with limited bureaucratic approval. Now, to get someone to come over for an extended period of time, even from friendly countries, we have to get them certified by the State Department. I wonder how much this national attitude or this national feeling is impacting upon the willingness of individual laboratories to share information particularly with non-military personnel and other governments?

Dr. Tweeddale: Well sir, that's a good question. I know that there are formally constituted arrangements. The Technology Cooperative Program, involving primarily NATO, does allow a certain amount of collegial interaction to take place. But, I'm very much aware of the fact that it is very difficult to bring foreign professionals to NPRDC on 1-year sabbaticals. We've tried to do this, and it's almost comical. It's almost too hard to do. We wanted to bring someone in from a friendly allied foreign academic institution with a well-established track record in a particular area that we were concerned with. The State Department basically, and I understand the problem, set up some very strong safeguards, probably in the interest of national security. I don't see that to be a major problem insofar as our business is concerned. I see it to be a kind of sticky issue that we would like not to have there. But, I haven't really thought or reflected upon whether or not that fits within the context of a national cultural issue.

Comment: It does sort of put a damper on the whole concept of sharing technology transfer and building up of relationships with other people and other groups. This sort of thing could permeate all levels of the organization. It could influence you not to invite somebody in to look over what you're doing or to find out what they're doing because you know it's not going to be very well supported up the line.

Comment: I want to respond a little bit. What you say is true. I think there's a paranoid psychology right now. We're

reacting to the apparent giveaway of our technological advantage to the rest of the world, particularly with regard to computers. We could theorize that part of this paranoia is our resentment of this fact; it's a sort of rationalization that we're losing a lead in something that we always took great pride in. We had greater technological aids even though we had inferior numbers. But, I think that an organization as big as ours ignores all that crap and doesn't let it get you down. You don't go out and break the law and get your butt in jail. That's dumb. It's hard to do research in jail. But literally, you don't have to have permission on a hell of a lot of things. Researchers may overact. I would agree with a previous comment that you must keep the people questioning; but, you want to be damn sure they're creating pearls and not potholes.

Comment: I'm having a problem in that I am probably the least acculturated person in the room. I know that there are a lot of things you're saying today in code. The only way to find out is to react, and then I'll find out from your reaction just how much distance there is. One of the things that I've observed is that the role of NPRDC is not essentially one of engaging yourself in basic research, but, rather, being engaged in the transition role. You find out if anybody's doing anything smart out there. You must be good at picking out what it is and then determining how to transition that technology into the Navy. If I look at it that way, one of the problems I see in the academic end of that production process is that in academics, the development of ideas in a field is often very sticky.

For example, a field germane to our topic is Division 14 of APA covering industrial and social psychology. This was a flourishing, rich, dynamic area in the 1940s and 1950s in large part because of the research sponsored by the Navy as well as by the Army. In the 1960s, it started to lose steam, and I would say, personally, it became stagnant by the 1970s, and it's been essentially braindead for 10 years now. The problem is the superstructure in the universities. You have all these tenured full professors who were trained during that period who only know how to do that stuff, and they're still doing it. If for institutional reasons, you are closely coupled with that set of people, then you're stuck because they're stuck.

". . . you must keep the people questioning; but, you want to be damn sure they're creating pearls and not potholes."

What I think's been happening in the business world, and among those who study the organizational behavior kinds of things, is that we've gone through two huge transitions in the last 10 years. You're aware of these because I know you keep tabs on this stuff. The first one was a bringing in of institutional economics. It is a very new kind of organizational area that has had an immense impact on the way people think about the field. As usual, that took place only in the top five business schools in the country, and it's been a very thorough change. You can't, for example, find these changes at the majority of business schools. I talked to the head of the organizational group at Northwestern on the phone last year and asked if he had hired anybody in the organizational behavior area. He said that he didn't hire anybody this year even though he had two openings. The reason was that he decided at Northwestern that heretofore they will not ever hire another behavioral scientist who didn't have good conversant skills in microeconomics because that is so clearly now established as the future of our field. You can't find anybody at Yale, Chicago, or UCLA who doesn't have those skills. But, if you go

into the other 290 accredited business schools in the AACSD, you aren't going to find that level of development. You will 15 years from now, and then while people are just catching up with that one, the next wave will be bringing in institutional political scientists for the first time in a fundamentally different way. It's going to cause a revolution in the way we study organizations in business schools. The foundations are just lining up now. I can tell you right now about $50 million in foundation support that will go into the business schools over the next 10 years to make this happen. It's going to be an intellectual revolution. When you've got things changing at this pace, then it seems entirely possible that the institutional structure that we have in place now, which was designed for a different period, may no longer be functional.

"When you've got things changing at this pace, . . . it seems entirely possible that the institutional structure that we have in place now, . . . may no longer be functional."

ISSUES IN RESEARCH TRANSITIONS: A PERSPECTIVE FROM RESEARCHERS

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The production and utilization systems for scientific research involve two distinct communities, both with well-developed values, norms, customs, and practices. The authors discuss a range of factors that contribute to successful dissemination of products from the science research community to the practitioner community. Several propositions are put forth regarding the transition process and how to improve it.

Just before the break, I really enjoyed the discussion of Jim's paper. However, I've got to tell you that when Bill Ouchi said that Division 14 used to be really strong and vigorous in the 40s and 50s and into the early 60s but by the 1970s had pretty much faded away, I think to use his rather colorful phrase "braindead," that got me right here. I was president of Division 14 in 1975. I'm really glad I came to this conference. Well, the remarks that I'm going to make this morning are a joint effort of myself and two of my Irvine colleagues, Jone Pearce and Bill Stevenson.

The topic of this conference--improving the research transition process--is one that is both fascinating in its complexity and important in its implications. It is also a topic that, from our perspective, has been relatively ignored in the past. Thus, we welcome the opportunity to explore it and offer our views and ideas about it. We believe, as we will stress later, that if progress is to be made in improving the quantity and quality of transitioning, it is necessary to start (and continue) thinking about it.

In the remainder of this paper, we will first try to delineate what we consider to be the nature of the basic "transitioning problem" (or, to use a more optimistic phrase, the "transitioning challenge"), then will present several fundamental propositions that will serve to outline our basic approach or orientation

to it. As the title of our paper indicates, we are deliberately taking the perspective of researchers--since that is what we know best. We want to emphasize in advance, however, that we fully appreciate and recognize that other perspectives are not only relevant to understanding the topic but also equally crucial for making progress in this area.

Nature of the Problem/Challenge

If progress is to be made in improving the research transition process, it seems essential that we have as clear a picture as possible of the nature of the obstacles that hinder such progress and of the factors that can facilitate it. Therefore, in this section we will attempt to analyze the challenge of research transition as a prelude to some of our ideas about what can be done to facilitate it. Throughout this section we will draw heavily on two recently published papers, one by Kilmann, Slevin, and Thomas (1983), and one by Beyer and Trice (1982). Both papers are extremely helpful in getting a grasp on the basic nature of the problem.

The Production/Utilization System. As a starting point for examining the research transition process, one can focus on the two most fundamental activities involved: the production of research and the utilization of research. In this connection, a systems model developed by Kilmann and his colleagues is quite useful in gaining an understanding of the context in which these two types of activities take place and how they interrelate (see Figure 1).

Let us first look at the so-called "production process." As Kilmann et al. and many others point out, the production of scientific knowledge takes place in what is, in effect, a "community of researchers." This community (or "subsystem," in systems terminology), like any other community has a set of well-developed values, norms, customs, and practices. A pivotal set of values for those who attempt to produce scientific knowledge revolves around such objectives as "rigor," "internal validity" (the elimination of competing alternative explanations for obtained findings), and "the pursuit of knowledge for its own sake." These values tend to be highly shared within this production community, and hence those who produce find it more comfortable to disseminate their findings to, and discuss these with, others inside rather than outside the community. In other words, there is an exceptionally strong "in-group" culture that gets developed and is consistently reinforced (e.g., by achieving acceptance of an article in a scientific journal) as long as the producers stay within their own community.

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The user community (or, perhaps it would be more accurate to say the community of potential users), of course, has its own set of values, norms, and practices. Would-be users of scientific research results in organizations value usefulness and relevance, with the objectives of making better decisions and solving problems (often, of an acute and short-term nature). They tend to place considerable weight on knowledge gained from experience (as compared to knowledge that might be learned from research), and they have a relatively high rate of interaction with other practitioners. Thus, they too, have their own tight-knit in-group community (at least within their own particular category of practitioners) and appear to be much

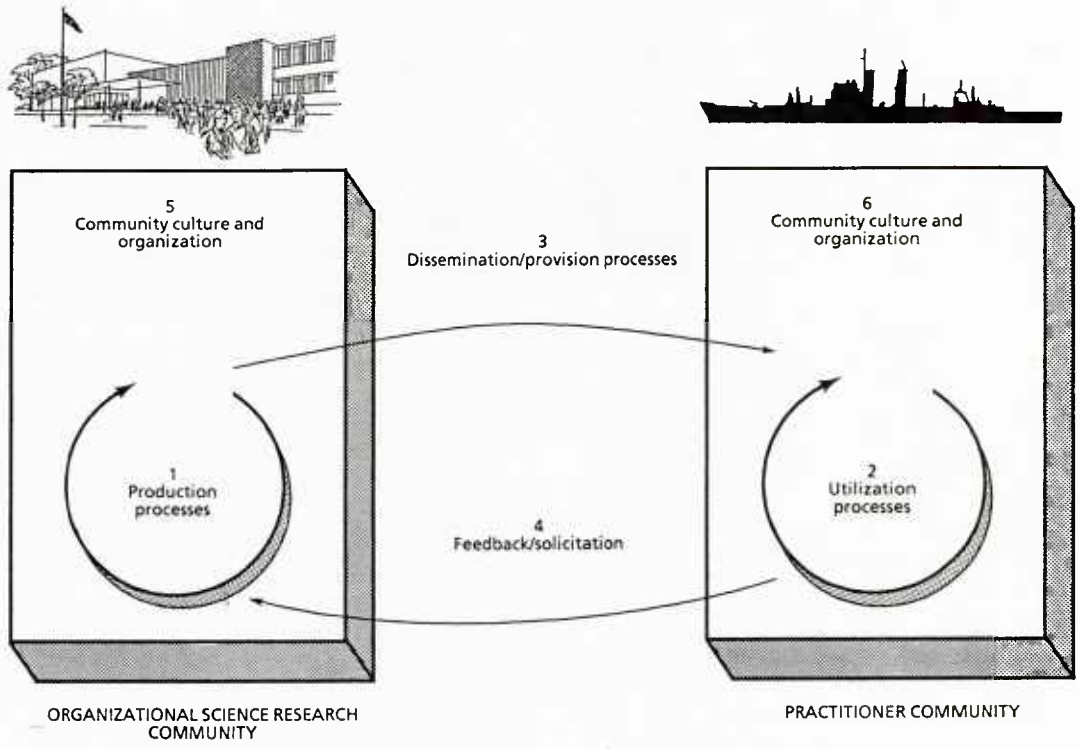

Figure 1. Overview of the product/utilization system for scientific research.

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more comfortable within that culture than within the (research) production culture or on the boundary between the two cultures.

If we put these two pictures of the production process/culture and the utilization process/culture together, we can agree strongly with the conclusion of Kilmann et al. (1983, p. 15): "These different cultures make it difficult for processes to occur across the boundaries. Processes take place rather well, relatively speaking, within each community as opposed to between the two communities."

To return to the (Kilmann et al.) diagram as an aid to our analysis, it is useful to highlight the other three sets of factors that also influence how well and how much the research transitioning takes place. These are the dissemination process (No. 3 in the diagram), the feedback process (No. 4) and environmental forces (No. 7). With respect to the first of these important factors, it seems clear that members of the research producing community have a strong tendency to disseminate their findings to other members of the same community rather than to the user community. Indeed, there are often strong negative forces (particularly if the producer is in an academic setting) against "popularizing" one's results for use by practitioners. The producer is in danger of being seen by his/her colleagues as overgeneralizing and going well beyond prudent (and scientific) qualifications of findings and their meanings. That situation characterizes the front end of the dissemination process. On the receiving

end, potential users tend not to turn to academic/scientific journals or other sources of research results for ideas or bases for action, and instead, as noted above, rely more on their own experience and that of their practitioner colleagues. In short, the dissemination process, as it typically takes place, is a very shaky bridge and often one that does not even stretch from researcher to user.

". . . the dissemination process, as it typically takes place, is a very shaky bridge and often one that does not even stretch from researcher to user."

Likewise, the feedback process from user to research producer is greatly attenuated. Researchers (at least in the organizational sciences area) frequently tend to find their research problems in the conceptual and empirical literature in academic journals rather than by engaging in some sort of dialogue with practitioners. Hence, input by users into the beginning of the research production process is limited (though by no means non-existent), both by virtue of researchers' proclivities as well as by frequent indifference (or the preemptive assumption that they won't be able to influence researchers' choice of problems) on the part of users. If practitioners, by some chance, do attempt to make some use of research findings, their experiences with such attempts do not necessarily get fed back to those who originated the research. Thus, the feedback loop, so often discussed in analyses of any communication process, very frequently does not get established in the research-production research-utilization cycle.

The final set of factors in this systems analysis concerns environmental forces that may impact how much transitioning does or does not take place. In recent years, as Kilmann et al. point out, both those who generate research knowledge (about organizations) and those who could use such knowledge have come under increasing pressure to pay more attention to each other's potential contributions. That is, the pressures appear to be increasingly against the tendency to remain totally within one or the other particular (researcher or user) cultural community because the sense of smug security that formerly existed is rapidly being eroded. Researchers (especially so-called basic researchers in social science areas in academic settings) are finding it increasingly difficult to obtain funding for pure (i.e., non-applied) research. Furthermore, various elements of society appear to be questioning seriously the usefulness--from a broad societal perspective--of much of the research that has been produced to date. On the other hand, organizational practitioners have not gone unscathed in terms of society's scrutiny. The vagaries of the economy--especially the example of the most recent recession--and the highly-publicized inroads made by foreign competition in the past decade have caused many organizations and managers to examine whether their past ("seat of the pants") practices are sufficient to meet future challenges. Society is, rightfully, asking many questions of managers and their organizations. Thus, there appears to be heavy environmental pressure on both research producers and users to consider in a more serious way and to a greater extent what the other side, so to speak, might have to offer. Nevertheless, despite these very real environmental forces that seem to be working in the direction of bringing researchers and practitioners closer together, "the know ledge production/utilization system oper ates currently as a very loosely linked system" (Kilmann et al., 1983, p. 13).

The Utilization Process. Let us now look at the utilization process in more detail. For this discussion, as we previously noted, we will rely extensively on the excellent article by Beyer and Trice (1982) that examined findings from some 27 empirical studies of the process as well as provided a useful conceptual framework for assessing those results. (We should note that we are using only a very small part of the findings and analyses that are discussed in detail in the article.) As they point out, the utilization process can be thought of as involving two sub-processes: adoption and implementation. The former sub-process "includes the set of behaviors through which decision makers choose research to be used..." while the implementation sub-process "includes the set of behaviors through which managers and other users actually carry out research prescriptions." It is important to stress (as Beyer and Trice do) that either subprocess can precede the other: Adoption of research findings would logically seem to precede implementation, but often in the real world a research finding is implemented (because "somebody" wants to try it) and only later, if it works out, is it adopted. In effect, these two subprocesses often co-mingle in a reciprocal sense.

If we, arbitrarily, look at the adoption part of the utilization process first, we need to consider such information processing activities as "sensing" and "search." The research literature, according to Beyer and Trice, focuses on four key issues in these activities: (1) the "nature of the linkage between researchers and users, (2) the "activities of persons in the linking roles," (3) the "timing of the research relative to events in the user system," and (4) the "ease with which users understand research results." Clearly, each of these four areas of behavior or activities, singly or together, can impede or strengthen the adoption process. The presumption in the literature is that adoption would be facilitated if researchers and users could establish stronger and more frequent links, if individuals in potential linking roles (e.g., human resource staff specialists in organizations) could be better utilized by both researchers and the organizations for which they work, if research results could be brought to bear in a more timely fashion on the problems faced by users, and if research findings were reported in ways more consonant with user interpretive frameworks. Suffice it to say that the available literature (our interpretation, not necessarily that of Beyer and Trice) does not provide very many clear cut and well-documented prescriptions for dealing with each of these adoption activities. (We will have more to say about this in the latter section of our paper.) Each of these activities is a good deal more complex than any simple prescriptions might indicate, but at the same time each does appear to be a useful point of attack for improving the adoption process.

". . . there appears to be heavy environmental pressure on both research producers and users to consider in a more serious way and to a greater extent what the other side, so to speak, might have to offer."

Turning to the subprocess of implementation, three types of use have been identified (Pelz, 1978): instrumental, conceptual, and symbolic. Instrumental use of research findings refers to the direct use of results for specific objectives. How frequently this occurs appears quite problematical (insofar as the literature shows). A key issue in potential instrumental use is how applicable any piece of research is to a specific organization or to a specific manager's situation in an organization. Conceptual use of

research findings--"using research results for general enlightenment"--appears much more prevalent than instrumental use, but, by the same token, has less direct effects. It also, as Beyer and Trice note, "demands much less of users than instrumental use." The third type of use, symbolic, refers to invoking research findings to support or legitimate some party's view of what ought to be done in a situation. Those who have studied the utilization process (e.g., Pelz, 1978; Weiss & Bucuvalas, 1980) disagree on the frequency with which this approach occurs. Certainly, organizational lore would indicate that it is not uncommon, since it seems so intimately tied up with political processes in organizational settings. At the very least, the potential symbolic use of research findings does raise two troublesome ethical issues (Beyer & Trice, 1982): The possibility that researchers and their findings may inadvertently (from their standpoint) be used by managers/management to legitimate changes or the maintenance of the status quo that favors them but not others, and the possibility that users may deliberately distort research findings to their own advantage.

Whether research findings get adopted and implemented appears to depend on a rather large number of factors, many of which we have discussed above. In the end, the available literature (according to Beyer and Trice) indicates that users employ four kinds of criteria to determine whether or not they will adopt and use (in some manner) research findings:

1. Quality of the research. This is an elusive criterion that exists in the eye of the beholder, and it is not always clear (from the available literature) that users necessarily prefer higher to lower quality findings, although presumably almost all would report that they are more influenced by the former. What does seem to be influential with respect to this criterion is whether there appears (to the user) to be some kind of "triangulation" of findings--from different studies and obtained by different methodologies--that can provide a reliable basis for action.

2. Congruence with experience. The more that research findings are seen as confirming a manager's own direct experience, the more likely they are to be utilized.

3. Relevance. If users perceive research findings to be relevant to their own job and organizational responsibilities, they are more likely to use them. However, such relevance is frequently defined in very narrow and often highly self-serving ways.

4. Perceived manipulability of variables. If users believe the research reveals variables that they can change or affect, then utilization is more likely. Again, it should be noted that what is manipulable for one manager or organization may not be so for another.

"The presumption in the literature is that adoption would be facilitated if researchers and users could establish stronger and more frequent links . . ."

Some Propositions Regarding the Transition Process

With the above analysis of the nature of the transition process as a backdrop, we now proceed to develop several propositions that we would put forth regarding the process and how to strengthen and improve it. These are not firm, proven conclusions, but, rather, are in the spirit of the dictionary definition of the term proposition: "something to be considered...something affirmed for discussion."

Proposition No. 1: To improve the transitioning process, there needs to be (more) direct focus on transitioning.

A review of the literature--at least in the organizational sciences literature--reveals that there has been only limited attention to the transitioning process, and most of that has occurred only within the past few years (under such labels as "knowledge utilization," "research utilization," and "producing useful knowledge"). Thus, to be honest about it, our field does not yet know a great deal about how to transition research findings successfully. Clearly, as we have attempted to indicate in the first section of this paper, some issues have been identified and clarified, and a knowledge base about "knowledge utilization" is beginning to be developed. However, we would assert that if major advances are to be made in this area, far more attention has to be paid to the transitioning process than has been the case heretofore. Our guess is that this will become a major topic during the latter half of this decade, and our assumption is that such increased attention will result in increased transitioning of basic research findings to a developmental stage and subsequently to organizational applications.

"... if major advances are to be made in this area, far more attention has to be paid to the transitioning process than has been the case heretofore."

Proposition No. 2: There already exists a rich "academic soup" of theory and research findings (in the organizational sciences area) that has formed the basis for transition to applications.

The basic thesis we are putting forth here is that there have been a number of conceptual and empirical developments in the organizational sciences area in the past 30 or so years that have already been transitioned and utilized by managers and organizations. Furthermore, and this is the heart of our proposition, we would contend that a major way to facilitate the transitioning process is to encourage the continued development of this "rich soup." To put this another way, the notion of a soup is that it is not any single ingredient that permits (so to speak) tasty utilization, but rather it is the mixture or combination of ingredients. To put too much emphasis on any single ingredient, or to try to select a single ingredient to form the basis of the soup, will destroy the hoped-for end result. Therefore, in terms of the research transitioning process, the implication is that it is the entire set of theories and research findings that can ultimately be of most help to organizations with respect to the production of something that can subsequently be applied. The richer this mix is, the more likely that theories and research findings will be developed for transitioning.

