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**Technological Innovation and
the Cost of Change**
Bobby R. Inman

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Technological Innovation and the Cost of Change

Admiral Bobby R. Inman

In 1981, Bobby R. Inman became the first Naval Intelligence Specialist to attain four-star rank when he was promoted to Admiral, coincident with his appointment as Deputy Director of Central Intelligence. From 1977 to 1981, he directed the National Security Agency, following two years as Director of Naval Intelligence. He was appointed President and Chief Executive Officer of Microelectronics and Computer Technology Corporation in 1983. His volunteer activities include serving as a director of The Atlantic Council, the Council on Foreign Relations, and the Rickover Foundation; a trustee of the Brookings Institution and Southwestern University; and a member of the National Academy of Public Administration, the Trilateral Commission, and the Defense Science Board.

In each of my past appearances before this seminar I've been asked to address an aspect of government policy making in the U.S. intelligence community, dealing with command, control, communications, and intelligence (C³I) decision making or crisis decision making. This year, Tony's invitation read, "I plan to explore intelligence, command and control in the business world and how changes in information technologies present strategic advantages or vulnerabilities for multinational corporations. I would hope you might share with us some of your views on the topic from your present vantage point in business, plus whatever comparisons you might care to make of the relative strengths and weaknesses of business and government practices."

I head a joint research venture, Microelectronics and Computer Technology Corporation (MCC), owned initially by 10 and now 21 U.S. corporations. They range widely in size, including some relatively small merchant semiconductor manufacturers (though even some of those small ones have overseas manufacturing), some mid-size computer manufacturers, four aerospace firms, the 40 percent of Bell Labs that with AT&T's divestiture went to the operating companies and is now called Bell Communications

Research, and two interesting and diverse companies, 3M and Eastman Kodak.

I also serve on the board of directors of a number of different companies and am trying to learn more about how business goes about doing its business. These include an international construction and minerals firm, an electronics firm that does mostly domestic business, a research organization that primarily works in the U.S. but does some business in the Middle East, a regional Bell operating company that works exclusively in the U.S. except for publications done in Australia, a small software house, and an energy firm that has extensive exploration activities outside the U.S. but whose prime business is in pipelines inside the country.

From all of those vantage points, when one turns specifically to the challenges before you, the depth of my knowledge is very shallow. I'm going to talk for a little while about my perceptions of activities undertaken by those U.S. companies that I've served, as they relate to this basic topic. I'll also offer some observations on what I see happening in other countries. Then I'm going to stop at that point and throw the floor open for a very wide-ranging period of

questions, not limiting you from looking back at my past lives as well as my present endeavors.

Professor Oettinger, from my present vantage point, what has surprised me more than anything else about the performance of industry as compared to government in this broad area we're discussing — the ability to gather knowledge or intelligence on the outside world and then integrate it into a decision-making process — is how poorly that is done. I had always held the view, from my 31 years of government service, that industry must be far more effective, far more efficient than government. I'm sure that there are many cases where that is true, but I haven't been exposed to a large number of them in the past four years.

Oettinger: This is on the basis of comparison with performance, not ideal?

Inman: That's right. Most of the companies with which I interact at least understand our current pace of change from a domestic to an international marketplace, but without exception they're still grappling with how to come to grips with it. They understand some fundamentals reasonably well, such as the fact that U.S. economic growth has been grounded in the creation of technology, and that they're beginning to fall behind in the creation of technology. MCC came together as the first effort of its kind to try to accelerate the creation of technology, driven by the perception of increasingly strong international competition. We would never have done it without that realization.

Once they created the consortium to their substantial benefit, the members focused not on trying to imitate the Japanese but on deciding what the enabling technologies in the middle 1990s will be for computing, and where the roadblocks will occur. They laid out some very vigorous programs to go after that. Thus, they also were helpful in getting the Congress to look at the issues of antitrust constraints on collaborative efforts in accelerating the creation of technology. With the passage of a National Corporate Research Act in 1984, there are now some 50 of these joint ventures that have been filed. That process is clearly a response mechanism, a decision mechanism as it were, for trying to deal with the need to accelerate the availability of technology.

As I have discovered over these past several years in looking at our competitiveness, accelerating the creation of technology is indeed one of the problems, but there are at least two others that need some careful examination. One of those is accelerating the

pace at which the emerging technologies are used, and the second is improving the success with which they are marketed in an international marketplace. In both of those two areas I'm a rank amateur. I'm still out there poking around, trying to understand the problems and provide some responses.