To return to our second proposition, we believe that there are a number of examples of past basic theory and research that have formed the basis for transitioning and utilization (sometimes instrumental but probably more frequently conceptual). Just to cite a few examples: In our view, much of what Douglas McGregor put forth in 1959 in terms of his arguments for Theory Y were subsequently adopted by a number of organizations in the United States, although this was not readily apparent until Peters and Waterman published their widely-read account (In Search of Excellence) of how the best-managed companies in the U.S. related to their employees. Similarly, the conceptual and empirical work by Rensis Likert at the University of Michigan in the later 1950s and early 1960s formed the basis for a number of successful applications of a Systems 4 type of approach by Michigan's Institute for Social Relations at General Motors and other organizations (e.g., see Bowers, 1983). Other examples we would cite would be the extensive basic research that has been carried out since the 1920s on test validation for selection that has been of assistance to organizations in meeting highly appropriate federal guidelines for EEO, the basic research on behavior modeling that has formed the foundation for a considerable amount of current approaches to supervisory training, the research on personality assessment that was the basis for the widely used assessment center approach to management selection and development, and the research findings in both decision making and participation that led to the development and subsequent use of the Vroom-Yetton decision-tree techniques for helping managers analyze when to use and encourage employee participation.

A major point to be made here is that the "real world" of managerial and organizational practice is confronted with a wide scope of problems to be solved, and it is not possible to predict with a high degree of reliability exactly which theories and research findings ultimately will be most useful. Hence, it seems logical to assume that the richer the available mix the more likely that managers/organizations will be able to find something that is useful. Furthermore, since real world organizational problems change over time, something that appeared not to be highly useful (or useful at all) in the past may turn out to be useful in the future. The problem is that some theory and research will (on a probability basis) never prove to be useful (at least over some defined span of time), and it would be helpful to know how to separate the two types. However, this is probably an unrealistic objective and the pursuit of the objective might actually weaken the broth rather than strengthening it. This chain of reasoning--that it is difficult to know or realize at the time a theory or research finding appears whether or not it will subsequently be useful--leads to our next proposition.

". . . the "real world" of managerial and organizational practice is confronted with a wide scope of problems to be solved, and it is not possible to predict with a high degree of reliability exactly which theories and research findings ultimately will be most useful."

Proposition No. 3: There is probably more basic theory and research literature already "out there" that can be put into a transition process than people realize.

The previous proposition attempted to demonstrate that the array of organizational theories and findings already available has led to some fairly clear-cut transitions into practice. In the present proposition, we are asserting that there are probably even more research results that could be put into transition than is currently recognized (either by researchers themselves or by organizations looking for findings to apply). To illustrate this proposition, we will focus on what we think is an excellent recent example of how basic theory/research findings can be put together to form the basis for transition. This example is based on the work of Professor Raymond Katzell and his colleagues in developing the "Motivational Audit." The example is presented here with the permission of Professor Katzell.

The Motivational Audit consists of a "set of instruments for diagnosing the work motivation of (an organization's) human resources," with the objective of providing the organization with information that would be "helpful in determining which kinds of motivation improvement programs are likely to be effective in a particular situation." The three instruments that form the Audit include a questionnaire survey of employee perceptions, an inventory of the organization's policies and practices (based on available documentation as well as on interviews with key managers and staff specialists), and a set of measurements (both objective and judgmental) of performance results. As noted, the audit is designed to form a sound basis for specific remedial actions (which in themselves have been found by research to have promise).

The really interesting aspect of the Audit (especially for our concerns at this workshop) is the rationale and bases for its development. In the words of its developers, "research shows that each of the current theories (of motivation) seems to provide weak or partial explanation of work motivation. Since both logical analysis and empirical data indicate that the theories generally do not contradict one another, a promising approach to predicting work motivation more accurately would appear to entail combining or integrating the more cogent of the theories. That is the approach taken in the Motivational Audit. (The theories include need theory, attitude theory, expectancy theory, goal theory, and so forth.) The integrated theory (as developed, tested, and expanded by research findings) encompasses some nine basic "elements" (e.g., employee preferences and values, job incentives, performance-reward linkages, etc.), each of which is covered by some part of the Audit. The information on the total set of nine elements thus forms a comprehensive picture of an organization's work motivation level and structure." To reiterate, and emphasize the point made by the developers, it was not a single theory or a single set of research findings that produced the Audit (and thus it could not have been developed after only an initial few years of research work on work motivation), but rather the "combination" and "integration" of such theoretical and empirical work.

We suspect that there are other sets of conceptual ideas and empirical data that have been collected over a period of years that similarly could be put together to provide for transition such as was done in the case of work motivation by Katzell and associates. Probably, the extensive theoretical and empirical work on leadership, if properly combined and integrated, could be put into a form for transitioning on a greater scale than has been the case to date. Similarly, some of the basic research on turnover and organizational commitment by Mobley and associates and by Mowday, Porter, and Steers, has potential for more transitioning. There are likely still other examples that have

not yet occurred to anyone. We believe there is, as we said above, already more in the broth than is apparent on the surface. Even so, other steps can be taken to facilitate and improve the transition of present and future research. Thus, the next proposition:

Proposition No. 4: Organizations such as ONR can take concrete steps to facilitate and encourage transition of research findings.

To say that there is considerable research and theory already available that possibly could be the basis for additional transitioning is not to say that the process itself cannot be improved. We believe there are some specific actions that research sponsors, such as ONR, could take that would have a strong, positive impact on transitioning.

One such approach that would be particularly appropriate to an organization such as the Navy would be to make specific use of "applied researchers" (such as at NPRDC) in the process of transitioning basic research findings. For one thing, the applied researchers are in a potentially highly advantageous position to bridge the gap between the basic research community (discussed in the early part of this paper) and the ultimate user community. They were trained and developed in the former community and hence can both communicate with academic and other basic researchers and readily understand their findings. Likewise, being a part of the larger user organization, they have easier access to users and are more likely to understand and appreciate their applications problems. In effect, the applied researchers in an organization like the Navy are in a good position to be translators and developers of basic research findings, if the organization makes a deliberate effort to utilize them (the applied researchers) in this capacity. Additionally, the applied researchers could form joint research projects with basic researchers with the explicit objectives of both (1) suggesting research issues and problems for investigation by basic researchers, and (2) transitioning certain basic research theories and findings to a further developmental stage. Such joint projects could take many forms, with various degrees and quality of involvement of both parties.

"We believe there are some specific actions that research sponsors, such as ONR, could take that would have a strong, positive impact on transitioning."

". . . one other rather simple step that ONR could take would be to require that each research project in its final report contain an explicit section on potential applications."

A second basic approach that a research sponsor organization such as ONR could take would be to fund some research projects on the transitioning process itself. Such research projects could focus on both how the origin or production of basic research projects subsequently helps or hinders the transition process, as well as on how user contexts facilitate or impede transitions. In other words, such research on the transition process could be directed to both the start and the finish of the process as well as to the linkages in between. Some systematic research on the transition process should have the potential for informing us more about it than we currently know. As already emphasized earlier, our knowledge about knowledge utilization is rather slim.

Yet one other rather simple step that ONR could take would be to require that each research project in its final report contain an explicit section on "potential applications." It should be clear that we are explicitly not recommending that the ratio of basic to applied (organizational) research in the Navy should necessarily be changed, or that ONR research should become more applied. We are only suggesting that researchers should be willing and able (even if not necessarily eager) to state what they think are the implications of their findings for possible subsequent transitioning and development for ultimate application. We do not think any researcher(s) should be able to say: "Just give us the money and leave us alone and don't bother us with those types of questions."

Proposition No. 5: Probably no single approach to improving the research transition process is likely to be uniquely successful. What appears to be needed is a multiple set of approaches, each of which can contribute to a better and more substantial process.

In the case of the research transition process, we would bet that multiple roads to Rome will prove to be better than building a single major highway. Complex problems/challenges are likely, fortunately or unfortunately, to yield to complex rather than simple solutions. So with that, I'll stop and we're open for discussion.

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COMMENTS FROM THE AUDIENCE

Comment: One thing struck me as being really interesting with regard to Figure 1. If I were to look at that from the standpoint of organizational economics, and I understand that this may not be the more efficient way to do it, I would say that this is a classic problem in vertical integration. The question is, Should the Navy make or buy applied research? That is, should it make or buy basic research and at what levels should it integrate vertically? What makes me think about the problem in this way is an example from private industry. On the left-hand side you have semiconductor maker who is a supplier and on the right-hand side you have a computer maker who is the customer. As the use and technological change in semiconductors has become more important and more ambiguous, more uncertain, we've seen very different kinds of solutions evolve.

Number one is the Motorola solution where Motorola is on the right-hand side. They simply buy most semiconductors from a variety of outside vendors, although they clearly make some of their own. The second solution is the GE solution. GE, on the right-hand side, used to have it's own vertically integrated semiconductor operation. They discovered that the left hand was so different from what they knew how to do well that they were ruining that semiconductor business. They got out of the semiconductor business in the 70s and then decided that they had to have a close relationship with that input but that they were not going to do it themselves. Thus, they went out and bought Intel and proceeded immediately to run Intel into the ground. The third solution is IBM on the right-hand side and Intel on the left-hand side. It's an intermediate solution. It's a solution in which IBM has purchased an 18 percent equity interest in Intel and has one member on the board. It's neither full vertical integration nor is it simply dealing in a faceless marketplace. It's an intermediate form,

"The question is, should the Navy make or buy applied research?"

and I think it's probably the best solution to that particular problem. It's far superior to either the Motorola or the GE solution.

In a sense, that's precisely what ONR does and what NPRDC does right now. Look at the dual leadership of the technical director and the CO. Look at ONR. They're going to encompass both people like you and people like me under this purview. That's precisely what they're doing right now. The question that I would ask myself, as one would with any vertical integration problem, is how can we alter the incentives faced by the provider and by the purchaser in the way that arrives at the most desirable outcome. For example, ONR may go around and push a basic researcher to see things in a way that they think is more useful to the Navy. As you know, there's competition for the best researchers in any field, and you can be pushed just so far. If you're the seller, you're the researcher, and if the demands that ONR places upon you get to be too great, you're going to say forget it. It's more trouble than it's worth, and I'll go get my money someplace else. So I guess the question I'd ask is, Do you have some suggestions on how

one alters the incentives in such a way that you're going to get a more desirable outcome?

Dr. Porter: I'd like to hear ONR and others. I think that's a really good question. What is the reinforcement environment for transitioning in which both producers and users operate? What is the advantage of the users to take whatever is produced and what is the incentive of the producers to try to work toward the dissemination of the product?

Comment: Let me say one thing that we have done at ONR. First of all, we recognize that there are basic researchers who only want to do basic research and not applied research. There are others though who are interested in applied research. What we try to do is provide opportunities at ONR for both categories of people. Of course, we always like to see something transition into applied research. Therefore, we also encourage research projects from those who are interested not necessarily in transitioning their own research but in taking some conceptual, methodological developments accounted for by somebody else and then seeing if it would work in the Navy context. But, I guess the real question would be, How much of this should we be doing? As I indicated, the amounts of money that we have in the 6.2 area is less than the money in the basic research arena. This has at least one important consequence. If everybody in our basic research program wanted to transition, there wouldn't be enough money to do it. I suppose the appropriate question is, What is an appropriate ratio of funding between the two categories?

Dr. Porter: I think one thing that you have to keep in mind relevant to this is that a particular dollar of basic ONR research has a multiplier effect. Basic research stimulates other producers, who are not funded by ONR and in no way connected, to further develop those results and challenges them and do their own basic research. So, over the years, ONR has gotten more for their money than might appear on the surface because research funded by ONR stimulated others to do more of it. Still, I think the issues are the bridges.

Comment: How much research transition is there from 6.1 to 6.2? Do the 6.1 and 6.2 research sponsors deal a lot with each other?

Comment: Maybe it's a foregone conclusion, but it seems like economics is probably one of the strongest criteria for many of the things that we've talked about. The products that come out of the left-hand research factories are not end products. They're the beginning of an entire series. That series is not linear in terms of funding. It is a pyramidal one in which you have a bunch of research ideas that are investigated. It then takes a horrendous budget to carry some of those through to implementation. Of course, many of the areas get ignored. I heard Jim mention technology on the shelf or the research soup. The ideas are there, the technology is there, but the budget isn't there to take them all to fruition and implementation. Unless you change the process either fundamentally or economically, I think technology on the shelf is a by-product of the process. So, in addition to the people side of the issues that are being brought up here, it seems to me that the driving force is the fundamental economic process itself.

"If everybody in our basic research program wanted to transition, there wouldn't be enough money to do it. ... Unless you change the process either fundamentally or economically, I think technology on the shelf is a by-product of the process."

Comment: You mean how budgets are allocated?

Comment: No. Given a handful of ideas, the user will develop those based on what the need is and on the budget available to carry it through to implementation.

Comment: The key thing is that technology on the shelf is not a failure. Technology that doesn't get transitioned is not a failure, and it shouldn't be viewed that way. We sometimes do. The success of transitioning is often used as a criterion to measure the performance of 6.1 researchers. We get out our suitcases and sell to the community saying, Here's a bunch of ideas. If they gel, if a need is seen and the funds are there to take an idea and go through the acquisition process and implement it, then it happens. What we're really talking about, I think, relates to the issue of whether the right ones are being transitioned, given that there are many ideas available for transition.

Comment: If technology is on the shelf, the only way we can sell putting 6.3 money in the budget is if there's an urgent fleet problem that requires that technology for solution. When it comes to the bottom line, you never have enough transition money. We're always cutting at the end of the budget cycle. So, the only way we can take something off the shelf is if we describe how it's going to solve fleet problems. The problem is that there's been a disjoint between the research community and the end user, and I mean the final end user, the command that's actually going to use the product. If you get the person that's actually going to use the R&D product to say that I have a need and I understand how the research will meet that need, then resources can usually be generated to transition the research. But, unless that gap is bridged, the research ends at 6.2 and doesn't transition into 6.3. Ironically, the 6.2/6.3 break isn't even our worse gap, it is the 6.3 to implementation transition. The problem here is that someone completely divorced from the research community must come up with implementation resources.

Comment: I'm from the Naval Medical Research and Development community and not from the operational forces. The problem I see is the distance the research laboratories are from fleet operations. We're even farther away than you are because we get our money from ONR. It then goes through the medical command, then to the R&D command, and then comes down to us. Somewhere out there, there's probably an admiral who at one time thought he wanted certain research but by the time it gets down to us, we're not sure who that admiral was or if he's even still there. I think there is an issue of whether the research community should be directly under the control of the operational commands or whether they should continue to be under the material command, R&D command, or medical command.

"The key thing is that technology on the shelf is not a failure. . . . What we're really talking about, . . . relates to the issue of whether the right ones are being transitioned, given that there are many ideas available for transition."

I was talking to a military researcher from England and a problem came up there with which I'm particularly concerned. It was the use of sleeping pills for their air group people in the Falklands. So, the strike command said I have this problem and he went directly to the research command and within three hours they had a solution. An hour later it was out in the field. Our research community goes through too many layers, and one admiral can stop the whole thing if he doesn't think it's worthwhile.

Comment: One of the critical problems we have is that there are too many layers of cooperation necessary to implement R&D. We need to have that cooperation up front instead of at the end where we must try to sell it and get everyone onboard. We need to work out differences between the R&D community and the users up front.

Comment: As an organizational type, I would say what you're talking about is role expectations and what impact organizational structure has on how this process takes place. The structural set-up seems to be critical.

Comment: One of the things that I think organizations need is a person that plays the role of the entrepreneur. I think that those organizations that I've seen in the Navy that appear to be doing well with respect to transferring technology have some individuals that serve effectively as an entrepreneur. This person establishes an affiliative network within the research community and then basically serves as the transfer agent. That's something you can't institutionalize, but you can probably set up a system of incentives that encourage that behavior. Of course, there's also a problem of taking technology that is not really fully developed or fully mature and trying to put a heavy sell on it, much to the chagrin of the research community. In these cases, the users ultimately find that the technology that's transferred doesn't work.

"One of the critical problems we have is that there are too many layers of cooperation necessary to implement R&D. . . . We need to have that cooperation up front instead of at the end where we must try to sell it and get everyone on board."

Comment: I'd like to say something about Division 14. I think it relates to this whole thing about transition. I don't think the problem is with change. I think the problem is with psychology per se. I don't think the problem is in the 70s. I think the problem is in the 60s. In the 60s, when psychology was growing, universities had many openings so psychologists didn't have to worry about placing their graduates in the outside. They could place them in the academic world. So psychology sort of focused on science per se. They sort of divorced themselves from issues concerned with transitioning research. In other words, they sort of did away with the applied technicians. They did away with industrial psychology so it moved to business schools. A lot of departments even got rid of clinical psychology because it was too applied. So within psychology, you had this competition and the applied people lost. Now, I think there's again an opportunity within psychology, given the restriction on enrollments. Psychologists at universities I've talked to are asking, "How do we place our students?" Now, they want to bridge that gap between science and application. Unfortunately, they've sent a lot of good people to the business schools, math departments, and education departments.

Comment: My feeling is that the 6.1, 6.2, 6.3 model may be inappropriate to the rapidly changing environment of the 1980s. Maybe what we should be considering is how to modify the model to make it more appropriate to transitioning research rather than buying more and more into the current model.

Comment: I would like to respond a little bit to a couple points that have been made. I would draw the diagram as overlapping. Rather than improving the incentive process, my own personal view is that each group must thoroughly understand the other community's culture. If you don't have some overlap, you'll never have effective transfer because you'll never build those bridges. I don't give a damn how many roads to Rome you build; nobody will travel on them, or everybody will get lost and go somewhere else. I would modify the diagram so that you have some overlap in those institutions and cultures and make sure that the military operators understood the values of the researcher. If they did, when they become in charge of acquisitions, they're apt to apply some of that knowledge and better understand the legitimate view of the researcher. Likewise, I would put some researchers out with the operators, which we've done. I could give you some very specific examples of very learned, capable Ph.D. level researchers that no one could refute, who spent two years out in the fleet and came back saying, "Hell, we finally really understand that those people aren't all rowdy John C. Calhoun intellects who wouldn't recognize the beauty of knowledge if they fell in bed with it." This is the critical linkage!

The other point I would like to make concerns the business of too many administrative layers. I totally agree that there are too many layers of administrative interface. I don't have any slick solutions. But I would recommend you look closely at the relation between truth and power. What is the best process to go from knowledge born, to research, and then to transition? How do you make things happen and ensure that only the beauty is connected to the ultimate utility? Many times you have to ask what value many research ideas have when you create them. We created so damn many. Who should control this process? We've argued that issue for four years now with no clear-cut solution.

"My feeling is that the 6.1, 6.2, 6.3 model may be inappropriate to the rapidly changing environment of the 1980s. Maybe what we should be considering is how to modify the model to make it more appropriate to transitioning research . . ."

SHIPBOARD CULTURE AND PEOPLE QUALITY

Dr. David G. Bowers
Rensis Likert Associates, Inc.

Successful research transitioning is often the result of an outgrowth of an evolutionary research stream. Bowers discusses a long line of research at the University of Michigan, funded by ONR, that ultimately "downstreamed" into successful applications in the Navy. He supports the argument that there is currently much technology "on the shelf" that could be successfully transitioned to address current Navy problems.

I would like to discuss some recent research that our group at Michigan has conducted, research that is applied, which produced results that are in some ways surprising, and which suggests future research directions whose implications we find tantalizing. To do so, and in the spirit of this workshop, it is useful to view it as an outgrowth of an evolutionary research stream. In a previous paper, I referred to it as an example of "downstreaming," one of two methods of research utilization with which I have some familiarity.

The story began in the late 1940s, when the newly founded Institute for Social Research was trying to establish an organizational behavior research program. A number of very applied research efforts, for the most part in business and industry, had been undertaken, but funding was lacking for real pursuit of knowledge in depth. Contacts by Rensis Likert led to a large grant or contract from the Office of Naval Research to fund real research using data accumulated from those more service-motivated industrial surveys. This early funding made possible

a large number of very important studies and publications. Over the years, these, and the following studies that they triggered, built a substantial body of organizational knowledge.

In 1965, the interest of some of us turned from organizational behavior to a somewhat more applied focus, that of organizational development and change. What was conceptualized, and ultimately carried to fruition, was a 5-year, multicompany effort labeled the Intercompany Longitudinal Study (ICLS). It grew from Likert's conviction that, in the study of organizations, time had been ignored as a variable. Organizational behaviors require time to form processes, and all of these require yet additional time to produce end results. To research the problem, therefore, required repeated, standardized measurements of those behaviors, processes, and results over a period of years and in a sufficient number of organizations to permit correlations and comparisons. There was, accordingly, a large component of longitudinal, organizational behavior research.

However, our interest in the processes of development and change coincided with a practical, real-world fact: that the participating organizations would scarcely stand still for, let alone fund, 5 years of pure research. We therefore added an on-line change agent component, and with it a third component--research on organizational development and change. Finally, the fourth and last component was added: human resources accounting, the procedure for forecasting and valuing the worth of an organization's human resources.

Once more real world factors intruded. The participating firms were willing to pay for the costs of measurement and on-site development work by the change agents. They were willing to pay little or nothing for real research, and nothing at all for cross-organizational research. Once again we went to the Office of Naval Research. Perhaps it was the rapidly changing times, or perhaps it was the opportunity to sponsor research in an area in which little had been conducted, but ONR found the proposal interesting and let a 3-year contract in 1968.

". . . it is useful to view it (transition) as an outgrowth of an evolutionary research stream."

The results of this research, and that from a 3-year renewal in 1971, showed an intriguing and convincing body of common findings and principles, as well as what was some of the first--if not the first--cross-organizational organizational development research. In all, 13 major technical reports were produced, which were distributed to a large number of Navy commands and offices.