There are cultural barriers to accelerating the use of technology in this country that do not exist in some others — the "not invented here" syndrome, a cultural belief that we're bound to have the best technology, and therefore a reluctance to look for it somewhere else. The Japanese aren't troubled by that at all.

Oettinger: That's a curious attitude, because until World War II we were the Japanese of the world in the sense that we subsisted by copying and importing. Do you have any thoughts as to what has happened to change that?

Inman: I think we became very arrogant over 40 years, believing that we were better than anyone else, and so the syndrome was bound to occur here. There's another factor that I don't really fully yet understand, Tony. Let me describe what I believe is the case: Because ours was primarily a domestic marketplace, we focused on the cost of production and not on the cost of change. As entities got larger and had a larger sector of an industry, they were reluctant to introduce change, or at least they tried to stretch out the periods of time between the introductions of change. As long as none of the other major competitors introduced new technology, none of them had to undergo that cost, and profits were good. What really brought great pressure to bear on that problem was the shift, beginning in 1960 and accelerating ever since, to an international marketplace and to a very different competitive climate, particularly as the Japanese take new technology to the marketplace very rapidly in products of sufficient quality to find a major customer base in this country. I go to industry gatherings and university gatherings and still encounter a reluctance to deal with the hard realities of industrial competitiveness at an international level.

There's another major factor — a decision-making factor — affecting the pace at which we introduce new technology, and that's the cost and availability of capital. Again, we play with a very different set of rules from the Japanese. Our concerns grew out of a domestic marketplace and a track record of a lot of difficulties, requiring not only antitrust laws

to deal with domestic competition but also, on the capital side, a stand-off distance between the banks and the corporations, and very substantial debt-to-equity ratios. Based on those rules we developed a lengthy decision-making process about taking new technology to the marketplace, first doing test marketing and then taking the data from that test marketing to the lending institutions to justify a major new capital investment for a whole new product line. Our Japanese colleagues, with the banks owning equity positions and sitting right on the board of directors, make a major decision to move with new technology straight to the marketplace very quickly, without that year of test marketing. Just as important is the cost of capital. Given the high cost of capital, the U.S. has used a strategy of trying to recover the maximum amount of the investment very early, whereas the Japanese enter with a pricing strategy aimed at recovering that cost over a very long time frame.

The marketing side presents some fundamental issues, such as how well you understand the market where you want to go; how well you understand the culture; whether you have the language ability; whether you have the ability to market effectively in the country; how much effort you put into that process and how effective it is over the long term. Save for the language ability, I don't believe that we automatically play at a substantial disadvantage, though I think that as the nature of the market changes and more and more marketing takes place out in developing countries, we may face more of a problem over the long term.

Oettinger: The notion of quick Japanese adoption and marketing of technology doesn't quite mesh with, for instance, their long-term efforts in the fifth-generation computer, much of which I believe was fluff anyway and which, as you mentioned earlier, may have been an element in the birth of your present enterprise. If the journal reports are accurate, and as I think you mentioned a moment ago, that's not the direction you're taking. If so, then that decision represents a judgment that at least one Japanese approach doesn't make any sense.

Inman: I am prepared to argue the case that the bulk of Japanese economic growth from the late 1950s through the early 1970s came from importing technology from abroad and using it very rapidly. Beginning in 1973, out of the worry that they might lose access to that technology abroad, they began to try to focus on efforts to create technology in Japan as

well as to import it from overseas. That was very successful in the semiconductor area, where a four-year effort produced a commercial version of the 64K random access memory (RAM) chip and a major share of the world market. They're taking a much longer range view than that in their so-called fifth-generation effort for computing. The point is that those two examples really fit at the first part of the question, the question of whether to create technology or import it.

Japan has an excellent record of good focus and reasonable success in the second part of the question, accelerating the introduction of technology. They honed that capability in the late 1950s and have continued to focus on it throughout subsequent years, moving new technology through the design and manufacturing stages and on into marketing, all with very good quality control, even when they export the manufacturing elsewhere.

The one other diversion that's going to impact on this stage of the technology cycle even more heavily in the years ahead has to do with the whole production process. We have a long history of moving production to find cheaper labor as the basis for trying to sustain profitability against competition, with textiles going to nonunion areas even within the country. When a brand new semiconductor industry had grown to some level of maturity here and was beginning to feel some price/cost pressure on wages, their response was precisely the same as the advice that the business schools had always offered: Go offshore for manufacturing — cheap labor. In the 1980 to 1981 time frame, when the Japanese semiconductor industry was beginning to experience some substantial wage/price escalation, they did a little bit of shifting offshore for manufacturing abroad, but the bulk of the effort was to shift their attitude about manufacturing. Without constraints of antitrust laws, the Japanese semiconductor firms gathered. They brought in the Japanese equipment manufacturers, funded their efforts to create state-of-the-art equipment for automated manufacturing of mass memory chips, and then, when the systems effort was finished, they applied the capital to build fully automated facilities for manufacturing mass memory chips at a price that no U.S. firm can match with cheap labor in any country overseas.