In 1972, the relevance of this research, to the Navy itself as a human organization became apparent. We submitted a proposal, focusing upon all-volunteer issues, to the Manpower Research and Development Program. Data similar to those from the Civilian ICLS effort were collected from a representative unit sample of Navy personnel, and from a representative national cross-section of persons age 15 and above. The result was a book-length final report on Navy human resource practices and requirements, supported by some 20 technical reports.

From periodic results briefings conducted as part of this effort, interest began to build among persons from the then-budding Navy Human Goals effort, as it became increasingly apparent that our civilian findings were replicated in Navy settings. This, in turn, led to ONR's funding of an additional 2 years of effort of a very applied kind, in which we designed tools and procedures for what became the Human Resource Management (HRM) Program and the Navy HRM Survey, a Navy-specific version of our own survey of organizations. As you will see, data from the HRM survey was central to our research efforts on Project Upgrade.

Later work transitioned from ONR to the Navy Personnel Research and Development Center (NPRDC), as the in-house, applied aspects became more central. One result of this last (NPRDC-sponsored) work verified another of our critical civilian findings, that of the "two-hump" pattern of significant relationships over time of organizational practices to outcome measures. Just as we had found in industry that there were significant relationships to concurrent measures of cost performance and absenteeism, followed by even larger predictive relationships to future performance, so, for Navy units we found similar effects in relationships to retention rate and readiness.

These findings led us to propose that we pick up the remaining ICLS thread, that of current value human resources accounting. Once more, the ONR Manpower Research and Development Program funded a study in 1978, in which we used our archived civilian survey and performance data in an attempt to forecast and value, discount and capitalize human organization resources. The study demonstrated that the procedure was quite feasible, and it led, in turn, to a proposal, subsequently funded by ONR, for a 2-year study to develop a Navy-specific form of current value human resources accounting.

This particular project, which began in 1981 with the building of a large file of archived Navy data, concluded in 1983 with what had been intended: a current value human resources accounting system for Navy units. However, in 1982 a separate study had been piggybacked on the same data set, an analysis around the effects of Project Upgrade, and it is this research that I would like to describe.

In July 1981, and again in January 1982, Navy Commanding Officers undertook Project Upgrade, an effort to raise the pride, professionalism, and performance of their units by the expeditious discharge of non-performers. Although feedback from the fleet was positive, the actual impact of this effort remained unknown, as did the origins of the problem performance by the persons in question.

"Project Upgrade (was) an effort to raise the pride, professionalism, and performance of units by the expeditious discharge of non-performers."

This present research effort undertook to examine two alternative causal explanations for the problem behavior. The first, the "Bad Apple" theory, was that a number of individuals, unsuited to any structured, demanding environment, had inadvertently slipped through the Navy's extensive screening procedures. If correct, this explanation would predict no particular organizational correlates of Upgrade rate other than a subsequent (to Upgrade) positive impact upon unit performance.

The second possible explanation was more situational and complex. It was that the Upgrade cases were persons whose characteristics and abilities combined with the jobs to which they were assigned and/or the treatment they received to result in poor discipline and poor performance. If this explanation were correct, at a unit level subsequent Upgrade rates should relate to organizational characteristics in the past. In a sense, a unit could be generating Upgrade cases as rapidly as it discharged them.

The research consisted of two complementary streams of inquiry. For the first of these, a large unit-level data file was assembled. For the 174 fleet units in the sample, there were assembled two waves of Navy Human Resource Management Survey (NHRMS) data drawn from the period July 1978 to August 1981, plus Upgrade rate and the following performance measures for quarterly or semiannual intervals over a period variously ranging from July 1978 through September 1982: reenlistment rate (first-term and total), unauthorized absence rate, desertion rate, non-judicial punishment rate, drug and marijuana offense rate, and unit readiness data (five measures).

The second research stream consisted of case-study interviews of persons familiar with Upgrade cases aboard 14 fleet units. The data obtained from these interviews was then coded by content analysts for (1) the Upgrade individuals, and (2) the units. The findings were intended to, and did, shed additional light upon the events and conditions surrounding the development of an Upgrade case. The results from the large-file quantitative analyses are shown in Table 1. The case study analyses (Bowers, Krauz, & Denison, 1983) resulted in the identification of five clearly distinct "types" of Upgrade cases, shown in Table 2.

"In a sense, a unit could be generating Upgrade cases as rapidly as it discharged them."

Several other conclusions resulted from the case study analyses: (1) In a high proportion of cases, the individual was doing well until some event, ordinarily in their personal lives, triggered a profound deterioration. (2) As in the large-file analyses, there was a definite organizational involvement. Units whose top leadership took a more human resources-oriented approach had fewer Upgrades--especially Rebels. Units whose top leadership emphasized immediate tasks had higher Upgrade rates. (3) Once more consistent with the large-file analyses, the key to the prevention of Upgrade behavior appeared to be a structure of cohesive teams, well integrated into the values and mission of the unit.

Table 1

Results From the Large-file Quantitative Analysis

- Unit Upgrade rates for 1981 and 1982 were significantly but moderately correlated.
- With the exception that extremely small units were likely to have relatively lower Upgrade rates, unit size was unrelated to Upgrade percentage.
- Unit type/class adds little variance to the prediction of Upgrade rate.
- Upgrade rate is strongly related to prior unit management practices, with the largest relationships being those over the longest time lag, that is, from Wave 1 NHRMS to Upgrade 1982.
- The strongest NHRMS predictors were those reflecting work group (peer) behaviors and relationships, not those reflecting command climate.
- For both these relationships, and those apparent from a unit profile-typing procedure, the results were consistent: the better the unit practices were 2-to-4 years earlier, the lower the subsequent Upgrade rate.
- Improvement or deterioration in unit conditions and practices also was related to subsequent Upgrade rate. Non-improvement or deterioration was associated with medium-level Upgrade percentages, whereas improvement or non-deterioration was associated with either high or low percentages.
- Unit readiness indicators were found to be unrelated to Upgrade rate.
- Both unauthorized absence and desertion rate correlated significantly throughout the preceding 3-year period with subsequent Upgrade rate. The peak relationship, however, was more or less concurrent to Upgrade.
- Similar results, with somewhat lower coefficients, were found for non-judicial punishment and drug and marijuana offense rates.
- Similar results were also obtained for first-term and total reenlistment rates.
- Combining selected survey and prior performance measures permitted prediction of 56 percent of total unit Upgrade variance (Mult R = .75).
- Special analyses around drug and alcohol measures showed similar lagged effects, with the most effective predictors being those at the work group, not the command level.

Table 2

The Five Types of Upgrade Cases

- Type 1. "Rebels" = Persons whose outstanding characteristic was an anti-authority stance, with performance and drug or alcohol involvements that were secondary to, or derivative from, that basic characteristic.
- Type 2. "Failures" = Persons seemingly unable to succeed, distinguished by lack of a high school diploma and a high unauthorized absence rate.
- Type 3. "Burnouts" = Chronic drug and alcohol abuse individuals, with concomitant hygiene performance, and interpersonal relations effects.
- Type 4. "Dropouts" = Individuals who have simply exited the system psychologically--who have "turned out and turned off."
- Type 5. "Sociopaths" = Aggressive, often violent persons with a recognized high intelligence or potential, and often a history of having been an abused child.

Perhaps the most stimulating, yet perplexing finding was that of the extremely long time lags involved. Considering the dates and times involved, the organizational practices and conditions which so strongly predicted Upgrade percentage appeared to have come into existence in these units 5 to 6 years prior to Project Upgrade--more than two complete crew changes earlier, and before the Upgrade cases themselves entered the Navy.

These findings press for a testable construct, or a set of alternative constructs, capable of explaining the following: (1) Long-term relationships between organizational conditions and practices and unit performance. (2) Long-term relationships between organizational conditions and practices and incidence of Upgrade. (3) Relationship time frames in both cases, which exceed complete new crews, changes of command, and even (for Upgrade cases) tenure in the Navy.

"Organizational practices, climate, and culture tend to be transmitted over relatively long time periods, including several changes in command and changes of the ship's complement."

One possibility, and the one that we propose to test in a subsequent project, may be termed the constancy-velocity explanation. Descriptively, organizational climate and culture are viewed as creating two simultaneous streams of events: (1) A socialization process that changes newcomers toward the unit's prevailing practices more than it is modified by them, and therefore tends to transmit the unit's conditions through time, and (2) a velocity or flow of personnel through the unit over time.

In the case of the incidence of Upgrade, it is proposed that poorly managed units have climates and cultures that demotivate and alienate. One result of this is poor performance as measured by common indicators: high rates of non-judicial punishment and unauthorized absence, lower reenlistment rates, and reduced unit readiness. As crew members are, in effect, "lost" through the personnel-related conditions that these measures reflect, they must be replaced. Over time, therefore, a poorly managed unit will have a greater absolute flow of persons through the unit. If one then acknowledges that there is, among the recruit population, some proportion of persons who may be termed "Upgrade vulnerable," a higher number of such individuals will be present. At the same time, the poor practices that have created this greater personnel velocity, having been perpetuated, serve also to trigger the disintegrative behavior of Upgrades.

Well-managed units, on the other hand, present an opposite pattern. Effective management practices result in a reduced personnel velocity, lower absolute numbers of Upgrade vulnerables, and a transmitted perpetuation of practices that tend to prevent the triggering. Schematically, the flow would be as it is depicted in Figure 1.

This model suggests the following testable general propositions:

- Organizational practices, climate, and culture tend to be transmitted over relatively long time periods, including several changes in command and changes of the ship's complement.

- Personnel velocity results from the replacement of losses incurred as a result of low reenlistment rates, reenlistment for reassignment, unauthorized absence, non-judicial punishment, and the like, which are themselves the result of organizational practices and conditions.

- Units with high velocity, but which have for some reason experienced a positive interruption of the climate-culture transmission, will have lower Upgrade rates than similar high velocity units whose negative practices have been transmitted, but higher Upgrade rates than low velocity units.

- Unit performance will be impacted by the joint effects of transmitted practices and conditions and personnel velocity.

- Velocity events, such as changes of command, deployments, and general or special changes in policy may impact organizational practices, the resulting climate and culture, or personnel velocity directly, thereby altering downstream consequences.

". . . a poorly managed unit will have a greater absolute flow of persons through the unit."

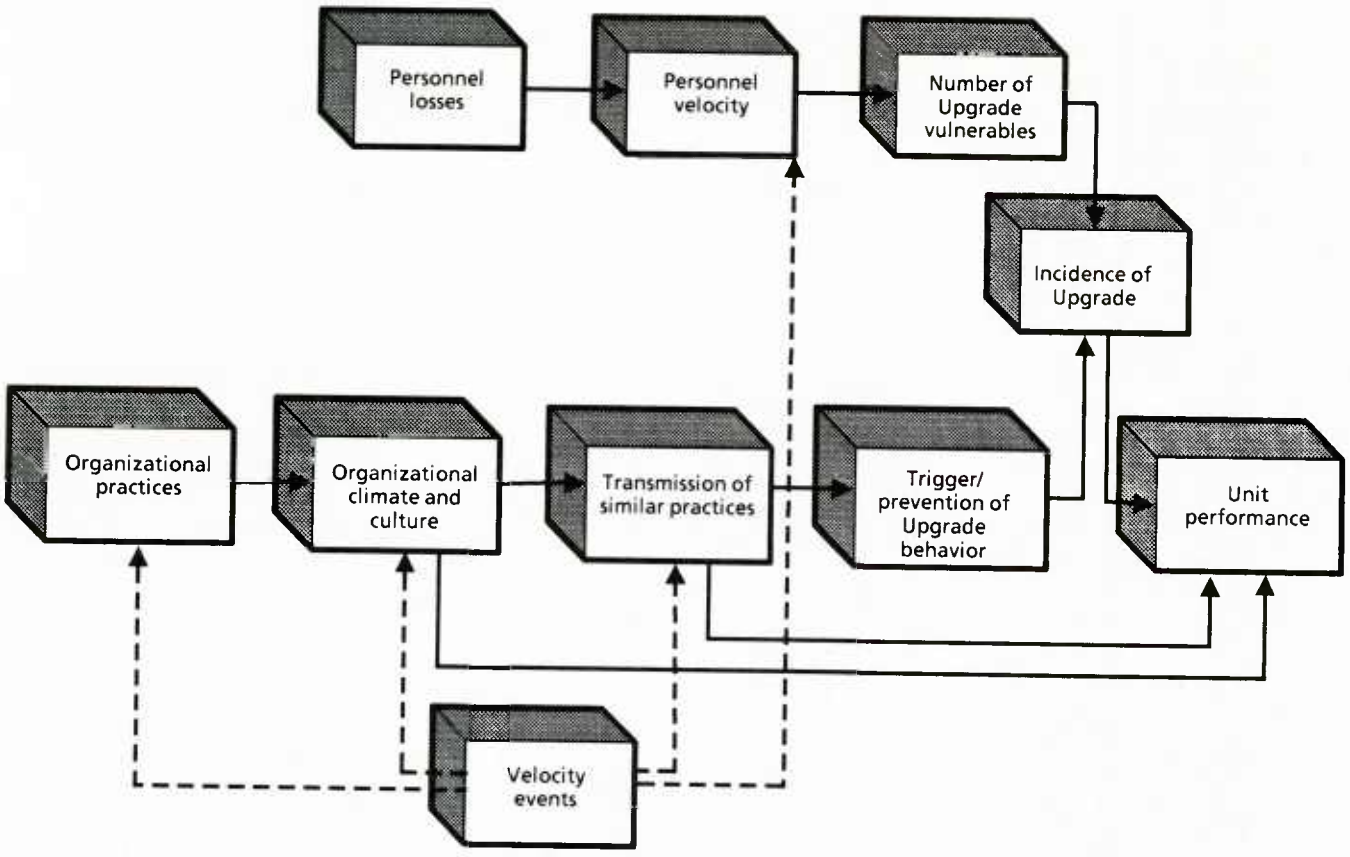

Figure 1. Constancy-velocity explanation: Network of hypothesized effects.

A Few Final Observations

This has been an account of findings from a recently completed study, one which grew out of a series of previous studies. It points, perhaps, to a seldom recognized fact, that there is a difference between a study and research. Studies are separate, self-contained entities, but research requires continuity; it is an accumulative process. In this case, not just this study, but the research of which it was a part, benefitted from extensive contact with the user system, the Navy itself. It enabled us to frame our substantive research problems in real world terms. Perhaps most importantly, it helped us to simulate the

". . . there is a difference between a study and research. Studies are separate, self contained entities, but research requires continuity; it is an accumulative process."

user's thought processes and them hopefully to simulate ours. It is from such as that, I believe, that research transitions successfully.

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COMMENTS FROM THE AUDIENCE

Comment: There's one thing that I find intriguing here. The importance of this, as I see it, is that it's consistent with much of the cultural literature that's coming out now. One of the things that you said was that the predictability came from peer kinds of data and not from leadership or command data. This triggers my mind to thinking that the acculturation process is occurring independently. It is certainly somewhat independent of whatever the CO, XO, and department heads are trying to accomplish. In a sense, there's an independent culture that either operates under Chiefs or E-5s and E-6s. Does that make any sense to you?

Dr. Bowers: It does. I think that the CO and XO probably have an indirect role in whether they encourage the development of that kind of thing. But, I think it's absolutely true that it's down there at that lower level where drug and alcohol offenses are either prevented or they're not, and so on.

Comment: I have to make a comment because I was at sea and a CO during that time frame. The first comment I'd make after you described the five types was that you guys thought we were all having fun out there. My experience agrees with pretty much everything you've said. One thing, though, I really believe is the good ship, bad ship idea. Project Upgrade, all of a sudden, gave the CO the tools to change the culture on a ship. Before, he had to dribble guys out; there were too many constraints such as two drug offenses and a lot of things like that. Project Upgrade, in my experience, gave you the opportunity to change that ship, to get rid of the bad cultural elements down in the bunkroom where people would sleep. As a case in point, the ship I went to in June of 1981 had a drug-related murder down in the sleeping quarters in May of 1981. The chiefs and first class wouldn't sleep down there. They were afraid to go in that area. That's how bad it was. The young man that committed the murder came from a fine family. He was a life scout and a high school graduate. He came into the Navy, and the peer pressure and what was going on down in the bunkroom in the previous 2 years turned him into a drug user. Project Upgrade on that ship allowed me to throw off about 53 people. We threw them off in August of 1981. We had a list of about 90 that we really wanted to get rid of in order to change the culture on that ship. But, we were deployed and I couldn't get rid of all of those people. So, we kept the ones that we thought might make it. Six months later when we came back, there was a second Project Upgrade. When we returned to port, we threw off another 40 people. The ones we thought wouldn't make it, didn't.

Dr. Bowers: I'd like to comment on the broader context of what's going on in the organizational research area. That is, on what should go on and on things that I think will effect it. Some of these are, in my opinion, problems, and some of them

are opportunities. One of the problems is fragmentation in the research. We have a rich soup but there sometimes comes a point where you need to pull things together to integrate them. I think back to 20 years ago. In 1964 in the organizational behavior program, there was a discussion about standardizing measurements. This would allow us to do some multi-organizational research. There was great reluctance on the part of most people to do it, so that was something that I guess Rensis Likert and I took on. It became a survey of organizations. It permitted direct comparisons across organizations just as we'd done with the civilian archives that we had. People may not agree with the Survey of Organizations or with what it measures. But, at least it collects the same data from all kinds of different organizations, and you can do some interesting things rather than try to reference them from fragmented research.

One way to make research more utilizable, if you want to call it that, is to reduce the fragmentation. It's hard to take a bit of this, a piece of that, and something over here and try to figure out whether he was talking about what I was talking about and so on. Something I think somebody alluded to yesterday, and if they did I certainly applaud it, is the notion that I think experiments in this field are probably not feasible in any real sense. When they are, they're probably not valuable. If we control everything except the one thing that you're looking at, that may tell you about that one thing in pure form, but the real world is never like that. Even if you could do it by systematically giving something to someone and systematically holding it back from others, it probably wouldn't be ethical.

Another problem area is that I think we still ignore time as a variable too often. When time is taken into account as a variable, it shows you can forget the forecast and perhaps explain things over time that are important to people out there in those organizations. There's still too little contact with user systems and not enough framing of substantive research problems in real world terms. One of the real advantages to the case studies in the Upgrade was the ability of our staff to go out and actually talk to the people who knew these people and see where they lived and worked. To hear and see it in real world terms was really valuable.

"One of the problems is fragmentation in the research. . . . One way to make research more utilizable . . . is to reduce the fragmentation."

A fact that is going to be of substantive research relevance in the future is the telecommunications revolution. Let me use as an example something in my own university. With the AT&T divestiture, the university was forced to buy a public phone system. It wasn't just a matter of buying a phone system; it was the whole telecommunications thing, particularly as they were then beginning the purchase of some 46,000 personal computers that would be put on campus. Every staff member will have a PC connected into a big mainframe research computer and into the business computer. Let's just take one little phenomenon, a travel voucher. If I put in a travel voucher, I have to list all of the things I spent money on, and I have to attach all those receipts for anything over $10.00. I do all of that and then I hand it to the center administrative assistant who checks it over to be sure that I've done it right. I have the receipts I need and if it goes by her, then it goes downstairs to the business office where two more

people look at it. They check it to be sure that each thing that I've paid is warranted and substantiated and then it goes over to the administrative people of the university. Three or four more people now check it and only after I have passed all those hurdles and they can no longer deny that I legitimately spent my money for these purposes, will they cut a check. All the transactions are going to be from remote terminals. I'm going to enter my expenses on a personal computer. There isn't going to be any paper. In theory somebody, a departmental secretary or someone else is supposed to stash all of these receipts somewhere. They're supposed to be there somehow, but they will pay without any proof. So, it's going to be a trust system instead of a mistrust system, and the whole accounting and control system is going to go haywire. Anyway, telecommunications is going to change a lot of things in organizations.

Another future issue concerns automation and robotics. I noticed one thing. They keep referring to the robots as "he." There's a certain personification going on and not only that, there are no female robots, only male robots. In the future, when I leave at night, I'll tell the robot what to do. Then, when I come back in, he'll have done it all. Tell me, what does middle management do in these kinds of situations? They used to be the integrators and disseminators of information. Now, they're left with nothing to do.

I'd like to also mention the issue of competition. I heard people say yesterday that there is no competitor for the Navy within the private sector. This is true; however, there's a key competitor overseas in the Soviet Navy. As our large industrial companies can testify, foreign competition can have a profound effect on their strategies and actions. Finally, the whole issue of changing opportunities, pressures, and values among the youth of America is an important area. All of the issues I've discussed are things that I think we need to study as organizational researchers. I likewise think that research in these areas has important implications and value to the Navy.

Comment: I thought your presentation on the history of your research work was really interesting. I was thinking in terms of the present. You were mentioning in our workshop yesterday that both the arrows could go both ways. Research should go to the user and the user should have feedback into the research system. Within this framework, I was thinking of the current status of the HRM program or Organizational Effectiveness program as it is now called. It is in trouble right now because the ultimate user is saying, well, this may be useful but under present fiscal constraints, we have very limited resources. Is there anything you could see at the present time where the fleet user and the OE system could turn back to research to help them evaluate the usefulness of their program or to find ways to improve it so it will be more useful?

"There's still too little contact with user systems and not enough framing of substantive research problems in real world terms."

Dr. Bowers: We did do this type of research in the early stages of the HRM program. We had enough evaluation data to determine the value added portion of the HRM effort. We found we could distinguish about five different kinds of fleet units. There were those that improved dramatically, those that improved modestly, those that deteriorated modestly, and those that deteriorated greatly. Then, there was a fifth type where the command climate got worse and peer relationships with supervisors got better, which was kind of strange. We found that the more the intervention activities were demand oriented rather than intense personal face to face kinds of things, the more things got better. We found a number of things like that. There could have been more research of that nature, but we were not funded to continue it.