That's not yet a broad example, but if you stand back and look at the U.S. scene, you find a few very large corporations dealing with the manufacturing technology process, looking at how to reduce the

cost of change. As I travel all over this country I find very few middle-sized firms and smaller firms focusing on a need, much less on a process, for dealing with the cost of change involved in introducing new technology, which I believe is an element that is going to play a substantially growing role in the future.

Oettinger: Yet one argument against what you just said is the very existence of MCC and what it represents.

Inman: We're here to create; we don't exist to do anything on the manufacturing side.

Oettinger: I presume that when you say "technology introduction," and when you talk about the design and manufacture stages, you're talking there about new products.

Inman: I'm talking about the application of new technologies that have been created, whether in university, industrial, or national laboratories.

Oettinger: As distinct from production processes and the improvement of production processes, whether for old or new products?

Inman: Precisely.

Oettinger: I think that clarifies that point somewhat. I was in Tokyo a week or so ago and engaged in a somewhat similar discussion, and the response to a statement somewhat like yours was, "That's what you Americans all say, but your Defense Department really performs that function, so why do you say antitrust laws, etc., handicap you and that there's all this concerted Japanese action, when the net effect of the defense contracting business is similar"?

Inman: And the answer is absolutely not! It goes in the exact opposite direction. If you look carefully at the period 1946 to 1960, Department of Defense (DOD) investment and research was the pacing element in creating new technologies in a broader way. They were moved through for commercialization in four to five years, because that was the length of the defense procurement cycle. Then we launched off to create a perfect procurement process, and we ended up with a procurement process that takes 12 to 13 years, and we don't get that flow-through for commercialization. So the significant competitive advantage to the U.S. which came from Defense-funded research up to the early 1960s does not exist today, by virtue of our own internal constraints.

I was somewhat optimistic three years ago that Defense would once again play a leading role in addressing manufacturing technologies, which is an area that colleges of business administration don't seem to want to join with colleges of engineering to address. What's happened? Under Gramm-Rudman those programs are the first casualties. Almost all of the Air Force's funding for the integrated computer-aided manufacturing (ICAM) technology program is being reduced. So Defense, which could indeed play a role — I've heard some people out at Berkeley saying, only half in jest, that DOD is really the U.S. MITI* — isn't doing so because of our own arbitrary internal constraints.

Student: I've heard a slightly different explanation of that same phenomenon. Everybody realizes that the DOD's research and development (R&D) profited the civilian economy much more in the early years after the war than it has in the last 15 or 20 years. People attribute that change to two things.

First of all, a lot of technologies that had been stimulated by the Defense effort were very rapidly commercialized because there was a sort of backlog or pregnancy there, so that science and engineering were mined during that period for a lot of latent potential. We've kept up with them better now, and we don't enjoy yields like that anymore. That's argument number one. The other argument is that somehow the nature of military technology today is such that it can't be commercialized. I've never understood exactly how this goes because while the old examples are always air frames and aircraft engines and computers, I don't know what people are looking at as today's equivalents. Maybe computerized manufacturing technologies can be commercialized just as well, but people don't look at that. They look at the actual specialized end products that are coming out of DOD investment and say that those don't have commercial relatives in the civilian world.

Inman: What both those arguments totally miss is the specifics of change, which are very documentable. Some excellent research and documentation has been done by Dr. George Kozmetsky, one of the founders of Teledyne, who went on to become the Dean of the College of Business Administration at the University of Texas for a number of years and now heads his own foundation, RGK Foundation, and the Institute for Constructive Capitalism. This is

*Japan's Ministry for International Trade and Industry

an area on which he's focused a great deal of research over the years.

When did the change come? It came with a decision in 1963 in the DOD budget debate on the way the Office of Naval Research (ONR) and its counterparts would invest in basic research. The decision was made that it was not cost-effective for ONR and its counterparts to provide grants or supporting equipment for research unless it was directly tied to a prospective weapon system.

Oettinger: It was the Mansfield Amendment.

Inman: No, the Mansfield Amendment followed the DOD decision by six or seven years, not being enacted until 1970. The first decision was actually made by Secretary McNamara, based on the systems analysis proposal in the budget debate in the fall of 1963, and the spring of 1964. That then was picked up by the staffs on the Hill but it didn't actually get into legislation until 1970. It was just removed two years ago; we have shifted away from the notion that we are so smart in applying systems analysis that we can make early judgments on which of those basic investments in science are likely to produce something of use.

Student: They shot themselves in the foot!

Inman: They shot the rest of us, all of us, the country. If I sound like a zealot on all of this it's because I've been digging into it, trying to understand our relative competitive positions in so many of these topics. Last spring I was on a panel for the first joint meeting of the American Council on Education and the National Association of Land Grant Colleges and State Universities. My specific panel dealt with where things are going in science and technology. There were about 650 people present, mostly age 45 and up, holding senior administrative positions in academic institutions, both public and private.

Out of curiosity from some of what George Kozmetsky had said to me, I asked for a show of hands as to how many of the people had doctorates. Almost every hand went up. My poor little baccalaureate degree was one of the few in the room. My second question was how many had received a grant from ONR or one of its counterparts toward their doctorate. More than half the hands in that room went up. If you were to do a survey on graduate research from 1980 to 1985, you'd find a tiny handful in a gathering of a comparable number of PhDs who had got-

ten any assistance at all. This effort to try to focus research at an early stage cut off the major source of grants for pursuing a very unconstrained look at broad ranges of science that might eventually have some use. Then you add on top of that the dead hand of bureaucracy. In doing that research I found that, in those years of grants, the scientists from ONR went to the campus and sat down to talk with individual graduate students about what they were working on; decided it's unique, it's new, it's different; discussed how they were going to approach it; asked them what they needed to sustain that year; and wrote them a voucher. That was the extent of the bureaucracy in the program. There were no great writing and shopping proposals to divert time away from the basic research process.

Now, how do I tie these points together? The U.S. is not marshalling its ability to understand the commercial marketplace in other countries effectively. The government does not lead, nor does industry collaborate in any significant way, in exchanging information about the status of markets or the movements of technology. The Japanese are prolific writers, yet as best I can find, only something like 5 percent of Japanese technical literature is ever translated into English so that we might understand their perspective on where trends in technology may be going. The assets that we have to focus on these areas that contribute to international competitiveness are not broadly available to, or used by, the mid-sized and small business sectors of the U.S. economy. These criticisms probably do not apply at all to the giant multinational corporations that have the resources to sustain in-depth research, collection, and analysis activities, and that understand very well their sector of the marketplace. But given the reality of how the marketplace is growing, the U.S. isn't going to be able to do the job just with a few giants. Indeed, much of the vitality of the U.S. market over the years has come from the start-ups, the small businesses that grow into mid-sized companies.

One of the questions I'm probing at, and for which I have no answers to offer you, is how one really brings about a much better availability of the information that will aid us in moving into the reality of that international marketplace. There are lots of questions about the government role, as to what it can and can't do. But I'm going to stop at that point and try to move into a discussion phase instead of a lecture.

Student: You were talking just now about the contrast between the large firms and the small and mid-sized ones. In your earlier comments about the disadvantages of U.S. firms, it seems to me that you outlined two problems that they have in competing. One is environmental or external, the cost of capital that the economy enforces. The other would seem to be more internal, the opportunity cost of losing mastery of manufacturing processes by farming them out. Yet that latter cost is not directly computed into corporate balance sheets, particularly in the case of the small and mid-sized firms (although perhaps not for IBM) because for them it's really an externality that they can't internalize and therefore are not conscious of. So they tend to do things that are damaging to the long-term interest of the economy.

Inman: I would generally subscribe to that view. I would add another example where what's beneficial in one context may be harmful on a larger scale, and that's the antitrust question. The antitrust laws were created to deal with rapacious conduct in the domestic marketplace. I think the record will generally show that the public at large has been well served by that focus on product competition at the domestic level. The real question then becomes, how do you make adjustments in that arrangement, without destroying a process that has a substantial number of benefits, in order to deal with the shift from a domestic marketplace to an international one? What I'm getting at is the question of the speed with which technology is used. My observation, Tony, is that as a new technology emerges, as it becomes visible, often some of its earliest uses are made by bright young innovators who see a potential niche; but there are also lots of instances where they start off and a year later a giant corporation comes out with an entirely different application, a different approach that becomes the standard. Over time that pattern tends to inhibit the innovators from moving too quickly with new technology. If you had a process for getting standards created quickly, as the Japanese do (in fact they have an entirely different, unregulated mechanism), that would significantly facilitate opening the marketplace for a variety of innovators to proceed with their own approaches with reasonable confidence that they would have better interoperability and that they weren't going to be driven out.