Comment: First, let me compliment you on what I consider an excellent presentation. I had a question about one of your last comments. I've long been concerned with the implications of our value system, not only in the Navy, but in the country. We can displace what we value as useful. We can maintain our standard of living with 10 percent of the labor base that we have, for example, as we've done in agriculture. We could also do that in the industrial side of the nation. Is anybody looking at the implications of that on a nation that views active participation as a requirement to share in the nation's wealth? We just don't believe in letting people participate in the quality of life in this country unless they're somehow making a contribution. What do you do with the displaced laborer? Is anybody looking at that?

Dr. Bowers: I would hope that somebody is. I'm not aware of who specifically is. Exactly what you mentioned is a problem in southeastern Michigan as the auto industry scaled down and closed plants. A lot of people who had gotten very used to a very good life at high wages by slapping hub caps on or something were suddenly laid off. They did not particularly want retraining, and they were not particularly well suited for the white-collar world. So, they suddenly were forced into rather grungy service jobs such as delivering dry cleaning or mowing lawns. Given increasing automation, I wonder what types of jobs the younger, better educated blue-collar workers of the future will fill?

"I heard people say yesterday that there is no competitor for the Navy within the private sector. This is true; however, there's a key competitor overseas in the Soviet Navy."

"Research should go to the user and the user should have feedback into the research system."

Comment: You're comments on automation triggered a reaction in me. I think it relates to this transition process, especially transitioning a final product to the user, and it relates to our new computer technology. An R&D product can take the place of something that a person did before, or it can be a tool to help a person do the job better, to augment. The slide rule was always thought of as a helpful tool when you had it hanging down from your hip. It worked for you, and you were the expert if you could use the slide rule. With many computer technologies, the change may be a replacement rather than an addition. It's not like it answers you. It's there to substitute because you weren't doing a good job. This is why I think we need to get the user onboard with our products instead of just delivering them. There could be resistance to change. We need to get the user to sort of take ownership of the product as it's coming along. Then, he'll be able to help us implement it. If we take the attitude of, "you haven't been able to do it, so here this is going to help you do it," it won't be accepted. I do think we need to have user involvement up front with our research that's going out to the ships. Then, any recommendations we have coming out of research will probably be accepted a lot better.

Comment: The automation question is really an interesting one because it focuses on another set of issues involving international economics. As I look at automation, I see that effective utilization of robotics can result in a substantial increase in capacity. You essentially create a capacity to accommodate additional workload that must be filled or other kinds of problems will occur. It basically transfers the problems to policy makers. If you look at what's happened in Japan, they've gone from an industrial economy producing junk to organizations producing highly sophisticated technology. They are capturing the international marketplace because they have been able to accommodate this change. I don't see the Catch 22 that changing technology and automation necessarily produces insurmountable problems. The key is that we have to change our policies and priorities.

"We need to get the user to sort of take ownership of the product as its coming along. Then, he'll be able to help us implement it."

Comment: This is kind of a general question concerning improving organizations. In some of the OE centers, they've found that only the most effective commands come to them. These organizations seek their services out. The less effective organizations don't come to them. In our work in civilian organizations, we've seen the same thing. It's extremely difficult to help what I call ineffective organizations. They're not willing to commit the resources necessary to improve themselves. If we're talking about organizational science here and improving organizations, do we really have a technology now for helping poor organizations?

Dr. Bowers: We have the technology for helping them, but we don't have the technology for getting them to want to be helped. I was called in to testify before Congress because of my role in the FAA. In the course of the questioning, they asked me something about how would you go about changing the FAA. Unfortunately, considering the heavy value problems, in order to create a commitment to constructive change in any reasonable amount of time, you may have to replace 40 or 50 percent of the management. That blew their minds. One congressman sat over there all by himself scowling and said the whole problem was my fault because my profession could not design a way to make those people want to change. Let me end up with just a little true story about automation. There was a robot down at the American Motors jeep plant, and its job was to weld down under the bumper. Somewhere along the way, a screw popped loose, and it got all screwed up. So instead of welding, it grabbed hold of the bumper and held on and wouldn't let go. The human operator that was standing there got so upset that he didn't know what to do. So, he just grabbed a 2 by 4 and started beating it. New technology can be frustrating.

Comment: Thank you very much for your presentation. I think this has been very illuminating in that it traced the roots of some current research and applications back to their theoretical foundations.

"I was called to testify before Congress because of my role in the FAA . . . . One Congressman . . . said the whole problem was my fault because my profession could not design a way to make those people want to change."

SOME INFORMAL REMARKS ON THE M-FORM SOCIETY

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Cooperative R&D ventures among Japanese companies have contributed to their enormous technology gains. The author of the recent best seller, Theory Z, outlines how structural arrangements can facilitate such cooperative ventures. He clearly demonstrates that the "macro" system within which R&D is conducted plays a central role in contributing to successful large scale research projects.

What I'd like to share with you today are some of the ideas I have discussed in my most recent book, The M-Form Society: How American Teamwork Can Recapture the Competitive Edge (Ouchi, 1984). Many of these ideas sprang to light when I was sitting down to write the last chapter of Theory Z (Ouchi, 1981) some three and a half years ago. I intended to make this chapter a grand statement on what I thought the role of government should be in restoring the competitive edge to American business. I said to myself, "Just suppose that every manager and every company in America were to do everything exactly right, then would all of our problems go away on the economic front?" And I concluded sadly that they would not. They would not because there remains a very serious problem of coordination between business and government.

Every company operates with a large number of common endowments. Some of them are physical, such as plentiful energy, land, and clean air. Others are social endowments, such as universal literacy, well established higher education with a research and development base, and honest and stable government. But there is one further endowment that we do not possess, but which other countries do. That endowment is the capacity for

collaboration between business and government.

Professor Jay Barney and I have spent the last 3 years with a team of 16 scholars at UCLA trying to learn something about business-government relations. As we looked more deeply into the problem, I reached the conclusion that it is entirely possible that your children and mine will never be able to look forward to the day when they will enjoy two cars, a boat, and a three-bedroom house in the suburbs. This is because a good deal of the prosperity that we have enjoyed for the past several decades has come about for reasons largely of industrial monopoly.

Before World War II, only 5 percent of the total GNP of the U.S. depended on trade. In 1950 it was still only 5 percent, and in 1960 it was still only 5%, but today it is 14 percent of our GNP. This is higher than most European nations and approaches the 17 percent of Japan. At the end of World War II, anyone who wanted to buy a ship, airplane, or oscilloscope had to buy it in North America. Much of the industrial plant of Germany, France, the U.K., and Japan had been destroyed. For nearly 40 years now, we have enjoyed an unprecedented period of industrial monopoly. While those countries were rebuilding, we supplied their needs.

Each of us can think of a time when there has been a monopoly, perhaps because a company had a better product or because it had government protection. Whenever there is a monopoly, the stage is set for superstitious learning. In the case of a company, it means that when there is a monopoly, the management can stay home and watch reruns of "Let's Make a Deal" and yet sales and earnings continue to rise each year. But typically, the management won't stay home, instead, they'll come to work. They'll work hard, but no matter what they do, sales and earnings will rise. In consequence they will learn, and learn deeply, that they know how to manage that business. But that learning is in every way superstitious. It is just as superstitious as the learning by a primitive tribe that knows that if they perform a ceremony each evening the sun will return 12 hours hence. Probably one member of that tribe, an intuitive scientist said, "I bet this is a bunch of hooey. I bet if we cut out this ceremony the sun would be back anyhow." And probably one of his colleagues said, "I bet you're right, but why take a chance?" Superstitious belief is difficult to change.

". . . a good deal of the prosperity that we have enjoyed for the past several decades has come about for reasons largely of industrial monopoly."

It occurs to me that a good deal of what we believe today about the underlying nature of our economy and how it should run is superstitious belief. We have on the one hand, an economic superstition that declares that the way to maintain the economic vitality of our economy is to cause each company to act entirely on its own in every way. In any industry, companies "A" and "B" should be made to stand in opposite corners with government in another corner. No combination of the three should be permitted to come together because what results will not be good. On the other hand, there is a superstition that argues that political-economic gridlock is the inevitable price of democracy.

This political-economical superstition has been expressed most recently and forcefully by Mancur Olson, a distinguished political economist at the University of Maryland (see Olson, 1982). Olson observes that in any country that has a long period of peace, those who are like-minded will find one another and form a special interest group. In time, these special interest groups will come to oppose one another. They will grow like weeds and ultimately will choke off the capacity of the nation to arrive at a national consensus, and therefore choke off its capacity to maintain economic vitality. He observes that in every Western nation, such as in the U.S., there has been a period of prosperity after the nation either lost a war or suffered a revolution. Those two catastrophic events are so completely upsetting that they will disorganize the existing interest group politics and make it possible to form a new national consensus. That will produce many years of economic growth until the weeds grow and once again choke off further growth.

What does this mean in the terms of an industry? It means that an industry that is young needs a certain form of regulation on the one hand, and of support on the other. But when that industry matures, it needs a very different form of regulation and of support, if it is to maintain its competitive vitality. It means that we cannot sustain competition unless we can change the rules of the game to meet the conditions at hand.

Baseball remains the great American game. It remains competitively vital in part, because the rules are changed from time to time. When the pitchers got too big and strong, the mound was lowered. When the pitchers became too specialized, they introduced the "designated hitter." Basketball retains its competitive vitality because when the players got too big, goal-tending was outlawed and when the game became too defensive they put in the shot-clock.

If we can't change the rules, we can't maintain the vitality of any competition. What that means is that as a nation, we must be able to focus our most scarce resource, which is not air, water, or land, but political will. If we can focus our political will, then we can bring about the changes in the rules that are necessary to allow each sector of our economy to retain and regain its vitality. But to focus in that way, we must engage in social choice. The implication is that we're not going to answer everyone's problems at once, but rather, that we're going to focus our energies on solving one set of problems at a time. Then next year, we will focus on the next set of problems.

". . . a good deal of what we believe today about the underlying nature of our economy and how it should run is superstitious belief."

In a democracy, we cannot engage in social choice unless those not chosen will support the designated choice. But who will support a choice that leaves him or her with an empty bag? No one, unless they know with certainty that there will be serial equity. Each party must be certain that over a series of events, decisions, and years, that their sacrificial support today, or their selfishness today, will be remembered and repaid in kind tomorrow. How can we know that there will be serial equity? Only by constructing units of social memory, the institutions that have the stability to remember and to repay both those who have been flexible and those who have been unreasonably rigid. What does it mean to think about putting in place a structure like this? Whenever we think about the problems of managing our economy, we turn, by tradition, to political scientists or to macroeconomists, but never to the scholars of business. Today some of our largest companies exceed in size and complexity some of the smaller national economies. You can't push the analogy too far because even the largest company is much simpler than the smallest nation or state. But we have learned some important lessons about how to manage and organize a large, complex enterprise. These may be important lessons for managing our nation.

The research of the last 7 or 8 years has produced some tremendously important innovations in the microeconomics and the sociology of large organizations. One of the most consistent findings is that there are only three forms of corporate structure that are possible in the large enterprise (Williamson, 1975). The simplest and most familiar of these is the U-Form or unified organization, more commonly known perhaps, as a functional organization. It is called unified, because the operating units have to stand as a group. None of them can exist or survive on its own. Furthermore, it is impossible to assess the performance of any one department in a clear manner. As a result, when there is a dispute between functional departments, the only person in the organization who has the right set of incentives and information to make the trade-offs between them is the chief executive. One consequence is that as a U-Form company grows, the number of decisions that must be made by the CEO becomes overwhelmingly large. Then the company bogs down.

The second pure form of organization is the H-Form or holding company. In the true H-Form company, the operating units have come in by acquisition and are involved in unrelated businesses. That means that there is no transferring of intermediate products or services between them. It means, as a result, that it is possible to measure with some precision the profitability and the return on investment attributable to each operating unit. The major task of the executive office is to conduct an internal capital market. It announces, for example, "We have a capital budget of $50 million this year, gentlemen, submit your bids." The operating units bid for capital by offering promised rates of return, "I'll earn you 28, 29, or 34 percent." The task of the financial staff is to cast a cold and skeptical eye on these typically optimistic expectations, boil them down to something more readily believable, and then allocate capital on the basis of expected

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". . . we cannot sustain competition unless we can change the rules of the game to meet the conditions at hand. . . . When the pitchers got too big and strong, the mound was lowered."

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return. However, in an H-Form company, the capacity of the units to coordinate together is very limited so that the corporate office, representing the organization as a whole, contributes little beyond summing the pieces. The research of the last several years very strongly implies that large companies of U-Form and H-Form are low-profit performers in the long run (Rumelt, 1974).

The high performing type in the long run is the M-Form, or multidivisional organization. In the true M-Form company, the operating units are semi-autonomous, that is, each stands alone and makes its own product line, but all of them draw upon some common resources such as corporate laboratories, marketing staff, or some manufacturing plant. One result is that the company is in an intermediate stage between centralized and decentralized. It is decentralized in the sense that each division is asked to operate as through it were a small entrepreneurial business so that the benefits of nimbleness and flexibility can be obtained. But on the other hand, because it is impossible to measure with precision exactly what has been contributed by each unit, it is necessary that all behave together as a team, and that there be some substantial capacity for memory about the subtleties of who has been flexible or too rigid in the past.

When an M-Form company works well, it is because the middle managers work as a team. To work as a team does not mean that they all share the same goals, nor does it mean that they love one another and walk arm-in-arm toward the future. It means, simply, that they trust one another sufficiently to be willing to confront one another directly and argue toe-to-toe when they have a dispute, for example, over the design of the new information system. If they will work together as a team, confront one another, and fight out their differences, then they can make a joint recommendation to the executive office and the company works well. But if the middle managers will not do that, but instead, each attempt an end run and go directly to the chief executive and say, "Please do it my way," the result will be that: (1) the corporate staff will balloon in size in order to study all of the claims and counterclaims, (2) the decision making will become more and more centralized in the chief executive, and (3) soon the middle-management will start to complain that the company is top-heavy, the staff intrusive and decisions too slow, without realizing that they themselves have created the problem. Another way to say this is that the essence of the M-Form organization, when it succeeds, is that it achieves a balance between competition on the one hand and teamwork on the other. That is precisely the problem that we face in our government.

"One of the most consistent findings is that there are only three forms of corporate structure that are possible in large enterprises."

"The high performing type in the long run is the M-Form, or multidivisional organization."

The Japanese Diet is a bicameral legislature. It has 763 members and meets in a one-year session. In a typical one-year session, the diet entertains 150 proposed new bills. Of those, on the average, 100 are proposed by the Ministries and 80 percent of those pass into law. Of the remaining 50, which are proposed by the diet members and which are of the "pork-barrel" variety, on the average 18 percent pass into law. Overall 60 percent of the proposed bills pass into law.

The U.S. Congress is also bicameral, has 535 members, and meets in a 2-year session. There are 22,000 bills proposed in the typical 2-year session. Of those, on the average, 2.5 percent pass into law.

It is relatively simple to construct a situation in which there is only competition between individuals and no teamwork. It is also relatively simple to construct a situation in which one emphasizes only teamwork without individual competition, but neither of those works very well. It is extremely difficult, whether in an economy or a company, to have simultaneously an emphasis on a great deal of competition and on a great deal of teamwork. The M-form company can do both. That is the lesson of business that can be applied to the governance of our nation.

What does the M-form suggest at the level of an entire industry, rather than at the level of a single firm? Consider the structure of the microelectronics and computer industries in Japan. The computer industry was born in the U.S. in 1944 with the design of Mark I, a joint venture between IBM and Harvard University, under a contract from the federal government. In 1946, the first commercial prototype machine, ENIAC, was built by the Univac Corporation.

The computer industry in Japan was born roughly 12 years later, the first computer being produced by a joint venture between NTT and the University of Tokyo. That first computer in Japan was followed by both individual company research and by a series of joint research and development project with acronyms such as FONTAC, DIPS, and PIPS. In 1964, the Japanese computer industry was just starting to get off the ground when IBM introduced the System 360. The 360 was so vastly superior to any business machine on the market that it and its successors drove GE and Xerox out of the computer business and threatened to destroy the Japanese computer industry as it was being born.

"... the essence of the M-Form organization, when it succeeds, is that it achieves a balance between competition on the one hand and teamwork on the other."

The Japanese responded with a strong form of protectionism, which no one would argue was fair to IBM. In addition to protectionism, they began a new joint R&D project in 1965, the Super Computer. This was to be a copy of the IBM 360, but the Super Computer came to fruition just as IBM introduced the next generation, the System 370. It had such a superior price-performance ratio that it laid the Japanese flat once again. They responded with yet more protectionism, and also with two new joint research and development cooperatives, the three company CDL group and the company NTIS group in 1971. By 1975 the situation in Japan looked dark for the Japanese. IBM held 70 percent of the domestic Japanese computer market and the seven Japanese makers as a group held the remaining 30 percent.

In 1975, most observers were predicting that the Japanese would never succeed in the computer business. In 1975, one of the fathers of the U.S. semi-conductor industry said to me, "Bill, the problem with the Japanese form of management is that it is so group-oriented and so consensual that it takes too long to make a decision. The semi-conductor business requires the capacity to turn on a dime, and that is why the so-called Japanese threat in semi-conductors will never develop."

The problem facing the Japanese in 1975 was simple. The first generation computer had been based on the vacuum tube, the second generation on the transistor, and the third on the integrated circuit. It was clear to everyone, in 1975, that the fourth generation machine would be based on very large scale, or VLSI integration. In all of Japan, there were probably not more than 100 scientists capable of working at the forefront of VLSI technology and they were distributed across so many companies that no one company had enough scientists to represent a critical mass, capable of achieving a breakthrough. The seven companies approached their government and said, "Please bestow upon us large sums of money so that we can go out and recruit, hire, and train many young scientists and in a decade each of us will have two or three hundred scientists." The response of the government approximately was, "You must be kidding. First of all there isn't enough money in the bank, and second, if we were to give big handouts to rich companies like you, the public would run us out of office. But if you can form a consensus," they said, "maybe we can help."

If we were faced with a similar problem in the U.S., how would we respond? Let me illustrate with an example. Today the U.S. is in danger of losing both its textile and apparel industries because the average wage in those industries in the United States is $6.85 an hour and in the People's Republic of China it is $.16 an hour. Despite that fact, our textile companies are competitive because of their tremendous automation. But the apparel makers, who are not as highly automated, are increasingly going off-shore. These foreign apparel makers buy their textiles off-shore and as a result the U.S. is losing its textile industry as well. The answer, in part, is for us to figure out how to build the fully automated sewing plant of the future. Then we can keep part of the industry in the U.S. by using our natural strength for those parts of the industry that belong here.

"In 1975, most observers were predicting that the Japanese would never succeed in the computer business."

Several people have offered this suggestion to the members of the administration and the Congress, "What do you think about sponsoring such a project and putting up some money?" Their response: "We'd love to do it. We will line up laws if necessary and put up the money. We'd love to see that happen, but here's the problem. What you're talking about is a project that would require the bringing together of companies producing apparel, textiles, fibers, sewing machines, robots, machine tools, lasers, computers, and software, along with several unions. There isn't any way for us to gather all of those people in and get them to agree on how to do this. If you can find a way, let us know."

That is precisely the problem that faced the Japanese computer makers in 1975. What did they do? They turned, first of all, to JEIDA, the trade association that represents the computer makers, and asked JEIDA to formulate a plan. JEIDA member companies agreed on a plan that involved a joint VLSI research association. Then, on behalf of its members, JEIDA went to the next higher level trade association, the EIAJ, which represents the makers of not only computers, but of consumer electronics, power generators, and the full range of electrical goods. They said to the members of the EIAJ, "Would those of you not in the computer industry temporarily set aside some of your own pet projects so that we, as a group, can get behind the VLSI joint R&D ideal? In other words, would you stand aside so that the traffic may flow through the intersection, rather than everybody trying to jam into the intersection at once saying, 'me, me, me,' thus, producing political economic gridlock." And the members said, "Yes."

Then the EIAJ, on the part of its members, went to the Keidanren, because there is nothing like it in the U.S. The Keidanren is a private organization initiated by business. It is organized a little bit like the United Nations. The "security council" equivalent consists of 812 of the largest companies of Japan, typically not more than 3 per industry. There is a small staff of perhaps 50 professionals, and there are 110 general trade associations that hold membership. Each of those associations has, as its members, specialized trade associations and they and their members represent one million medium-sized and small companies.

The Keidanren is not a unit of central planning, but instead resembles a great big "boxing ring." When there is a dispute between the chemical companies and the mining companies, between the life insurance companies and the securities companies, or between the banks and the thrifts, they can step into this "ring," put up their dukes, and have it out. When there is a dispute between big business and small business they can step into this "ring" and they can "duke around." If and when they reach a consensus, they can go with one voice to speak to their government and lobby as a group.

"The Keidanren is a private organization initiated by business. It is organized a little bit like the United Nations."

The seven companies approached MITI through two separate avenues. The first avenue was through the MITI staff, which, unlike the U.S. Department of Commerce, invites participation from business. The MITI staff is organized in the simplest matrix one can imagine. There are several industry bureaus, each of which is subdivided into industry specialties so that if you are in the shoe business, there will be two or three staff members who do nothing but maintain contact with and know everybody in the shoe business. Then there are several issue bureaus, which cut across industries, but all you need is your contact man in the shoe section and he can instantaneously, through this matrix, put you in contact with everyone who will be important in whatever it is you have in mind. With a big issue like VLSI, however, you go, in addition, to the MITI Discussion Councils.