I'm watching, necessarily from a distance, a new approach called the Corporation for Open Systems (COS). This of course is precisely such an effort to cut across the computing industry and create stan-

dards. I suspect that before that process is very far down the road they will end up having to do the same thing that we did, which is to turn to the Congress for very specifically designed antitrust exemptions that are clear in terms of what is approved and what's not approved. So my basic approach is not to throw out all the antitrust laws, but to try to determine which ones actually produced a documentable delay in introducing technology into the marketplace or in looking at the cost of introducing change.

Student: To go back to your discussion of ONR, I agreed with the point you were making but didn't think it was based on accurate data concerning ONR support of basic research. The history there is that from 1946 until 1950 there was no National Science Foundation, and Alan Waterman* and ONR took the job of doing what everybody recognized was necessary, which was to fund basic research. Then that was gradually phased out through the 1950s and 1960s and a lot of those responsibilities were transferred to the National Science Foundation (NSF), the Department of Energy (DOE), the Atomic Energy Commission, and the Advanced Research Projects Agency. Looking at the dwindling number of people doing basic research funded by ONR really isn't the point. It is true that DOD began to take less seriously the job of providing the nation's basic research foundation and began narrowing its perspective from a nationwide mission to a mission-specific views. But I would also say that the most important impact of DOD's departure from the basic research business was not on basic research itself, but on the applied research area. That's where that narrowing of perspective really began to hurt. It's an indirect impact.

Inman: I would just basically dispute that understanding of the facts, and I would send you back to Kozmetsky's research. In fact, ONR funding didn't start dropping off in the early 1950s; it was sustained at a very substantial level until the early 1960s. Even though NSF began to increase its funding, there was not a substantial drop in ONR's funding or its breadth in the 1950s. It was not until the early 1960s, when the decision was made to narrow the focus toward prospective weapon systems, that ONR funding for university research dropped. Now, what obscures a lot of that until you go back and pull it out is the space race, because much of the funding that flowed out of NASA went to those areas that ONR and the

*Alan Waterman, Director of ONR, 1946-1951.

Air Force and Army counterparts had been funding earlier.

The Defense Advanced Research Projects Agency (DARPA) was created in 1958 because of a worry that the other investments had begun to look near-term; not that they weren't funding basic research, but they weren't looking out as widely toward as many future things. So DARPA was given the responsibility, and some of the Services' resource dollars were reduced to add to that DARPA pool beginning in 1958.

Student: From what you just said, it sounds as if federally funded support for basic research declined.

Inman: In total terms it declined substantially beginning in the early 1960s. What went up was the research in the National Institutes of Health (NIH). If you're looking purely at total federal expenditures in research, what you get is the great surge in NIH in an area where there had been no funding at all. But the basic sciences experienced a definite, documentable decline in federal funding.

Oettinger: There was a decline not only in dollars, but I think in quality. I was one of the first National Science Foundation Fellows, graduating in 1951 and becoming an NSF PhD and post-doc. Nobody asked many questions; we did what we wanted. In the early 1950s the ONR detail man would come around, much as Bob described. He knew everybody's names, and he'd have a cup of coffee and chat with you. Then NSF got bureaucratized to the point where it was impossible to get a small bit of money or fellowship. The ONR stuff dried up and the Air Force Office of Scientific Research (AFOSR) disappeared. DARPA had three or four glorious years, but when they offered me the job of director of the information processing techniques program a bit later on, I refused to take it because by that time it had become a nothing; you could go nuts over it. And by now it's dead.

Student: If you say that the overall basic research funding for the physical sciences declined in early 1960s, maybe you're correct. My point is that it's not clear what the relationship is between basic research and the problem we're discussing; it's an indirect influence. I'm persuaded that basic research is where it really begins.

Inman: My institution does almost no basic research. We still have to do some basic research in artificial intelligence and in parallel processing simply because

there is not yet a sufficient breadth in those areas. For all the rest of it, we're not doing any basic research, we're doing the applied research. The more I get out and look at where our competitive advantage might be in an international marketplace, the more I'm persuaded that, over the long run, the breadth of that basic research capacity, and then our ability to focus it in applied research, has been one of the reasons we have been able to be effective in competition.

Student: I'm not an expert on this, but the argument that I hear most often is that our basic research base is still doing very well. It's still large; it's producing patents and so forth; it's producing licensable innovations.

Inman: But it has been on a downward slope.

Student: I think the problem is with commercialization of this technology.