MITI maintains 38 Industry Discussion Councils, of which the most important is the Industrial Structure Council. The one that deals with the computer industry is the Aircraft-Machinery Council. The several proposals currently before the U.S. Congress have called for the formation of a National Economic Planning Board whose membership would be one-third labor leaders, one-third business leaders, and one-third government officials. Compare that and think about its implications for the structure of the Industrial Structure Council. The Industrial Structure Council has 82 members of whom none are government officials. It is a private voice. It is a boxing ring into which come 28 representatives of trade associations, 20 people representing their own manufacturing companies, 11 university professors, 4 leaders of major labor federations, 3 leaders of the largest consumer groups, 2 senior members of the press and 14 others representing groups, such as the Council of Mayors and the Council of Governors. Now imagine such a diverse group achieving a consensus; it then needs no power beyond the power of free speech to attract the attention of the appropriate government officials.

The computer companies were able to activate a network that was already in place instead of having a chaotic scramble in which everyone is standing up and shouting at the same time. There was a more reasoned dialogue and communication among all of the parties who had an interest in this problem. In addition, these institutions possess a stability and permanence that comprises a social memory. As a result, everyone has an incentive when entering into this discussion to behave in a reasonable way.

"Here, we might think, were all these Japanese competitors linking arms with one another and marching down the road happily together. We can't possibly imagine IBM, DEC, Honeywell, NCR, and Hewlett-Packard contemplating such a thing."

Agreement was reached that there could be a 4-year project, from 1976 through 1979, and that the technology goal would be to move an order of magnitude from the then state-of-the-art 16K RAM, to the 1000K device, any from the 100 gate to the 1,000 gate logic device. Here, we might think, were all of these Japanese competitors linking arms with one another and marching off down the road happily together. We can't possibly imagine IBM, DEC, Honeywell, NCR, and Hewlett-Packard contemplating such a thing.

Upon closer inspection however, what we see is not seven companies happily expressing their allegiance to country and to emperor. What we see, instead, is something much more familiar. We see seven companies, each of which at the outset intended to send to the project their least experienced young scientists, each hoping to contribute as little as possible and get back as much as possible. What we see is the normal amount of pettiness, of jealousy, and elbowing for position. What we see is perfectly normal self-interested human behavior, but working within a system that has a memory.

One of the first disputes was over the composition of the project. Of the seven possibilities, one company, NTT, didn't want to join. NTT had the most advanced microelectronics research and felt they had little to gain and perhaps a lot to lose. Because the other six companies were all big suppliers to NTT, they couldn't put pressure on them and NTT never did join. Oki, on the other hand, wanted very much to be in the project, but the other companies didn't want Oki in. So they got together within JEIDA and drafted an agreement that said, "Any company may join this project as long as it possesses this specific set of technology," which they knew Oki did not possess, and Oki was cut out.

The five remaining companies then said to the government, "Now we're ready, we have the consensus, send us the money." And the government said, "You must really think we're dumb. The public is not going to stand for large outlays of public funds for your companies. There has got to be a joint physical laboratory with human bodies in it that gives at least the appearance of true teamwork." The companies had been intending to focus their research on the 64K RAM, but when they heard this they realized that if there were a joint lab in which they worked on next year's products, they might lose some proprietary "know-how." So they changed their target to the 1000K RAM, which was so distant technologically that there was little know-how to lose, and all agreed that there would be a joint lab.

"What we see is perfectly normal self-interested human behavior, but working within a system that has a memory."

But where was the lab to be? The three-company CDL group insisted that it had to be their location. The NTIS group insisted that it had to be their location. They argued for several months, but there was no hope of compromise. Finally, in desperation, they turned to the head of JEIDA and said, "You choose and we'll abide." After a little study and a lot of fancy footwork, a location was picked. Everyone moved in.

When they moved into the laboratory, everyone knew that their plan would be to send their least experienced and youngest scientist in order to contribute as little as possible, and get back as much as they could. The laboratory chief scientist was a highly respected man from the Government Electro-Technical Lab, the ETL, named Dr. Tarui. Tarui did two things. First, he started out with the fact that there were only three research projects but there were five companies plus ETL. He specified six separate research projects so that each of the participating groups would have a project director. Then he announced that he would personally interview each of the scientists sent to the joint lab. He did not imply that he had the right to choose or to refuse anyone, but the simple knowledge of certain discovery, within this system of memory, was sufficient to deter such behavior, and everyone sent their best.

The lab opened up, but the walls between units were thick, so thick that most of the scientists didn't come to the lab in the first year. Many were afraid that their friends back at their own corporate labs would think them of questionable loyalty. Mr. Nebashi, the lab director, responded to this problem. He insisted that the executive and operations committees, which consisted of top executives from the five participating companies, must have monthly meetings at the lab. As they came each month, they began to see that the other scientists were at least as good as theirs and that they had a good deal to learn. They started to pass down the word, "Perhaps we should really work together. Perhaps we should open up." Meanwhile, each night Nebashi began to practice what he called "Whiskey Operations." This involved gathering up a couple of armloads of scientists each night, taking them out and drinking with them. After a couple of months of this, the walls came down, and people went to work.

At the end of four years, the joint lab had filed 1000 patent applications, from which they expected ultimately to achieve 500 patents. They had achieved the technology for the 256 K RAM and the 1000 gate logic device. At the end of the project in 1979, the lab closed and the scientists went home. Dr. Tarui took a position at the Tokyo University of Science and Agriculture. Nebashi took a job at IBM/Japan.

"Meanwhile, each night Nebashi began to practice what he called 'Whiskey Operations.' This involved gathering up a couple of armloads of scientists each night, taking them out and drinking with them."

In the interest of candor and of balance, note that Oki, which was not a part of the project, was the first company to test the commercially viable 256 K RAM. But consider the implications of this example. In 1975, many observers were predicting that Fujitsu would fail. Fujitsu was the main Japanese computer maker. In 1975, many in Silicon Valley were saying that the so-called Japanese threat in semiconductors would never come to pass. By 1982, Fujitsu had replaced IBM as the major vendor of computers in Japan. The Japanese makers as a whole had taken over their home market.

During this period, it appears that IBM and other U.S. computer makers suffered from unfair treatment and protectionism. In addition, throughout this period, the U.S. Government had IBM under the threat of a Department of Justice antitrust suit. So on the one hand, IBM was working against its government and against seven Japanese companies who were working together and with their government. Yet IBM held its own reasonably well. On the other hand, it is undeniable that what we see here is a new way to think about managing an economy and it is a view that violates some of our most deeply held underlying beliefs about what works and about what should be. If we find this example to be troubling, worrisome, and fearsome in some respects, perhaps that is because it works.

What do we do in the U.S. when we're faced with a problem like this? Consider an example. In 1978 the U.S. was, we thought, in the grip of the OPEC cartel. The public was clamoring for energy independence and the U.S. Congress had to act. There was the sun shining away, 12 hours a day. In 1978, the American Physical Society published a report on photovoltaic solar energy, in which they contended that it was impossible that photovoltaic solar energy could account for more than 1 percent of the total electricity needs of the U.S.A.

". . . what we see here is a new way to think about managing an economy and it is a view that violates some of our most deeply held underlying beliefs about what works and about what should be."

in fewer than 50 years. What was needed, they said, was a steady stream of financial support for basic R&D, $20-$30 million a year for the next 20 years. In that same year, the U.S. Congress allocated $1.5 billion dollars for photovoltaic solar energy research in the U.S. over a 10-year period.

Have you ever asked yourself how we distributed R&D money in the U.S.? Do we do it the way the Japanese do? Is there a dialogue, a discussion, a debate with the government? How do you distribute $1.5 billion of R&D money in America? The way they did it was to make an arrangement with four labs that at least knew something about photovoltaics, the M.I.T. Lincoln Lab, Sandia, Solar Energy Research Institute, and J.P.L. These they assigned to review the applications. The scientists at those four shops knew a lot about photovoltaics, but they had not political power and no reason in the world to deny a company a project since that company might be a future supporter of theirs. The result was that in the first 2 years of the project, they granted 402 research contracts to 250 different organizations. There was no provision for any form of conversation between them, and no attempt at coordination. Many experts would say that in the year 1978 there were not 250 individual scientists in the U.S. capable of photovoltaic solar research.

The whole project was such a disappointment, despite several individual successes, that it was cancelled by the Congress in the third year of its operation, except for $32 million a year of basic R&D funding. The real tragedy of this example is what we learned from it. The scientific establishment learned once again that you can't depend on government funding. The Congress learned once again that business will always over-promise and under deliver. The public learned once again that you can't trust any of them.

But the story isn't always a disappointing one: Consider another example. The Soviets have more ships, more airplanes, more men under arms, and more tanks than we do, and probably always will. Our military edge is a technology edge, primarily an electronics edge. That edge used to be 12-15 years, now many people would say it's down to 2-3 years. The problem is that in 1960 the Department of Defense purchased 60 percent of all of the output of the U.S. semiconductor industry and so they got exactly what they wanted. But today the nondefense users of semi-conductors are so much more vast that the DoD now buys only 4 percent of the industry's output and has to take what it can get off the shelf. What it can get off the shelf is not radiation-hardened and doesn't have the tremendously high speed that is needed for weapons guidance, control, and detection. The semiconductor devices must be radiation-hardened and capable of executing 12 billion additions or subtractions per second and be on a chip the size of your thumbnail. The problem is that the semiconductor firms that have the technology don't understand weapon systems and don't want to learn how to navigate Pentagon bureaucracies. The computer companies who understand the software don't have the semi-conductor technology, and the defense contractors who understand the Pentagon don't have the computer or the semi-conductor technology.

The solution is that for the first time in the history of our republic there are six company teams comprising the very high speed integrated circuit (VHSIC) project. Each team combines the knowledge of the semi-conductor hardware, computer software, and defense systems knowledge. Working across the three military branches, everyone is a team (IBM has the only one company team). Although the project is only half completed, the early reviews suggest that it is succeeding well.

But let's return now to thinking more generally about the model of business/government relationship and what it means. What we see in Japan is approximately an M-Form structure. First, in the business community the principal group is the Keidanren, which I have mentioned already. Then there is the Keizai Doyukai, which consists of a thousand individuals rather than corporate members who conduct studies and issue position papers on more general topics such as an aging population, cost of health care, or the need for green space. Next is the Chamber of Commerce with 478 chapters across Japan, which represents small and medium businesses primarily. Finally, there is the Nikkeiren, a federation of 30,000 companies, which exists for the purpose of carrying out a dialogue with the major labor unions. There is conversation between them other than that which occurs across the bargaining table. Because this structure is in place, the "boxing rings" are available, and the system has a memory, there can be a conversation rather than a chaotic yelling of everyone at once.

Some might think that the Japanese don't care about small business. There are many ways to define small business. One standard definition is any business with fewer than 20 employees if it is in service. By that definition, 20 percent of the U.S. labor force works for a small business as compared with 50 percent in Japan.

What the Japanese have done for small business is impressive. Japan has 47 prefectures, each roughly akin to a state in the U.S. In each prefecture there is a federation of the many different kinds of organizations, which are intended to help small business. In the larger cities there are Chambers of Commerce, an average of 10 in each prefecture. In the small towns that do not have a chamber, there is a Society of Commerce of Industry, an average of 82 in each prefecture.

"While you're out on the golf course this afternoon, they're back there in Tokyo having meetings from 9:00 a.m. until 10:00 p.m., Monday through Friday, for 3 months straight."

The local government bureaus coordinate with the national small business organizations, such as the People's Finance Corporation, which makes loans to small business. There is also a Small Business Corporation owned by the government to make small business loans. Then there are three MITI councils, which are exclusively devoted to the interests of small business as well as a whole bureau within MITI that does nothing but focus on small business. All of these resources are brought to the local level through the coordination of the prefectural federations.

What structure do we have in place in the U.S.? We have the basic units necessary for an M-Form organization. We have the National Federation of Independent Businesses with 600,000 small business members, the Business Roundtable, which represents 196 of the biggest companies in America, the National Association of Manufacturers with 50,000 manufacturing members, the Chamber of

Commerce with medium and small business members, and the American Society of Association Executives. Within one industry, the electronics industry, we have several specialized associations, such as the EIA, AEA, SIA, SAMA, and CBEMA. But they won't work through their own specialized association. Everybody wants to go direct to government because they know that there is no social memory in place. If they get into a "boxing ring" or a group process they will be asked to wait, and they know that if they wait, they won't be remembered. If we don't have the units of social memory, then we condemn ourselves to the kind of political-economic gridlock that Mancur Olson foresaw.

If the Department of Commerce isn't presently very useful, that's because the business community doesn't care and doesn't put pressure on it to get organized and properly staffed. If the trade associations in America aren't useful, it's because their members don't care. Last year I spoke at a meeting at one of the major U.S. trade associations. It was a typical association meeting, the time was winter and the place was Florida. I spoke one morning and they played golf in the afternoon. They had another speaker the next morning and then they played tennis. They had a speaker the third morning and then they went fishing. Now, I love fishing, golf, and tennis, and I'm not trying to be goodie-two-shoes about this, but I said to these fellows, "Look, when you're out on the golf course this afternoon waiting to tee-up, let me ask you to think about something. Last month I was in Tokyo where I met your counterpart association, which has the 200 companies who are your direct competitors. While you're out on the golf course this afternoon, they're back there in Tokyo having meetings from 9:00 a.m. until 10:00 p.m., Monday through Friday, for 3 months straight. They are sorting out their product standardization policies, just as you're trying to do, so that a customer can buy an oscilloscope from one vendor and an instrument from another vendor and plug them together. They're trying to sort out their recommendations to the government on product safety standards instead of arguing before a federal board for 12 months about what the safety standard should be and holding up everybody in new product introduction. They're trying to "duke out" their differences on what they really want by the way of export assistance, legislative reform, and so on and so forth, so they can go to the government with one voice. You tell me who's going to be in better shape 5 years from now."

"No one can see into the future. In a large company, the people who are best equipped to see into the future are the 23-year-old 'rookies' who are working close to the customers and the technology."

In 1969, the maximum tax on capital gains was raised from 20 to 49 percent. In 1970, there was a 1/50th as much venture capital available for small businesses as there had been the year before. It just dried up. One of the people who was hurt by that was a fellow named Ed Zschau, who was running a little 50 person company in Silicon Valley. Ed Zschau was suffering because of the difficulty in raising capital. In 1976, Jimmy Carter was elected President. As you remember, he campaigned against the three martini lunch. His tax bill was going to raise taxes on business and one of his key targets was to raise the capital gains tax even more. Ed Zschau was a member of a group of small businessmen who are members of the American Electronics Association and who met for their annual 2-day meeting in Washington, D.C. One of the people who spoke to them at their breakfast was Representative Al Ullman of Oregon, who was then chairman of the House Ways and Means Committee. Ullman said to these high-tech small businessmen, "I've got good news for you. I'm going to sponsor a provision in the 1978 tax bill to do away with the double taxation on corporate dividends." His audience sat there on their hands and looked glum. Ullman couldn't believe it. He thought they'd stand up and cheer. They said to him, "Let us give you some help, Congressman Ullman. None of us pay corporate taxes. All of our companies are start-up companies. Any profits we make go back into buying equipment on which we get depreciation. So we never pay taxes to begin with. If you reduce taxes on corporate income or dividends, that's going to make investments in the large, stable, mature companies more attractive and make it even harder for us to get capital. What we need is a cut in the capital gains rate." Ullman said to them, "Look, if you guys really feel this way, you must remember that democracy only works when there is an involved citizen." That night, the AEA had a dinner at which Ullman was present again. The president of the AEA said, "I'm proud to announce that the AEA has formed a task force on the cost of capital and it is headed by Ed Zschau."

"What we need to do is to lower the cost of political participation by building the institutions that can make it easy for people to participate."

It was the first time Ed Zschau had heard of it. Ed Zschau, however, was fast on his feet. He started a drive in Washington to cut the capital gains tax and his position was, "We think it should be zero, but we'll take a rollback to 20 percent. The Chamber of Commerce wouldn't help. The members of the Roundtable and the members of the NFIB couldn't agree, so neither took a position. It was Ed Zschau with volunteers from Silicon Valley who ran their own businesses, who were trying to get the cut in capital gains. They didn't know that a couple of concerned citizens couldn't have an impact among all the pros in Washington. They went before the Congressional hearings and told their stories. They did their research and spoke to anybody who would listen. To make a long story short, in 1978 Jimmy Carter, who wanted to raise business taxes, signed a bill that cut the capital gains tax from 49 to 28 percent.

In 1981, the AEA went back again, headed by Ed Zschau and got the tax cut from 28 to 20 percent. They were joined by the Massachusetts High Technology Council, the Semiconductor Industry Association, the Scientific Apparatus Makers Association, the Electronics Industry Association, and others.

In 1982, Ed Zschau entered the Congress as the elected representative of Silicon Valley. Twelve months later, the New York Times dubbed him the star of the freshman class in the House of Representatives.

I don't believe that the idea of national central planning is any wiser than that of corporate central planning. No one can see into the future. In a large company, the people who are best equipped to see into the future are the 23 year-old "rookies" who are working close to the customers and the technology. But they don't have the wisdom to make major policy judgments. The best "strategic plan" is to have a good conversation between the rookies, who know what they're doing, and the top executives, who may not know what they're doing, but who have wisdom. As long as there is conversation between them, the organization will make its way to the future.

The best national economic policy is an involved citizenry. Durkheim predicted that, in a mass urban nation like ours, if the only form of political participation most people have is to vote, then the democracy will wither because voting is a too impersonal and too distant form of democracy. There must instead be a host of intermediate organizations that knit people and interest groups together.

Another way to put the problem of industrial policy, in my view, is to observe that we don't have enough special interest groups in America. I don't belong to a special interest group because there isn't one that fits enough of my interests closely enough to get me to join. There are 12 pizza parlors within 10 minutes of my house, so I can get any kind of pizza that I could possibly want. There aren't that many civic or interest groups in my neighborhood. Why? Because none of these special interest groups talk to each other and as a result none of them has much influence. If none of them has much influence, who will want to start up yet another special interest group that's going to also have no influence? Nobody. If we can knit them together, then they will all have influence on one another. Then there will be a tremendous flowering of new kinds of special interest groups, or intermediary institutions. This network can knit our society together. Right now the only people who have reliable influence in Washington are the 85 or so companies that can afford to maintain large permanent staffs. If you can't afford a 40-60 person staff in Washington, you aren't a player. That means that the other 99 percent of us are locked out of a part of the political process. What we need to do is to lower the cost of political participation by building the institutions that can make it easy for people to participate.

I visited the headquarters of Tohmatsu, Awoki, and Company, the largest CPA firm in Japan and a division of Touche, Ross International. I sat down with five of their senior partners who said to me, "You must understand that in Japan nobody cares about reported company earnings. Therefore, the fundamental job of the CPA is different in Japan than it is in the U.S. In the U.S., the stockholders of a large, public company know so little about the business that they must rely on the accountants' definition of earnings. Therefore, the chief function of the CPA in the U.S. is to come up with a completely understandable and standardized definition of earnings. But in Japan, the owners of the company are so well-informed and so close to the company that they already know how it's doing this year and how it is going to do next year as well. There's

very little that the CPA can add to their understanding. His task, instead, is to help them build the information system that keeps them informed every day."

Our research team studied the financing of the 814 publicly listed electronic and aerospace companies in the U.S. and in Japan. We found that the weighted average cost of capital, of equity and of debt, is far higher for the U.S. company than it is for the Japanese company. It translates into a major competitive disadvantage. Why is that? The reason in essence is that there cannot be an effective relationship between the owner of a company and the manager of the company at arms length, but that is what we have in the U.S. Another way to say it is that in the U.S. the typical company, say a big chemical company, will have 300,000 shareholders. If you have 300,000 shareholders, what is the likelihood that they are going to know what's going on in the company? Suppose you're the management and you say, "I want to communicate to my shareholders some of our 5-year plans for capital investment and automation. Let's send them a 50-page report." What are they going to do with that 50-page report? They're going to throw it in the rubbish can. If you only own 1/300,000th of a company you have no incentive to spend more than two minutes discovering what's going on, let alone attempt to influence the management. It's easier to sell your shares and buy something else. That is what produces the short-run pressures on American management.

"If you only own 1/300,000th of a company you have no incentive to spend more than two minutes discovering what's going on, let alone attempt to influence the management."

But you might say, "Wait a minute, that chemical company is probably financed 30 percent through debt. Certainly the bank even though it isn't allowed to own shares, must be governing the company." Not so. The bank in the U.S., as our bankruptcy law has evolved, is not allowed to try to influence the management of a company to which it makes the loan. If the bank can't influence the management, and the owners can't influence the management,

that means that nobody "owns" American business. No one can exercise the rights of an owner over these companies. Now I ask, how can you have a free enterprise system, based on private property, if there are not effective property owners?

Akio Morita, the chairman of Sony, remarked several months ago, "Our lead bank is the Mitsui Bank. They own some of our shares. They represent the other banks that own some of our shares. Their chief function is to keep an eye on me, the chairman of the company, and to look out for the rights of all of the other owners of Sony, as well as the customers, employees, suppliers, and everybody who has an interest in the corporation. If they conclude that I'm not doing my job right, they can kick me out. In most American companies that's not possible."