Inman: That's also a problem; they're both problems. That's the point that I'm trying to drive at: You cannot simply focus on the applied side, on the use of technology, and stay competitive out to the year 2000. You may be able to deal with some problems right now, for the near term, with a quick-fix solution that will satisfy those who are most concerned about imbalance of trade, but you are not going to make that transition to an international marketplace on a perceptible scale and still continue to accept a decline in that basic research base.

Student: That's like saying we need everything, and I guess we do, but I'm just trying to prioritize it in terms of impact.

Inman: I suggest you go next door to your sister institution and look at the research that the Massachusetts Institute of Technology has done during the period 1865 to 1940 in their studies on the role of the creation of technology, coming out of basic research, in the economic growth of the U.S. My recollection of their figures is that about 80 percent of the GNP growth from 1865 to 1940 comes from that. It then gets an enormous spurt in World War II and goes on for a period of time. But then in 1968 it begins a slow glide slope down from an enormous base. There is a steady decline in that investment in the broad base of basic research, in the creation of scientists and engineers, which is all part of the basic framework. Did the seats go vacant? No. There was a large influx of foreign graduate students. But look

at the decline in the pool of U.S. graduate students coming out of that period.

McLaughlin: That's related to the problems in the international marketplace that you mentioned before. While your critical languages people and area studies experts were flush in those days, when some of the basic science money began shifting you had to compete for human resources as well. Those language and area studies people dried up in the mid-1970s. Yet they would seem to be fairly important in creating international competitiveness in the marketplace. Are we robbing Peter to pay Paul here?

Inman: Many people would want to do that. We're talking about three different areas, none of which can be neglected except at our long-term peril. The 1968 drop was in the funding for U.S. graduate students in science and engineering. That's where we crested and began the decline in the creating of technology. As it goes on, that trend does ultimately have some impact on the implementation aspect as well, the using of technology. There's also the decline that comes a little later in area studies and languages, but that impacts on the marketing stage. We haven't reached the full effect of that yet.

Student: In terms of science and engineering graduates, we still produce more scientists and engineers per ten thousand population than any other country except the Soviet Union.

When I started out as an undergraduate in 1969, my freshman physics professor told me not to continue in this field unless I truly would be unhappy doing anything else, because it would be very difficult to become a physics professor. Some of that was just due to the change in the number of students going to school and the number of slots to be available for grants. There was a great hiring surge in the early 1960s that led people to forecast a long-term trend, for 20 years or more, of a strong demand for scientists, which in turn led to a surge of students into the field and hence a surplus. I think some of that's turning around now. All you have to do is look at the number of job openings in physics today, where, because so many people were scared out of going into graduate Ph.D. programs, there's now a shortage. Also, the Nixon Administration decided to cut back on certain kinds of funding in basic research, such as the NSF traineeships, the NSTP program. I don't know if the current trend reflects a crisis so much as just poor judgment at a government-

tal level. It wouldn't take more to fix it than just refunding those things.

Inman: At this point I'm not sure that I would use the word crisis yet, though you might get an argument from somebody in steel that they've passed the crisis stage a long time ago. The point is that what dropped beginning with the budget decision of 1963-1964 was the number of grants available for graduate studies in science and engineering. There was not a surge in funding from NSF, and as has already been articulated, even those grants have become more and more bureaucratic. The grants that had been authorized up through 1964 expired in 1968. What took their place has often been grants from foreign governments for their students here.

When you get out to the marketing area, or even just in using technologies, you find some interesting trends because, in relative terms, the technological competence of other countries has been improving while ours has been declining. This is still a mass market compared to any other. Where are the trends going? I guess the one that has most gotten my attention is the change in revenues tied to international trade from 1960 to 1985. In 1960, no major U.S. industrial sector drew more than 10 percent of its revenues from international trade. In 1985 there's a significant number of sectors where a 25 percent factor is not uncommon. But if you look at it closely, setting aside the price of oil, that figure does not come from success at exporting U.S. products. It is in very large measure a reflection of success at selling foreign products in the U.S.

I'm trying to whip up some state of alarm in these matters because, ultimately, it's a question of how we shape public policies to lead us to focus on international competitiveness. That's the whole thrust of what I'm trying to build to in this dialogue. We need to focus on mechanisms that increase our ability to compete in an international marketplace, rather than on processes that were developed over a very long time to deal with competition in a domestic marketplace.

Student: If you had to frame a reverse Mansfield Amendment — in other words, provide funding for research that can go the other way, from defense to the commercial world — how would you do that? What categories would you push?