The only remedy we have is the unfriendly takeover, but things have to get extremely bad before that remedy comes into play. The situation in the U.S. is one in which even the big stockholders, such as the bank trust departments, pension funds, and insurance companies, which among them own more than one-third of all the equities of American business, are fiduciary trustees. They are not able to exercise any governance over the company whose shares they own. As a result, there is nobody who oversees the operations and behaves like an owner of many of the largest U.S. firms. Our large businesses are so large today that it is typically not possible for a single family or a few individuals to own them. There needs instead to be some institutional form of ownership, and the most logical institution is the bank. We prohibit banks from doing that by law.

Why do we prohibit banks from owning the equity shares of non-bank businesses? The restriction is rested in the National Banking Act of 1864. It was the end of the Civil War and the U.S. Treasury had been depleted. In addition, it was very important to symbolically reunite the nation. The big banks of the day were issuing their own bank notes as their private currency. In order to solve both problems, the Senate passed a bill that put a tax on all private bank currencies and allowed banks to obtain the new U.S. bank notes primarily by buying securities of the U.S. Treasury.

In 1865, a federal court held that because the law had not given banks the explicit right to own nonbank securities, they were thereby forbidden to do so, because they would be competing against the Treasury Department for scarce capital. That need has long since passed, but the law is still on the books. It seems to me that it's another example of a change that we need to make and that needs to be carefully examined.

"Now, I ask, how can you have a free enterprise system, based on private property, if there are not effective property owners?"

These examples, I hope, have been stimulating, but many will feel that, "This simply lies too far beyond the American experience. There's something about it that's too collective, too homogeneous, not individualistic enough."

Let me tell you a little bit about Minneapolis. Minneapolis is a city of 500,000. The Twin Cities have about a million people. They haven't had an easy time of it economically in Minnesota. Seventy percent of the state of Minnesota is covered with trees. Their first industry was timbering. They clear-cut the forests, used their assets, and they had nothing. Then they found the Mesabi range, the richest deposit of iron ore in the world, 30 miles long by 1 mile wide. It supplied 65 percent of all the iron ore used in the U.S. until about the turn of the century. Once again the money flowed East and afterward all they had was a big hole in the ground. The

other major industry was grain. By the year 1900, there were 500 flour mills operating in Minnesota. Today Minnesota is a center of electronics, financial services, and retail industry. Four out of the five major computer mainframe makers in the U.S. have either their corporate headquarters or a major plant in Minneapolis.

How did they accomplish what every other American city would like to accomplish? Minneapolis is anomalous in yet another way. In 1965, General Mills moved its corporate headquarters out of the center city to the suburbs. Everybody feared it was the beginning of the end: the loss of tax base, white flight, and urban decay. Today Minneapolis has a thriving downtown. It has the $400 million Nicollet Mall and a pedestrian skyway system that connects the 40 blocks of the center of the city. The skyway keeps pedestrians away from the cold, above the traffic, and they've stayed downtown to live, work, be entertained.

Minneapolis-St. Paul is thriving. How did they do it? Minneapolis is anomalous in another way. The average U.S. company donates 6 percent of pretax earnings to charity each year. The estimates are that there are approximately 100 companies in the U.S. that donates 5 percent or more of pretax earnings to civic groups each year. Sixty percent of those companies are in Minneapolis.

How do we explain that behavior in this day of self-seeking, profit-minded individual firms? When we look closely at Minneapolis, what we see is a structure of social memory that very closely resembles what we find in Japan. In Minneapolis, the Citizens League consists of 3000 ordinary citizens like you and me, each of whom pays $20 a year to join. Anybody may join a study group for the purposes of writing a position paper on the need for downtown parking, green space, pedestrian circulation, or better elementary school education.

The Chamber of Commerce runs the Five Percent Club and brings together the small and medium businesses to fight out their differences with one another and then go to the other groups. The Downtown Council consists of the small shopkeepers and the big bankers, everybody who cares about the future of downtown. Their president one year was the head of a local coffee shop, the year before that the head of the largest bank and another year it was the head of the Lutheran Brotherhood.

"The situation in the U.S. is one in which even the big stockholders . . . are not able to exercise any governance over the company whose shares they own."

The Minnesota Association of Commerce and Industry, MACI, brings together the farmers, manufacturers, and service companies so that they can "duke it out" when they have a difference. The Minnesota Project on Corporate Responsibility brings together 200 companies so that they can be educated several times a year on what it means to be a good corporate citizen and on how to make it happen.

The Minnesota Business Partnership consists of the 42 CEO's of the biggest companies in Minneapolis, including the heads of General Mills, Pillsbury, 3M, and Honeywell. What do these 42 do when they get together? Do they scheme, do they plot? Do they figure out how to grind the common man down? Not at all. They go out on field trips like so many school children. They get together in groups of 3, 4, and 5 and call on the mayor, governor, legislative leader of the opposition, and heads of the major labor unions: the kinds of people whom each of them individually would be reluctant to see, and who are never going to come see them. They establish a dialogue between business and government. Because each of these organizations is linked to the other, there are not only a host of "boxing rings," they also have become the social memory in Minneapolis.

It seems to me that we have before us a national agenda. In outline, it really isn't very complex. We need to build the units of social memory that will enable us to engage in the process of social choice. Through social choice, we can focus our scarce resources, and it is that focus that will allow us to achieve prosperity. The basic building blocks are in place. In the business community, we have the American Business Conference, the Conference Board, National Association of Manufacturers, Chamber of Commerce, National Federation of Independent Businesses, and the Roundtable. Most of them are new organizations, formed to meet a new need. They ought to be linked to one another. If they will confront one another when they have differences and "duke it out," nose-to-nose, we'd be going a long way in the right direction.

Business is only a part of the solution. There needs to be a means through which we can connect the other semi-autonomous units of an M-Form society to one another. We need to have in addition to the business organizations, a similar network within the labor community. There must also be an organization that causes the farmers to fight out their differences with one another. The municipalities and the states, because we are one nation undivided, have to have a way to interact within this network. The consumer and civic groups must be involved.

"We need to build the units of social memory that will enable us to engage in the process of social choice."

Last spring I had a parking lot conversation with a friend. It was one of those 15 minute discussions at the end of an evening, an extended good-bye. I was talking to a fellow named John Doyle, who is the vice president for R&D at the Hewlett-Packard Company. He oversees the stream of inventions that is his company's lifeblood. It was the kind of discussion that is best held in the semi-darkness of the parking lot of a Chinese restaurant, where the dim light conceals your commonness and permits you, for moment, to discuss matters of state, to pretend you're Hobbes, Locke, or Adam Smith. Five years ago John was reading books on management, on productivity, and on creativity at work but more recently he has been reading books on economic history. Most of the books explain in painful detail why our current economic malaise is both inevitable and

irreversible, why we should gracefully accept our fate of poverty as the British have learned to accept theirs. But John has the mind of a scientist. He is a skeptic. He is skeptical that anything is impossible, that anything is inevitable, that anything widely believed, is true. He said as he headed for his car, "You know that the really important inventions have all been impossible. It was only after they appeared that the scholars rushed around to construct new theories to explain their existence."

It seems to me that it is that spirit of pragmatic and optimistic skepticism with which we should approach our perhaps superstitious beliefs about what it is that makes our economy tick and our nation survive. We owe it to ourselves to search for a better way.

"You know that the really important inventions have all been impossible. It was only after they appeared that the scholars rushed around to construct new theories to explain their existence."

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COMMENTS FROM THE AUDIENCE

Comment: Due to schedule constraints, we only have time for one question for Dr. Ouchi.

Comment: As you were talking, I was thinking about the fact that we do have in our own military research community a number of interactive corroborative arenas through which we actively engage in inter-agency debate. We duke it out with the Air Force, with the Army, with industry, with NATO organizations, and with the academic circles. However, we haven't really thought about integrating the whole and duking it out on more transcending issues that could ultimately affect R&D policy. Perhaps we're spending too much energy duking it out at the micro level when we should simultaneously be debating large-scale, macro R&D issues.

Dr. Ouchi: I think it's important to have several levels of integration at both the micro and macro levels. However, if you try to completely integrate two different sets of concerns in one unit then all you do is cause it to act like one unit. I usually think of the architecture of complexities and models. You try to collect at each of several levels just enough consensus to make the discussion useful but not so much as to make it impossible.

"... if you try to completely integrate two different sets of concerns in one unit then all you do is cause it to act like one unit."

TRANSITION PROCESS WORK GROUPS

Dr. Robert Penn
Dr. William Montague
Dr. Laurie Broedling

The three leaders of separate workgroups summarize what workshop participants saw as the major problems with the current system used by the Navy to manage the research transition process. Concrete recommendations are also offered on how to either improve the R&D system or re-examine its usefulness.

During the afternoon of the first day of the workshop, the participants were divided into the three groups. Each group discussed three issues:

1. The strengths of the current system that the Navy uses to manage the research transition process.

2. The major problems with the current system.

3. Recommendations for improving the system or re-examining its usefulness.

The groups met separately for approximately 1-1/2 hours. At the end of those discussions, each leader reported the results to the entire workshop. These reports are presented below.

WORK GROUP A

Leader: Dr. Robert Penn (NPRDC)

Dr. Robert Blanchard (NPRDC)
LCDR Mark Butler (NPRDC)
Dr. James Colvard (NAVMAT)
Dr. Laverne Johnson (NHRC)
Dr. William Ouchi (UCLA)
Mr. Richard Lanterman (Coast Guard HQ)
Dr. James Tweeddale (NPRDC)
Dr. Ray Williams (CNET)

We immediately dispensed with the tasks that were given us and went on to more appropriate thoughts. We discussed whether the 6.1/6.2/6.3 model is really the best one to use, what are the problems that exist under it, and what we would recommend doing to improve it. I think it was our conclusion that we're not going to do much about that 6.1 model. We have to live with it and we're not going to be able to change it. We also felt that transitioning from 6.1 to 6.2 to 6.3, particularly as it relates to the softer behavioral social sciences, was not an important issue. We just didn't see that was as much of a problem.

Our group viewed the problems associated with transitioning successful research into the user community to be the most significant issue. We dealt with a number of different problems rel evant to that issue. One was the competition that we continually confront for resources. That competition for resources often defines the nature of the efforts that we undertake, but we still need to ask questions such as what are the problems to be worked on and who decides what those problems are? Also, how do we develop strategies for getting research funds to address problems that are relevant and important to the Navy? To use marketing language, how do we dress them up so they can have some sexy application to people outside of the research organization? By research organization, we were tending to focus on NPRDC. That may have been unfortunate since NPRDC is only one research organization and not the research community. Nonetheless, there's a question of transitioning research, both into NPRDC and out of it, into the user community.

We dealt also with the assessment of different communities that are doing research. We talked at considerable length about the different types of strategies to bridge the gap, or certainly to develop better bridges, between the academic community and the applied research community. We also talked about needing to do a considerable amount of assessment of how we sell our research. Maybe to get our work more accepted by the users, we need to conduct research differently than we're currently doing. We have a tendency to think that the model that we're operating under and the research mode that we operate under is the only way to do business. We need to take some stock of ourselves and maybe look at a whole different way of allocating personnel resources and funds. We need to continually ask who should be doing what and whether we as a research community are engaged in the kinds of efforts that are necessary to successfully implement research. One thing that some of us felt was that if you want to transition research, you have to do it yourself. Otherwise, it doesn't get done. Researchers who have a set of values that tend to say I am not interested in engaging myself in the transition process may find themselves on the outs or moving to a different type of organization.

I think the primary problem is that we don't deal with those kinds of products that the hard sciences do. Our research is much more diffuse, both in terms of the product and in terms of the user. Indeed, there's no definitive user for much of what we do. There may be a specific problem, and OP-14 or 13 or 12 is interested in some particular task. But, in terms of the transition of the product itself to the Navy, it is much more diffuse. We don't have a given command that we're going to transition our work to over and over again.

Another issue we discussed was that we do have a lot of efforts that successfully transition. However, nobody knows about it because it's embedded in a much broader activity. For example, training is an area that is very broad, and the extent to which an NPRDC or an ONR product gets incorporated in that particular total domain often gets lost. So, people tend to

say, "Well, what are you people doing for the Navy?" They just don't visibly see our end products. The same might be said for testing. The services now have a more effective vocational battery; however, they don't see NPRDC's role in that. The human factors area is even more significant. You can see the ship; you can see the weapon system; but you can't see what the human factor's contribution was. So there may be a lot of work that is being transitioned that the Navy doesn't know about. Thus, we tend to end up on the short end of the stick with regard to examples of successful transition.

We discussed the need to spend a considerable amount of time in looking at multiple research strategies and multiple strategies for talking about transition. I think that Porter's talk this morning, which gave several approaches of the way this might be undertaken, is one that I certainly can identify with. A number of mechanisms do exist. We need to explore whether they're appropriate. For example, we have a science advisory board and various other advisory groups.

There also needs to be formalized mechanisms involving people at relatively high levels within the Navy organization. These formal groups need to help us determine long-range, as well as short-term research needs and how to tie that into funding requirements. This must occur on an ongoing basis since we have to deal with the continual turbulence of having key people moving in and out. These groups must help us identify the problems and identify who are the customers or consumers.

Another problem concerns funding pressures in the R&D world. We spend so much time worrying about the development of appropriate funding that we tend to forget about the transition process. If there's no funding to do the research, there is no reason to worry about transition. We expend considerable effort on the funding issue, especially those of us in the organizational sciences. Indeed, until we secure more permanent funding for organizational research, I think that transition is going to be the least of our concerns. However, unless we're able to transition, I don't think the funding is going to occur. So, these are not inseparable problems.

I saw for myself a research task out of all this. I have become interested in cultural issues since I first came to the Navy. However, what I've found is that it is very difficult to do cultural research. Most of the data gathering instruments that we have aren't worth very much. Still, I think it's important that we do research to determine the primary cultural values operating among the managers in the Navy. Then, we can tie those findings into the kind of research and development and transition strategies that we need to employ. I think if we could be successful with that, we might be more successful at promulgating our research findings.

WORK GROUP B

Leader: Dr. William Montague (NPRDC)

Dr. Jules Borack (NPRDC)
Dr. Bob Carroll (OP-01)
Dr. Robert Frey, Jr. (Coast Guard HQ)
Dr. Eugene Gloye (ONR)
Dr. Bert King (ONR)
Dr. Lyman Porter (UCI)
Ms. Lorraine Ratto (NPRDC)
CDR Warren Schultz (ONR)
Dr. John Silva (NOSC)
Dr. Mike Zajkowski (NTEC)

We stuck a little more to task. The discussion seemed to range over the same topics that have been discussed earlier today, so you'll hear a lot of familiar things. We looked at what we can say is good about the current system. That wound up being a short list and didn't receive as much attention as some of the problems we see in it and some recommendations that could help it. With regard to the current system, there was some discussion of some recent positive things that are going on within the system. For example, we discussed the new planning system in the MPT area that seems to now be coming to grips with the whole planning, system evaluation and implementation problem and trying to promote and facilitate that. This new approach is much more systematic than it has been in the past and hopefully could be promoted in other areas. Thus, one of the obvious recommendations that comes out of this is that these kinds of efforts should be supported.

One other area that we think is very positive in the current system is some of the tri-service initiatives. These have been generated to attempt to worry about applications such as TRIAD, which is a computer based training initiative, to try and prevent a lot of duplication of effort and promote the more widespread implementation of things that have already proven to be fairly good. There are other positive coordination efforts that have been growing in the 6.1, 6.2, 6.3 and 6.4 arenas. The groups that manage those different pots of money are actually, for the first time in history, getting together and worrying about how you get from one stage to another in that model and how to facilitate the connections. We also discussed the value of a current effort in training documentation. It seems like a move in the right direction to help with evaluation and with amassing a data base that can help support research planning. It would enable us to look backward in time and say something about what we've accomplished.

There was also a note of support for the idea that the current system, regardless of how badly it is organized, has done some good things. For example, the ONR organization was established after the Second World War, and it supports programmatic efforts in R&D. It's a well-protected organization. It gets supported regularly and does some good things. NPRDC is another example. It's been around awhile. It coalesced out of a couple of earlier laboratories, but it's been around now for 10 or 12 years. Again, its survival demonstrates organizational commitment by the Navy to R&D; a commitment we shouldn't forget. Sometimes, those of us who have to continually deal with funding limitations sort of forget about that kind of support.

As you might expect, there was a lot more discussion about problems in the system. One of the first issues that came up was why are we the ones here worrying about transition issue? Where are the people who use the R&D efforts or who see the problems in the operational world? Why aren't they the ones who initiate concern for the transition process? Another thing we discussed was that R&D funding is too often predicated on today's problems. The result is that by the time the organization gets cranked up to support some sort of research project, the problem has gone away. Thus, the projects are either cancelled or radically changed. Discussion also centered around the idea that it's difficult to prioritize the research efforts that we have. We get different priorities from different groups. This process is somewhat arbitrary and maybe something should be done about improving this aspect of the system.

We were particularly concerned with the fact that there seems to be a lack of emphasis on the evaluation of new technologies after they are implemented. We do a small-scale evaluation and then turn it over to the users. Whether that project gets implemented on any wide scale is almost an unknown in a lot of instances. There's no systematic tracking system to monitor the longer-term applications of

R&D technologies and there should be. I guess that means that more of us should have some input into what gets put into that sort of data base. There was some discussion of the idea that the structure of the Navy is somewhat opposed to research and development. Rather, it facilitates the planning and carrying out of day to day business. Research takes a longer range focus and takes a long time to accomplish. However, the short-term perspective of the Navy, combined with the fact that we have so much turnover in personnel at the top, creates a management climate that often isn't very conducive to supporting a lot of research and development activity.

One area that we seemed to come back to a few times was that there seems to be some problem in the way in which our R&D system is organized. It doesn't give enough credit to researchers who get interested in the transition process and carry out implementation. The professional world doesn't reward individuals for this in the sense that publications usually don't expand and that you spend all your time worrying about transition. Our organizations do not provide enough incentive so there's a sort of lack of interest for this kind of business by researchers.

Now, let's turn to the recommendations. We think that first of all the notion of coordination of the research pipeline is very important. The whole transition process from 6.1 to 6.2, 6.3 and 6.4 is very important and can't be effectively done without good coordination. One of the things that we also discussed is that there doesn't seem to be a whole lot of flexibility in that system right now. If things come along out of 6.1 or 6.2 that are fairly sudden, that are rapid developments, and that could be implemented rapidly, there doesn't seem to be a mechanism to deal with such research projects. So, we need a new approach for doing this. At that same time, we may have to consider alternatives to that pipeline model of research and development. Sometimes, it may not fit very well. What alternative models are there? We didn't discuss any alternatives, and I'll just leave that for the rest of you to think about because there certainly are alternative frameworks.

Another recommendation is to do more evaluation of the impact of R&D technologies that have been implemented. We need direct support and perhaps more R&D resource support for those kinds of efforts. They're not done very often. The reason that a lot of the research doesn't get followed up is that there isn't funding available to do it. A final major recommendation concerns the whole business of transitioning R&D. We should know more about it from a research standpoint. What is an effective transition? I guess one of the things I thought of in our discussion was that probably transitioning fundamental research into the beginning of an application is really a very different process from transitioning the applied research into an organization. We need to better understand all points of transition along the continuum.

WORK GROUP C

Leader: Dr. Laurie Broedling (NPRDC)

Dr. David Bowers (Rensis Likert Associates)
Dr. Kent Crawford (NPRDC)
Dr. Norman Kerr (CNET)
Dr. James McBride (NPRDC)
Mr. Eugene Ramras (NPRDC)
CAPT David Ringberg (OP-04)
Dr. Jeffrey Schneider (ONR)
Mr. Robert Sniffin (NAVMAT)
Mr. Glenn Spalding (NAVMAT)

Our group also ended up deciding that the fundamental problem was getting research into use and that part of that problem was the result of transitioning across different funding categories. However, the basic problem underlying this whole area is funding, and the availability of that funding ended up being one of the important issues. As with the other groups, we also talked about the user and more communication with the user.

Before I go on, I want to say a few things about the user community based on the research that I do. We routinely talk to users although maybe not as systematically as we should do. But, it's the nature of our business to do a lot of field research, so we're actually out there doing things with the organizations who are going to be the recipients of our R&D. We can't help but interact with users a lot. Some of what we learned we publish, and some of what we learn we don't. Some of the most interesting things we learn, we can't publish, but sometimes we can talk about them.

Just to give you a feeling of the ups and downs of communication with users, let me describe a meeting that my staff had with a fairly high placed person in a Navy organization. We were discussing the matter of work motivation, since it is one of our research areas, and some of my people are experts on that topic. We were asked to talk about some ideas about motivating the work force. We said something like we're here to talk about work motivation and ideas we have, and he said, "Stop! Motivation, I know all about that, and I've given it a lot of thought. As a matter of fact, I've had some reserve officer looking into it, and I have the answer." We said, "That's nice; it's a complicated issue." He said, "I have the answer." We were on the edge of our chairs wondering what it was. He said, "toasters." My people said, "Oh?" He proceeded to wax eloquent about the motivational potential and value of toasters. He wanted to reward his good performers with toasters.

In some seriousness, there probably is some motivational value to small appliances. Nevertheless, it was interesting how fixated he was on toasters. It is always useful to get the full spectrum of user's views and opinions to improve one's own perspective on what the user needs and how we can meet those needs. Nonetheless, we do bring some expertise to that interaction and shouldn't always be sold on the user's view. Otherwise, we may be buying a lot of toasters. Anyway, we did keep in mind the user's problems and views.