Inman: May I add a proviso on that question, and that's not what would I want to do, but what's the political reality, what's going to be possible? I spent

31 years of my life looking at the outside world. I've now spent three years and nine months looking at my own country. Site selection for MCC was a fascinating crash post-graduate course. Fifty-seven places in 27 states were bidding to be home. It gave me a pretty intense look at what a whole variety of locales and states are doing; we were looking at economic development, growth, creation of jobs, infrastructure, education systems, communications, transportation, and basic attitudes about government.

This country began with a basic philosophy of keeping government close to those who were governed. A Great Depression followed by a global conflict led us to a process where, for about 40 years, we came to look to the federal government as the investor, initiator, and innovator. My sense is that the pendulum began to swing back again in the late 1970s. A latent isolationism may have played a role in that. There are a lot of factors; I don't really understand them all. But I did notice it began to move. If I'm reasonably close to right, Gramm-Rudman's just a manifestation of that swing. No matter who wins in 1988, the role of the federal government is likely, in relative terms, to decline rather than increase, short of a global conflict or a major depression.

That leads to the prospect that you aren't likely to be able to create new agencies or organizations or get substantially increased funds. Therefore, as you set out to develop some programs to address the technology arena, you're going to have to try to adjust or change the structure that you already have, as opposed to building a brand new one. Going out to create a national technology agency is a nonstarter, even though that may be one way to deal with the problem.

Given that environment, then, let me break the problem into its various pieces — creating technology, accelerating its use, and marketing products in the international marketplace. On the creation of technology, I'd take a fairly simple approach. I would change the appropriations and authorization bills to increase the unconstrained funds in the Office of Naval Research and its counterparts from \$25 million (up from \$3 million last year) to \$250 million. Moreover, I'd use specific language that limited the reporting requirements so as to minimize the amount of bureaucracy involved in its execution, and aim it at an investment in basic science without trying to say which sciences in particular. It would not be a matter of increasing the budget, but simply earmarking a

larger portion. Now that will clearly create a great deal of unhappiness, particularly on the industrial side that has been getting a great deal of those research dollars. It also will cause unhappiness in the national laboratories, because they will likely see some of their money flowing away to fund the broader basic sciences.

Somewhere there also needs to be a pool of money to deal with facilities and equipment, because you aren't going to get a lot of those bright youngsters to stay on a campus, even with an improved grant, unless we can offer them substantially better equipment to work with. So those two approaches together should help address the problem of how to broaden the research base for the creation of technology. The joint venture has already shown another approach, and I think we're going to see a lot more of those come along.

Student: Another place where you get resistance is the basic research community itself. Eventually they will catch on to the fact that they're getting more money that way, but there seems to be some kind of religion about how money should be funneled out. Because ONR money isn't peer-reviewed, it breaks the rules and makes people unhappy.

Oettinger: But the peer-review religion has grown up as these people get themselves locked into it. Peer review means, "I scratch your back and you'll scratch mine."

Inman: You're exactly right that the research community will be one of the opponents. I realize I'm attacking a lot of things that are now all part of the structure. There are going to be a lot of people who say, "Gee, I don't want that work to appear in defense." But the answer is, where else do you have a prospect of it appearing? As I mentioned before, you see people at Berkeley suggesting DOD perform some of the roles that MITI performs, to the degree that it's possible to do so.

When I move to the area of using the technology, there I'd take a meat ax approach. I'd institute a six-year legislated ceiling for the Defense procurement cycle. Accept some mistakes, and put in an accountability process; if someone's ship goes aground, if there's a major cost overrun in a program, that's the end of his career. Accountability for performance. We do it in black box programs all the time, in those kinds of time frames. It isn't asking for the impossible, it's just asking for a standard of performance. But it's also forcing an approach to design wherein

the ship, the aircraft, the personnel carrier is designed to last 30 years. You plan from the beginning to replace the avionics, the electronics, the areas where technology is moving fast, every six to eight years. You use a modular design to force a focus on interoperability and on minimizing the cost of change. That approach will be fought tooth and nail by those who are in the procurement process because it gets at a large number of jobs and procedures that have been in place for a long time.

Am I recommending it purely to make Defense procurement a lot better? I think it would have that result, but that's not my primary objective. My primary objective is an early commercial flow-through of the technologies that come from that Defense investment. Another reaction I see often is, "Let's shift 20 percent of the federal research investment from defense research to civilian research." Well, Norm Hackerman taught me some years ago when he was president of Rice that there is no such thing as military science or civilian science. There are scientific disciplines that you push, and it's how you choose to apply it later that shapes its use. I can't fight the structure. Maybe the NSF is one area where you could shift 20 percent of all that funding and hope to get a broader focus on the things that will flow on to good use. I'm very skeptical of that. I think you would be much more likely to get it from the six-year procurement cycle, accepting that there would indeed be some mistakes made in looking for efficiency and speed rather than perfection.