Our group also had trouble coming up with a long list of strengths, but here are a few. We did see some good integrating mechanisms with 6.1 to 6.2 in the manpower, personnel, and training arena. There are a number of good examples of transitions in this area. There is also value in the fact that the Navy supports basic research through ONR. Another area concerns funding categories. There's flexibility in the use of these different categories, and this can be good and bad. We found that if somebody doesn't like a research idea, they can simply say it's too applied, or too basic, or whatever funding category you're asking for support. That's a negative kind of use.

This flexibility also has a positive side. If somebody values the idea, if a user or program sponsor really supports it, there's generally enough flexibility to be able to use almost any kind of money for a given kind of problem. Despite the fact that the R&D world is divided up into three magic categories, problems can usually be defined to use different kinds of money for different kinds of things. Another advantage of this flexibility is that it does allow keeping some new technology in the system that may not be needed right at this particular moment because it may be dependent upon other technologies coming along. Thus, it allows you to sort of keep things alive on

the shelf, particularly in the 6.1 and 6.2 arena. These are all strengths of the current system.

Our group saw a number of problems with the current R&D system. Within the funding transition process, one of the key ones was from 6.2 to 6.3. This is probably the single biggest hurdle because of the different organizational structures that are involved. You have to go from the 6.2 ONT world to the 6.3 OPNAV world. However, there aren't any direct structural links between these two worlds. In the 6.3 6.4, 6.5 arena, R&D is all handled within the same structural entity, so, theoretically, this transition should be easier except that a new problem emerges. In the 6.4 and 6.5 arena, there aren't clear-cut program elements to be utilized to fund MPT kind of research. So, even though we have a common set of program managers, they don't have a lot of 6.4 and 6.5 funds to support MPT transition. Similarly, you've got a fairly large demarcation between going from this world to the user world of O&MN dollars. The user world is a different group of people who don't automatically communicate with the R&D world. So again, you have a lack of communication across those structural lines.

Besides funding, we have some other continuing problems. There's a lack of dialogue between the researchers and users. Thus, we don't assimilate each other's thought processes as Lyman Porter was talking about this morning. In some instances, there is not enough thought given to implementation issues. Sometimes, it's not appropriate. Sometimes, especially in 6.1, you don't want to bog people down worrying about implementations since that can be disruptive. But, there's a point at which, if you're going to transition it, somebody has to consider how this is going to really fit into the organizational culture. We sometimes find problems with that in our research. As a matter of fact, I think we find that's a problem more often than not. Once we get into the organization itself, there's a whole host of things that we hadn't thought of that we should have.

Another issue is that the whole budget process is conceived around hardware systems that isn't quite appropriate for personnel research. We don't think that's going to be changed. But, there are some differences that we need to be continually aware of. Since we're not usually developing a system, like a hardware system, then we don't necessarily have clear-cut automatically identified users. There's not a single program manager that we can identify with. That's related to the point that there's no focal point for what we're doing. It's very confused. There's lots of different people involved. No single person is the responsible agent for the product line. This problem is complicated more by the transient nature of R&D management, the military, and, to some extent, civilians. Again, we don't think we'll solve this problem, but it's good to be aware of it if you're working over 3-, 4-, 5-, 10-year periods. The chances are that you're going to have several changes in people that you're dealing with and that makes transition more difficult.

Another problem area that we've already talked about involves incentives. There are no immediate direct incentives for either researchers or R&D managers to successfully transition research work for which they are responsible. That doesn't mean that there aren't indirect incentives or intrinsic desires to see these things utilized. Likewise, it doesn't mean that there aren't some long-term incentives. If we don't do effective transitioning over the long term, all of the support for R&D will eventually dry up. It may take 20 years for the system to catch up, but you know that if the stuff doesn't get transitioned into use sooner or later, the operational community will come to bear on the funding cycle and reduce the funding. The long-term incentives are there; it's the immediate, short-term rewards that we see as lacking.

In terms of recommendations, we had two. The first one concerns development of a descriptive map as to where the funding sources come from and also who is involved in managing 6.1, 6.2, and 6.3 research. What we have found is that there aren't any integrating mechanisms that go across the various funding lines. While people acknowledge that ONR and ONT ought to be talking to people in OPNAV and so forth and so on, the fact of the matter is that the immediate rewards are from one's own chain of command. So, R&D managers are going to communicate and spend most of their time talking to people in their own chain of command rather than going across funding categories. So, the first step basically would be to develop a map of who's involved in each of those domains and an idea of who ought to be talking to whom.

Our second recommendation would be to use this map to develop a formal bridge between the different funding groups. We started to discuss what kind of a bridge. Would it be an institutional bridge or a particular individual? If it was an individual, would it be somebody from R&D management or somebody from the operational community? What little happens right now in the way of bridging tends to come from the research community, but maybe it shouldn't be primarily research managers. It could also be somebody in the user community who has the responsibility for seeing that there's communication across those different lines. We just began to discuss this area. We didn't have any specific ideas. But, we thought that if the map was generated, it would lead to some further thinking on how one could create that integrating mechanism. Without this link, you primarily have a differentiated system where the different funding managers are responsible only to their primary organizational entity.

COMMENTS FROM THE AUDIENCE

Comment: The notion was presented about problems and who identifies them. That struck very close to home to me. If we get involved in transition and accept the need to continue to be in touch with whatever customer world or area that we're concerned about, then we've got to be very sensitive to user problems. We can't just sell them our solutions, or our research answers. We must continually ensure that we are giving them products that help solve their problems as they see them and not just their problems as we see them.

Comment: The image is that we are not responsive enough. The image is that we're trying to peddle our wares instead of being responsive. I think we need to somehow structure the R&D system to give the appearance of responsiveness, regardless of what's obtained or what's actually done. If we can change that appearance of responsiveness, I think we have a lot to gain as far as ability to obtain funds for both research and transition.

PANEL DISCUSSION

Glenn Spalding
Dr. James W. Tweeddale
Dr. Bert King

A provocative interchange between three Navy R&D managers and workshop participants offers interesting insights into the day-to-day realities of transitioning research in the dynamic Navy environment. Availability of resources seems to play the central role; however, many opportunities still exist for improving the current R&D system even given major fiscal constraints.

Mr. Glenn Spalding
Office of Naval Technology

I'm not sure how I got to this position. I thought I was coming to this meeting to learn about transition and transition technology. When I arrived here, I found that I'm supposed to be one of the 6.2 guys who obviously has all the answers about how we do transition. I thought all along that I was the guy with the transition problem rather than the transition answer. What I did was jot down a few notes during the break. I

"I think that the situation that we see really is driven by economics."

thought I would share with you some of my thoughts and summarize some of the things that have already been mentioned here. Then, I'll try to weave into what my perception is of the situation that we find ourselves in right now.

Someone in our group asked why we're here. I think we're here because we in the R&D community perceive that we have a problem, and that problem is that things are not transitioning fast enough to suit us. We see too many things that stay on the shelf that aren't going through the transition process. That's our perception of the problem we face. If I would turn around and look at it from the other side of the fence, from the perspective of the acquisition manager or a guy in the fleet, I think I might have a different viewpoint. I might look back at the technological community and say, "Those guys really do have too much money." They're giving me too many options, more options than I can handle in my job, which is to get something out there in the fleet that works today.

I think that the situation that we see really is driven by economics. The overall budget that each of us has. It's that constrained budget or the emphasis that has been placed on the budget that is causing us the problem that we perceive here. It is that budget that drives the priorities in the system, and I think we have to accept that today we are in a mode of hardware acquisition. That's the position of this administration. It's to build up resources that are out in the fleet. It's to handle some of those problems of spare parts and other related things that we've ignored for many years and that have gotten us into a readiness problem. In order to do this, it is the R&D that is suffering at the present time, particularly the lower end of the research spectrum on those things that take a long time to develop. These are the projects that are suffering the most. These projects are a critical part of the R&D community that we are a part of.

Our complaint is that we're not transitioning quickly enough and that we're leaving too many things on the shelf. My office is a part of that crying plea, and we would be remiss in our duties, I think, if we did not make that plea. However, I do not believe that that situation is going to turn around in the near future. We are committed to building up a 600 ship Navy, and that train is on the track. It's already left the station, and it's going to continue to run its course. In the process of doing that, as I said, things are backing up in the system. One of the complaints that we have in the 6.2 area is that we are having to hold things in the 6.2 world that we think should transition to 6.3. I think that is one of the concerns that you see here.

"Our complaint is that we're not transitioning quickly enough and that we're leaving too many things on the shelf."

I'm not sure why this meeting was kicked off by ONR, but certainly the technical director of ONR has expressed concern that he's beginning to see the pressures on the 6.1 community to hold things in the 6.1 community because there are not funds to transition them. We just recently, last week as a matter of fact, went over and presented the results of the 86 POM. We were negative in that presentation and were called to task for that. We were told that we presented a lot of negative things and if we had that as an attitude, we were never going to get out of the situation that we thought we were in right now.

I think that we do tend to concentrate on the negative. All of us, as we looked at the process there, had difficulty coming up with a number of strengths of the current R&D system. We could all come up with many negative comments. I think that we do tend to concentrate on the negative too

much. It's not that transitions are not occurring. They are occurring. It's just that they may not be occurring as fast as we would like to see them.

I was asked to say something about the particular problems that are faced in transitioning human factors R&D and other personnel-oriented research. Certainly, behavioral sciences R&D is a different world, and I think one of the problems that I see there is that the R&D structure that we have was built for acquisition. I do think it works in the personnel world. It's difficulty, as I see it, is that it's hard to define the categories and decide what belongs in one category.

I don't believe that problem is unique to the R&D in the personnel world. I think the same problems exist in electronic devices for instance. The guy who tried to develop a better transistor or a better memory for a computer has those same problems of selling his product to another community, to a broader community. He has to work at that, and he has to overcome those same barriers that you do. He has to learn to relate to a different technological world from the one that he normally lives in. It's always going to be easier to sell the bullets and the guns and the platforms. These are things that you can see and touch. They are things that go bang. They are unlike products from some of the softer sciences, and I don't deny that at all. You're not out there alone in having that problem. I think that we just have to make the commitment to do that communication and do it better than we've done in the past. We have to learn how to communicate better. We can't sit back and wait for them to come to us. We have to take that initiative and get on with the job. I think that we have to quit being so negative on ourselves. We've done lots of good things. We've done things that transition and that are still transitioning. Let's take a positive look at things rather than focus on insoluble problems.

"I think that we do tend to concentrate on the negative too much. It's not that transitions are not occurring. . . . It's just that they may not be occurring as fast as we would like to see them."

"We have to learn how to communicate better. We can't sit back and wait for them to come to us. We have to take that initiative and get on with the job."

COMMENTS FROM THE AUDIENCE

Comment: I'd like to comment on one thing. I think I hear a theme here that suggests we're hung up on technological imperatives. Because technology exists, we must use it. In other words, if it's there, it has to be transferred. I don't think we know psychologically how to deal with the fact that even though the research was successfully completed, it may have no current utility. It was not a bad piece of work, and we don't know how to sense closure and completeness until we've generated an end product. Maybe we need to deal a little bit more with what constitutes completion of a task. Because I'm 6.2, backing up into 6.1, this suggests that there's some kind of expectation. You get to a certain point and then it must transfer. If it doesn't transfer, you have to keep working on it. Maybe we should just say, "That's enough." Bert and I were talking recently about a piece of research that somebody's doing. We felt we got all we wanted out of it and we're done with it. It's a good piece of work, the guy did an excellent job. There's no sense of failure that it isn't flying around the sky. It occurs to me that maybe we ought to talk about technology transfer and transition within the broader context of when transition is necessary and when it isn't.

Mr. Spalding: That's a very good point, but it's something that's being ignored now because even in 6.1, you have to justify somewhere down the line that it's relevant. Maybe you could get across to these scientists and say, "Okay, this is an interesting question; it's important to find the answers." I'm just not sure you'd get a sponsor to do that. Anyway, your point is well-taken. I think some years ago that that would have been a reasonable stopping point if we weren't so hung up on relevance. You have to change the incentive I guess.

Comment: Not the incentives so much, but change the people in Washington, including our salesmen. There's no guarantee that research will be successful or that it should be transferred when it is successful. We just don't know how to deal with that issue in the funding world.

Comment: We don't know how to deal with it in the evaluation world either. A guy is successful when he expands his program, when he gets things to transition. He may be just as valuable in his decision to cancel the program and to get out of it.

Comment: We talk about a negative report being a useful thing. In other words, there's no gold in the hills. That is a useful discovery. Yet, we seldom produce such reports.

"It occurs to me that maybe we ought to talk about technology transfer and transition within the broader context of when transition is necessary and when it isn't."

Dr. James W. Tweeddale
Navy Personnel Research and Development Center

During the morning and early part of the afternoon, I was reflecting to some extent upon this audience. We have representation from BUMED, OP-01, NAVMAT, the university community, NPRDC, and we even have a Coast Guard representative. We also have a token representative from a hardware lab, and I really can't forget that the Naval Ocean Systems Center as another laboratory does represent a major market for the transfer of technology into other laboratory settings, both within the Navy and within other organizations. Much of what we said I think involves a couple of general problems and problems I think that we can fix. One of which is that we deal in an R&D domain where the identity of our products are often lost in transition. The problems with the technology base, I think we can fix. Dr. Porter gave us a couple of aspects of the problem for us to look at. His notion of the rich academic soup seems helpful. We need to understand the richness of the soup and hope that we aren't creating a fruit salad when the market really wants bouillabaisse.

The notion of a motivational audit wherein we seek to integrate more cogent dimensions of theory and apply the integrated set to current problems is somewhat similar to the traditional transition approach. But, whether it be a soup or an integrated set of theories, the implication is that we need to do more to label and to identify the technology that we deal with. If, in fact, the technologies are mature, we need to think about how to articulate and convey that maturity and how to address those technologies at meaningful targets of opportunity. If there are not targets of opportunity, we need to go back and look at that. We must then ask what we're all about because it would appear that if we're working on irrelevant technologies, the Navy doesn't need us.

"If, . . . the technologies are mature, we need to think about how to articulate . . . that maturity and . . . address those technologies at meaningful targets of opportunity."

This kind of gets us back to the pivotal values thing and what are the pivotal values. I think there's maybe some need to explore that issue as well. There's a problem of psychological ownership of that which is new. I reflect upon the pervasive impact that one Navy individual has had upon an industrial community. I think of Wil Willoughby. There are few large industrial meetings that I go to where Willoughby is not mentioned. He's almost as well-known in those circles as the Pope. Reliability and maintainability is his world. He's a hard person to live with. He's an iconoclast that's convinced he knows more about reliability and maintenance then anybody else, and you can't convince him that he doesn't. I'll say this. He knows a hell of a lot about reliability and maintainability within the industrial infrastructure. He knows his discipline.

I think that if we want to deal with the bouillabaisse or the motivational audit model, we really have to know the composition of that soup. We really have to understand the kind of language and semantics through which we can communicate our technology. We need to know the market, and I'd say it better be the right market. No doubt about it, Willoughby addresses himself to the right kinds of marketplace traditions. He also knows the players. As a matter of fact, I would say that rather than seeing rotation as a problem, Willoughby sees senior management rotation among three- and four-star admirals as an opportunity, not as a problem. He says that it's great

because rotation is an opportunity to work on a new, urgent, and pressing need in the Navy.

Willoughby sees that we've never arrived and that there's a chance of arriving in the present regime. He will do all he can now, and when he gets rotated, he's going to do what he can to incrementally advance his new organization one step closer to an ideal model that he has conceptually erected in his mind. Willoughby knows that model is not possible today. He views it as being possible at some point in the future. Therefore, I would view that model as dealing within the framework of the arts. It's a possibility. I think we need to think about this issue of technological transfer as an art field. We are dealing with the infusion of the possible into present organizational arrangement, always recognizing that we may not arrive. We're not finished yet either. I think those kinds of thoughts come through loud and clear to me when I consider the area of technology transfer.

Dr. Bert King
Office of Naval Research

Sometimes you feel beleaguered and all alone in the world, and I think the thing to do sometimes is to look up, look around. What you find are organizational effectiveness issues right out there. Somebody's been listening to us. It seems to me in terms of what we've been talking about today that there are several major clusters that keep coming up over and over again. One of these certainly is in the area of organization effectiveness. I would like to emphasize again this matter of management attitudes, management statements, and management actions with respect to the matter of transition. I think there needs to be clear communications on the part of management in the various parts of the Navy R&D world as to just what is wanted in the way of transition. I think those statements then need to be followed by action. The kinds of actions

". . . we must learn what the values of the organization are in which we wish to do work."

that make sense to all of us. That is, if you do this, you'll get a bigger office or you get a bigger paycheck, or whatever. I'm not sure, at least where I've been living, that the reward structure is that clear for transitioning. Some people take the approach that transitioning detracts from my major responsibility, which is to do something else. So, I think that we can help people by structuring the organization, structuring the reward system, such that people can understand that if they want to achieve certain rewards, then they can do such and such.

Another problem that I'd like to respond to, I think it was mentioned by Lyman Porter, is the matter of criteria implementation. I think he called one factor "congruence with experience" and another factor "manipulability of the variables." I think "manipulability of the variables" is particularly difficult for those of us who work in the organizational area. If we talked about organization structures, for example, where are we going to find somebody in a blue suit who really wants to talk about changing the shipboard organization? Of course, we are constrained by hardware. There's only so much you can do with respect to the spaces aboard a ship and how you organize that. But, that seems to be one problem.

Another problem has to do with the matter of communication between researchers and users. I think each of our work groups here has touched on that. We do need to develop better ways of increasing the communication among the different parts of the Navy organization. We should bear in mind, indeed, that the Navy organization is one of the largest organizations around. So, from time to time, there are going to be problems in communicating within it, especially given the different value structures within different parts of the Navy.

On the matter of communication, I think a related problem, particularly when it comes to organizational research, is that there may indeed be drastically different value systems in the organizational research field in general as compared to the value system in the Navy. This might not be as much of a problem for people in the physical sciences or in engineering who may share to a greater extent the values of the Navy. But, I think it probably is more of a problem for people in social and behavioral sciences who tend to have values that place a premium on changing an organization. They want to improve it if it isn't doing what you want it to do. On the other hand, the values of the military typically place a premium on preserving the organization as opposed to turning it over or pulling it up by the roots, if you will. The military managers are not as willing to start a new procedure or even to put in place a new organization structure. Perhaps, that accounts for some of the kinds of comments that I think Laurie Broedling made about the comments that she hears in corridors.

There's almost a fundamental antagonism on the part of many people in social behaviorial science toward organizations, toward conventional ways of doing things. To a degree, that's as it should be since these are the people who ought to be coming up with new ways of telling us how to do things. But, it does make it difficult for many of the people in the social behaviorial science field to work within organizations other than the academic organization that share their attitudes and their values.

I also heard reference, several times, particularly I think in Jim Tweeddale's initial presentation, to the fact that we must learn what the values of the organization are in which we wish to do work. I certainly agree with that, but at the same time, since we are all in the research and development world dedicated to determining new ways to do things, I think we have to accept as a matter of faith that whatever the values are in an organization at a given point in time, they are

likely to change. Even the most conservative organizations do change. It's amazing. Look at the change from the battleship admirals to the carrier admirals and then back to battleship admirals again. There are changes, and, therefore, I would hold out hope to those of us in the research and development community who want change that there is a prospect of trying to anticipate some of those changes. I would hope that we would not only try to adapt to the values of the organization at a given point in time, but I would also hope that we would try to help the organization as it continues to change its values and concepts and approaches.

I would like to make one more comment, and it stems from the remarks that Lyman Porter made about the transition process. The fact is that there is basically so little we know about it. It seemed to him, and I would certainly second the motion, that this would call for increasing our store of knowledge about this area. I would hope that there would be some opportunities in the future to do this sort of thing. For example, we need to examine the past record in the Navy and in other organizations with respect to this kind of problem. We need to find exemplary projects and perhaps even find fiascoes from which we can learn some lessons. We need to determine what are the characteristics of organizations, such as the structure of their value and reward systems, that contribute to successful or unsuccessful transitions. That's all I have to say on substantive matters. Are there any questions or comments?

COMMENTS FROM THE AUDIENCE

Comment: It would help me if you could take a couple of minutes to explain the directions or movement of funds within ONR and NPRDC in the last 10 years. Has it gone up a lot, has it leveled off, or has it gone up and down?

Dr. King: Let me say something about ONR, and then Jim Tweeddale can say something about NPRDC. At ONR, the basic research pot at present is something on the order of 8 million for social and behaviorial sciences. That has gone up somewhat. All of the increases in that budget have been in the area that we call personnel and training. It's an area headed up by Marshall Farr, and it has included a great emphasis in the last several years on cognitive science for one thing and the training research world for the other, particularly things like computer assisted instruction. Quite recently, they have gotten into the area of using background characteristics for the selection of personnel. The organizational area has not fared as well. There's been no increase for organizational research, and at the present time, to put it very charitably, we are in the position of having to justify its existence in terms of why the Navy should support research on this topic. What is it about the Navy that makes sense for the Navy to support research in this area, given that the Air Force isn't supporting anything in this area, or that the Army has a negligible amount of research in this area? That's the kind of situation in which we find ourselves at the present time. I'll turn to Jim for NPRDC funding.

"We need to determine what are the characteristics of organizations, such as the structure of their value and reward systems, that contribute to successful transition."

Dr. Tweeddale: I find the organizational arena is continually one of impoverishment. I think that in the organizational management area, we really have less funding, especially with regard to trying to create a 6.2 framework to support it. We really don't have a substantial 6.1 program in any area in NPRDC. In the 6.3 area we've just been trying to work within the context of the system to articulate and present the needs. But, there's a mind set looking at reducing costs by reducing the number of program elements. The discussion centers on why do we need this research given that the organizational sciences are a body of knowledge that's already well-identified in textbooks. Therefore, there's really not much more work that needs to be done in that area. So, we get back to the issues that we've discussed today in terms of trying to create a needs-oriented strategy to articulate the R&D and the language to communicate those needs to the operational community.

Comment: The only areas we really look at are 6.2 and 6.3. It is hard to identify just what's applied to what in the 6.1 research in the other services. Also, the 6.4 is kind of meaningless because it's one big system of B1 bomber simulators, but, if you look at 6.2 and 6.3, the Navy funding over the last five years has gone down slightly. It's basically horizontal. The Air Force and Army R&D in 6.2 and 6.3 has doubled. As a matter of fact, right now, 1984, the Air Force and Army has double the increase in R&D budgets that the Navy has. Historically, the Navy had more R&D 5 years ago. I think one of the reasons is that the Navy is placing its greatest emphasis in hardware acquisition.

Comment: We may be using a wrong organizational mindset. I'm thinking about the discussion we had earlier, and it's all true. Bill was talking about how you must get clear on what your organizational objectives are. If it's just to do research, you better have a lot of friends or you better be independently wealthy. You're not in a research institution; you're in an operations institution. You're not in a research society so the premium on hiring all researchers with Ph.Ds may be a wrong organizational mindset. I've found in a research and development center that I can only afford a small percentage of my organization to be dedicated to true research. If I laid out a strategy that said my objective is to do something useful for the Navy that requires research, I need to optimize the total process, not just research or its transition into utility.

"I've found in a research and development center that I can only afford a small percentage of my organization to be dedicated to true research."

I may put 90 percent of my organization into a hell of a lot of other things. It isn't just a research center. This may be seen as unnecessary overhead by researchers who tend to take a very arrogant view of the world. These scientists ask why don't those plebeians understand the beauty and truth and fund it. But, if you looked at the equation you were solving and said at the end of 5 years I want to have done the following for the Navy that involves research, the overhead utility was worth it. When you try to exist on research alone, which quite often centers on pride for awhile, you damn near go out of business. You may have a lot of good researchers, brilliant as hell, all speaking German and having beards, but they just won't be able to get anywhere that useful to the Navy. If you think you're talking down to them and I'm really saying this in a pragmatic way, you have to expand your mindset. You must understand that the reality of

the plebeian or blue suiter is just as valuable and valid, and if they control the resources, by definition they have importance.

Comment: I think there's a kind of interesting problem here. It relates both to communication and to specifically what you were saying. In the work I've been involved with for over 10 years, I think there has been a tremendous growing realization on my part about the need for transitioning things and getting involved in doing that. In actuality, in a lot of the training in the educational world, there's been a lot of concern for the same issues. There's been a lot of work done on it. There's a lot of publications on it. Yet, we've heard people mention several times how little is known in the scientific literature. I've been involved in research transition and attempting to figure out how the hell we got some things into the Navy world. I've been working on that for 10 years, and yet I've never written a paper on it. I've written a lot of other papers, but never one on worrying about research transition. That points out to me that we've got more of a problem than we were talking about earlier. We really need to pay more attention to the transition process, study it, and promote it at some level.

Comment: Right now, there's one thing that's really puzzling to me. In the private sector, some of the largest, most complex organizations invest maybe four or five million bucks a year in studying how they're organized and on how to stimulate improvement. These companies then consume huge amounts of training in the form of management consultants, as well as in the form of internal organizational research. These companies invest a far greater proportion of their resources on organizational issues than does the Navy.

I can think of several possibilities. One is that the Navy is perfectly organized. That's one possibility. The Navy is really about as good an organization as it's ever going to be. It certainly pays to be well-organized. The other is that it's essentially like a small business where the fundamental unit of organization is small. You have only the captain and the crew at sea, and that's a small enough organization that you don't need very intricate knowledge about the organization. Of course, another possibility is that there's some reason that I don't fully understand. Maybe there's some pressures on the Navy not to look at how it is functioning. On the other hand, people who run the Navy aren't all that closed-minded, or maybe they are.

I don't understand enough about the Navy to understand how an organization of its size can apparently pay so little attention to the way it's organized, whereas every big company that I know of feels that the most important competitive advantage they have is how they're organized. They all believe, all the big companies believe, that if you're organized wrong and you're competitor is organized a little bit better, you're going to lose every time. They all believe that you cannot successfully develop today's technology with yesterday's organization. They all believe that you can't successfully distribute today's product with yesterday's organization. They all believe that.

"I don't understand enough about the Navy to understand how an organization of its size can apparently pay so little attention to how its organized, whereas every big company that I know of feels that the most competitive advantage they have is how they're organized."

Comment: I think the Navy does spend quite a bit of resources on reorganization. They have reorganizations all the time. One of the things the Navy is very compelled with is to have studies done by contractors. The Navy then uses this information to allow its internal staff to reorganize. For instance, there's always internal reorganizations going on. You'll find that a new CO comes in and the first thing he'll do is reorganize. Also, the Navy has a large number of organizational effectiveness centers taking a look at its organizations. So, I think that six million figure might be misleading on how dynamic the Navy is. The Navy is a very dynamic organization.

Comment: There is a distinction between studying the organization and just changing the damn thing.

Comment: The question is, do you go external or do you view it internally? I think internally, we study ourselves like that. It's a question of how open-minded we really are. But, we do have big studies occasionally. We'll contract out to some firm to come in with big recommendations.

Comment: I think there's a lot of other factors. One is the fact that there isn't one Navy, there's a lot of navies. There really isn't a board of directors of the Navy so the Navy can't effectively look at a single organization. In truth, there's not an alternative Navy so we're a monopoly. This could cause you to be lazy. There's no competitive pressure, and there's no effective way to create it. We can't say, okay Congress, this year you can decide to buy from the U.S. Navy, or the French Navy, or the English Navy. It's a matter of making decisions; it's not a matter of substitution. I think that we do constantly study ourselves.

For example, in my own command we have right now a lot of studies. A lot of them are not necessarily run by NPRDC, and that's probably what I would hit Jim about. We've got someone

...all the big companies believe, that if you're organized wrong and you're competitor is organized a little bit better, you're going to lose every time."

from CNA right now doing a fairly elaborate study on what are the meaningful parameters that one measures in industrial institutions to judge performance. How in the hell does one take a look at institutional feedback and determine when you've got a problem in a monopoly? You don't have a marketplace; you don't have any form of mediation of value or competition, so we are unique. No public institution can effectively have competition. So, I think there's more being spent than meets the eye. In many respects, you're first point is true. We've got a lot of little-bitty organizations. Each commander can piddle around in his organization any way he wants to, and there's a certain amount of value in that. There's also a certain amount of wasted motion.

However, fundamentally, I think we don't spend enough time or money looking at the issues you've raised. That's what I personally would like to see more of, and its part of the reason I came to this conference. I believe we need to support an objective look at our organizations. We need some people in R&D to understand truth and reality and to relate to the rest of the community and the rest of the world. We'll never own enough people to do all the basic research. We wouldn't want them because it would become too damn expensive to buy it. But, if they can't bridge with the operational community and if they can't give us that integrated perspective, then we don't need them. So, I think there's a fertile field here. Hell, just in materials command alone, we spend 60 billion a year.

We lose more than we invest in research just counting the damn thing.

Comment: An informal observation that I've noted is that when organizations are faced with the threat of part of their services being contracted out, you generally find a lot of constructive activity. They're trying to do something to increase their position. So, I have concluded that competitive pressure is very important. There could be a lot more competitive pressure put on our Navy organizations. Another comment that occurred to me is the matter of users. For us, input from the user is of major concern, but we don't need a lot of users. What I mean is that when something gets transitioned and utilized, what researchers need are a few good users. They need to meet with line managers and staff people who are progressive and who are willing to take a risk with all those things that we've talked about. We can't expect the entire Navy to be that way. But you need a few places like that with a few people who are willing to say that we value and are willing to try some different things. We usually find these people by trial and error. There may be a way to be a more systematic about that. It would save everybody a lot of time and effort. It may also get these people off the hook a little bit. They're sticking their necks out. We keep getting back to users, and what we need are those good, informed, willing users. Let's find a few.

Comment: Going back to the model linking the producing community and the user community, it seems to me that the bridge between those groups was sort of undefined. I would agree with that. I guess at this point in time, it seems that there are two reactions that we can have to the situation that we find ourselves in. One, we can sort of withdraw from the user community and come back and become the research community again. Or, we can do the things that we think are important and continue to embrace that user community. I think that even though we run the danger of having more of the 6.3 type research by embracing that community, I really believe that we have to move forward and build that bridge better rather than step back and live in our own world and only do things that we think are important.

Comment: It seems to me that the choice is obvious. For what do we exist if the user is ignored? If we exist to improve the capability of the Navy, there's no choice in drawing back and saying we want to do research. We exist to work with that user and improve him.

"For what do we exist if the user is ignored? . . . We exist to work with that user and improve him."

SUMMARY PRESENTATION

Dr. Lyman Porter

Do Navy operators really care very much whether research is transitioned or not? The answer, of course, is only if it ultimately improves the Navy's capability to achieve its primary mission. Porter points out that in order to get the maximum benefits from its R&D, the Navy must consider possible changes in current structural arrangements, the reward system, and the research process itself.

I must say that during most of yesterday as I was sitting here listening to our various discussions on the transitioning process, I felt a little bit like Benjamin Franklin. He was in the Continental Congress and was looking at the webbing on the back of a chair where there was a picture of the sun's rays coming out. Franklin was continually trying to figure out whether that sun was setting or rising. I had a little of those same feelings yesterday when we were talking about all the positive, optimistic possibilities of transitioning and also all the problems and pessimistic thinking. I wasn't quite sure how I was feeling at the end of the day; whether I should be thinking that transitioning was rising or setting.

After this morning's presentations, I'm somewhat more attracted to the image of the sun rising. I think the key question that really sort of underlies all that we talked about here, in terms of transitioning, is one that I began thinking about yesterday. The key question is how much does the Navy, as an organization, really value the transitioning of research, especially research in the areas of personnel and organizational behavior? To use Jim's phrase, is research transitioning really a pivotal value or not? Do people really care very much about whether research in these areas is transitioned or not? That's a question, at least for me, that remains unanswered. In thinking about that question, I am reminded of a comment that Jim Tweeddale made yesterday. He said that transitioning is only important if it ultimately serves the Navy in its primary mission. So, I think in answer to the question whether transition is important or not, you really have to put

it in that kind of context. The people in the Navy are the ones that have to decide. How much does the Navy value research and transition in a given area?

Another question we have to ask is whether all the research that we do should be transitioned? Is it all capable of being transitioned? I think that's not a trivial aspect of this issue. If we assume that transitioning is important, at least to some degree, then there's a set of about five or six critical variables that different people mentioned at different times that seem to effect how successfully that process does or does not work. The first set of variables concern the resources issue. As much as we might value transitioning or look at it positively, I think we have to recognize that resources are a key factor and that they are going to be limited. They're always going to be limited, and it may be a waste of time to think about what we could do if we had greater resources. The real issue here is how much transitioning can we do within the limits of the funds that are available? We need to take that level as a given and not keep hoping that those limits are going to go away.

"The key question is how much does the Navy, as an organization, really value the transitioning of research . . ."

The second set of variables, it seems to me, concerns our structural arrangement. How are the structural arrangements in the Navy as an organization set up that either facilitate or hinder the transition process? How do the different components that might get involved in the transitioning process relate to each other? Also, is there any way that the structural arrangements can be changed or altered that might help transitioning without, at the same time, creating new problems or increasing current problems? I think the issue here is what are the facilitative arrangements and what are the roadblocks? We have to better understand how the current R&D structure affects the transition issues.

". . . transitioning is only important if it ultimately serves the Navy in its primary mission."

A third set of variables concerns organizational culture. This area was emphasized in the opening talk yesterday morning by Jim Tweeddale and was also mentioned at various times by other people, including Dave Bowers. How do the cultures of the researchers and cul tures of the users overlap and differ? Here, the norms, the values, and the traditions of the different organizational elements are clearly critical.

A fourth set of variables that we didn't discuss concerns the attitudes and beliefs of key individuals that can have an impact on whether transitioning is going to be paid attention to. While it's true that organizational members have a shared set of beliefs, attitudes, and values, there are always key individuals that can have different views. If these individuals are in the critical power positions, they can have an overwhelming positive or negative influence on the transition process. This influence can be independent of the basic culture of the organization. We need to have a better understanding of how such people affect transitioning of research.

A fifth category of variables that came up in a number of different discussions was the reward system. What are the rewards, or what I would call reinforcement systems, that are supporting the transitioning of research? Here, you're talking about incentives for individuals to go out and do something, try to facilitate change, try to take part in the transition process. We must also look at the incentives for potential users to use research that is coming toward them in the transitioning process. I'm reminded of a comment that Jim Tweeddale made to those of us who are involved in any way in organizational research. Whether it's basic research or more applied research, if we're going to interest users, we really need to create a needs-oriented strategy where users actually want to bring forward research. Users must feel there's a need to do that and that it will be helpful to them in some way. So, I think we need to look closely at the incentive issues--What are the current patterns of incentives and rewards that strengthen or interfere with transitioning?

"How are the structural arrangements in the Navy as an organization set up that either facilitate or hinder the transition process?"

I think a sixth major category of variables really related to the nature of the research itself and the research process. Again, how much research is ready for transitioning, should it be transitioned, and what are our best areas for transitioning research? We need to look at how we conduct our research as an important factor. What type of researchers are we using to address certain issues? I think the presentations by Dave Bowers and Bill Ouchi certainly illustrate that there are different approaches to research. Bill's argument was that we need to combine organizational sociology with microeconomics to better understand organizations. Dave, on the other hand, stressed a more micro focus using organizational psychology and organizational development. I think, from my point of view, that both of those approaches are valuable. I think we shouldn't put all our research eggs in a single basket or to use my analogy, put only one ingredient in our soup.

Finally, I leave you with the question, what's next? When we all leave here in about 5 minutes, what happens? Do we just simply say, "Well, Kent Crawford is going to get all these papers and produce a nice little document." No self-respecting conference can really feel good about itself unless it has some proceedings to hand out afterwards to people who say, "What did you do out there in San Diego for a day and a half?" I think there's a lot more that can be done than just getting out a report. One thing that was raised by myself and others yesterday is that there is a lot of useful R&D that can be done on the transition process itself. A second thing, Jim, is a key role for NPRDC to play here if it chooses to do so. It can really focus attention on transition. I don't understand all the structural arrangements in the Navy, but from what I've heard, I think your organization can play a really significant role. The question is what should that role be and how you should play that role? What other actors need to get involved?

That leads to a third thing I'll mention. That is the possibility of setting up some sort of cross segment, NPRDC, ONR, and others perhaps, to simply work on what to do next. This group could look at questions like how transition could be done better and what sort of advantages might be gained if we had more transitions or a better transition. Again, I think that the involvement of different elements is key. I go back in the way to what Bill said about using the M-Form society philosophy. You've got some different subgroups here with their own individual interests. So, there's clearly some inter-organizational competition. But, there's also a lot of lateral teamwork. I think such a group can make progress in this area, especially if you use some M-Form types of strategies in the decision process. It all goes back to my opening question. How important is transitioning to the Navy and does the Navy, as an organization, really care about this problem? I'll end with the question I started with.

COMMENTS FROM THE AUDIENCE

Comment: I'd like to offer just one response. Those of us in the organizational sciences have been substantially impressed by the quality of thought being given to this subject. I think the presentations that we've heard here are representative of the fact that a substantial body of knowledge is emerging that deals in a very well-disciplined manner with many of the issues that must be addressed as we deal with social forces in organizations.

One of the things that we're going to do is to go back and revisit our own linkage to the academic community. We need to look at that body of knowledge and look at ourselves in terms of our own linkages to our own institutional hierarchy. We need to explore the extent to which we can improve and facilitate those linkages. We need to create a living laboratory in the Navy to transfer, to test, and to evaluate. I like Dave Bower's illustration. He said that we can't really study these things in vitro. We've got to really apply ourselves to the fact that we're dealing in a real world where many social forces are at work. We need to understand those forces and conduct research that includes those social factors as variables. We certainly don't lack for

research methodologies in these areas. In the past day and a half, I think we have gained an improved understanding of those social forces. I think that what we created was an agenda through which we could introspect and evaluate our own behavior within that cultural and structural context.

Comment: In NAVMAT, which is a primary resource sponsor for NPRDC, the attitude is that we definitely need to increase work in this area. We need to transition research from the technology base into the natural setting. I think if we can improve our image and communicate better, the funds will follow. I know the general orientation is very much toward more transition. That doesn't mean, of course, that everything has to be implemented.

"I think if we can improve our image and communicate better, the funds will follow."

Comment: I've been encouraged to hear that there may be signs of increased interest in implementation and transitioning. I think on the basis of what's transpired here that we have a better idea of what some of the variables are that we can work on. I hope that we all will continue to conduct dialogue and support some action programs in this area.

CONCLUSIONS

Dr. Kent S. Crawford
Editor

There are clearly a number of ways in which the Navy can begin to systematically address and improve the research transition process. Ten conclusions from the workshop are offered as potential areas for improvement. Ultimately, our focus must be whether or not operational problems are being solved rather than whether R&D products are being transitioned.

The theme of this workshop was ways to improve the research transition process. Ultimately, the bottom line is whether operational problems are getting solved, rather than whether R&D products are getting transitioned. In some ways, a more germane orientation may have been how the operational Navy can better use existing R&D to solve current problems. This perspective would come more from the user and less from the researcher. Nonetheless, given that Navy R&D is usually generated via operational requirements of the fleet, there shouldn't be a large disconnect between the two viewpoints.

During the course of the 1-1/2 day workshop, a number of suggestions and conclusions were offered by participants. Because there was no attempt to gain consensus, the following conclusions are based on the degree to which a concern was echoed by a number of different attendees. They are offered here not as concrete facts but rather as constructive suggestions emerging from years of R&D experience of the participants. They suggest ways in which the Navy can begin to systematically improve the research transition process. There is a need to:

1. Develop a clearer definition of what constitutes successful transition and when transition is or isn't necessary. Successful transitions vary across a range of factors and along a continuum of degree of utilization. There needs to be an assessment of the optimal levels

of transition given different types of technologies. Also, under what circumstances should transition be discouraged even though the initial 6.1/6.2 research was very successful?

2. Develop a framework that links mature technologies of the behavioral sciences with targets of opportunity in the operational forces. While a "rich academic soup" of potential applications exists, there is a need to integrate the most cogent dimensions of behavioral theories and apply them to current Navy problems. This may involve better methods of communication with the fleet and "selling" the benefits of behavioral science that are available.

3. Systematically evaluate new technologies after they are implemented. Many newly implemented technologies are not fully used. This failure to maximize their usefulness can result from complex interaction of the characteristics of technology and the organization. There are presently insufficient funds at the 6.5 and O&MN levels to support systematic evaluations. It may turn out that performance gains from "fine tuning" newly implemented technology will substantially offset the evaluation costs.

4. Assess extent to which current R&D system rewards for researchers who successfully transition their efforts. Workshop participants noted insufficient short-term rewards that may discourage both researchers and their managers from giving more attention to transition issues. In the long run, the productivity of Navy labs will be assessed on transition success; in the short run, however, the R&D system's rewards are more directed toward achieving research objectives than transition objectives.

5. Improve communication between the research community and the user community. The Navy has a number of programs in this area, but there may be a need to re-examine how well user problems and views are translated to the bench level researcher. Likewise, the user community needs to understand the researcher's need to retain a certain degree of objectivity and creativity so that constructive innovation is fostered.

6. Examine whether different methods of conducting Navy R&D result in more successful transition. Different methodologies may create user-relevant knowledge as opposed to scientifically relevant knowledge. Even though the general focus of different methodologies might be the same, the research process could be very different if the major concern were transition.

7. Develop a better bridge between private sector academics and the Navy applied research community. The academic community represents a tremendous resource for solutions to Navy problems. Even though most academic work is available in journals and books, increased contact between academic and Navy researchers can foster creativity and help direct private sector expertise to Navy problems.

8. Encourage more communication between the research managers and sponsors of 6.1 and 6.2 MPT work and their counterparts in the 6.3 to 6.5 community. Much of the 6.1 basic research and 6.2 exploratory development is funded through the ONR/ONT link, whereas much of the 6.3-6.5 advanced development, engineering, and test and evaluation is funded through the OPNAV organizations. The existence of two different reporting chains increases the potential for poor communication. Given that research must often move across the 6.1 to 6.5 track, it is critical that there be clear lines of lateral communication across the different research elements. One suggestion of workshop participants was a descriptive map of the Navy R&D world by different content areas. This map would show where the dollars come from and go to, and who manages the elements in the 6.1 to 6.5 arena. This

map might suggest who should be talking more to whom. It also could help develop formal bridges between the different research sectors.

9. Assess whether the structure surrounding R&D management in the Navy promotes transition of mature technologies. The macro structural elements ultimately determine how well the whole system functions. If the R&D management structure lacks the formal links necessary to support transition, then transition will not occur effectively.

10. Learn more about the transition process itself. While there has been some systematic research in the private sector on knowledge use and how to produce useful knowledge, there has been only limited research in the Navy. Certainly, the resources for research transition play a central role. However, given that the aim of Navy labs is a technology base that is both useful and used, it is surprising that more research has not been directed at the when, where, and why of successful transition.

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