McLaughlin: That point goes back to your discussion of the Japanese capital structure and the banks. It turns out that something like 90 percent of all new products that go off to market fail...

Inman: I think it's 68 percent; that is, 68 percent of all new companies fail.

McLaughlin: I'm talking about products. The national figure that's been very robust for about 20 years is about 90 percent, according to dozens of studies. Now, I don't know how many of those have been market tested and how much that helps, but the statistics tell me that a Japanese company deciding to bring something into the marketplace runs a very high risk of failure. I know that's what happened to a lot of them with quadriphonic sound, at least in the pre-standards days. There's got to be a price in pushing to market. Do you have a sense of that?

Inman: There is clearly a cost. It is a phrase I've used half a dozen times already, the cost of change. I keep going around trying to find out who's working on that problem. General Motors is, with Saturn; that's a clearly-stated principal purpose. But now I note in the public dialogue that they're beginning to shift to look at Saturn in terms of which size car they're going to produce, and not as a demonstration of how to reduce the cost of change for all the automobile models down the line. So I worry that Saturn could be judged a mistake and dropped if they don't find the right niche for the specific first car they produce.

In continuing on the government policy side, a proven route by government to focus private sector investment on specific problem sets has been tax policy, whether through R&D incentives, investment tax credits, or accelerated depreciation; there are a variety of techniques. It has had a documentable impact. Tax reform may be totally dead at this point, but my sense is that in our efforts to bring fairness to a tax system, we've paid almost no attention to the impact of tax policy on these elements of creating technology, accelerating its use, and marketing it. I believe there are things that can and should be done by the federal government on the tax policy side to help bring about a focus in the private sector on dealing with those problems.

I've already mentioned the antitrust aspect of government policy, specifically with the COS case. The other role I see for the federal government is in demonstration systems. Introducing new technology frequently is a pretty expensive enterprise, particularly when you're trying to do it in such a way that people can quickly procure it in large quantities. The example I have in mind is one where we have been troubled in the past year — not necessarily in the international marketplace, but it may even have an impact there as well — and that's the nature of the financial system, the flow of information for transactions. It is entirely feasible, with existing technology, to create a model financial system where essentially you do away with float. But developing that first model is not an inexpensive evolution.

Now, where in our current structure would you get that done? My answer is the Federal Reserve. Several years ago Congress gave the Federal Reserve the responsibility for servicing a lot of banks that weren't being serviced adequately or effectively by the large correspondent banks. But because those large correspondent banks complained about the Fed being given

that role, there's always been a sort of dampening effect on that effort, essentially telling the Fed, "Do it but don't do very much of it, don't make any money at it." The goals are in fact to limit the profits that the Fed makes. It would require no new tax to be able to add a little bit of the cost of those services and build a model financial system, test it, demonstrate it, and then make it available to be procured at a much smaller price by many financial institutions.

That's one example where the government can help set up model or prototype systems. I'm looking for others.

Oettinger: You're shifting the advantage of the float to the industrial sector, away from the banks. The banks aren't going to be happy about that.

Inman: They're not going to be at all thrilled to see that, but over the long term it will increase the efficiency of the financial system. But, yes, just as in the case of the peer-review advocates, you can be sure that there's going to be a large noise factor for every one of these ideas that comes along — which probably explains in part why government hasn't been eager to try to deal with them.

McLaughlin: By my latest count, there are also 113 federal and state regulatory agencies with which you have to deal if you really want to address the financial sector nationwide.

Inman: I haven't even thought much about the whole regulatory process.

Oettinger: I'd like to pull together these two threads of your discussion, the cost of change and your response to the "reverse Mansfield Amendment" question as to what you would do to get that change. You said, I believe accurately, that the current shift away from federal government to more local or state government is likely to be the prevailing trend in the future as well. That is why you said you wouldn't increase budgets or create new agencies and so on, but only shift money, or loosen it, or reclassify it. But your response still focuses pretty much on the federal government, and as a matter of fact on Defense Department or perhaps National Science Foundation action, and makes relatively little mention of the private sector.

As for the question of minimizing the cost of change, you said some of these problems in technology are middle tier problems that the very large corporations in the U.S. don't necessarily share. In the private sector, the large corporations seem capable

of change. We have the example of IBM, which has managed, in spite of its outwardly monolithic aspect, to cope with change in an extraordinarily successful manner over 30 or 40 years by a fascinating combination of internal anarchy and external dictatorship. At the same time, the antitrust suit against IBM has been dropped, and big corporations in general seem to have gotten out from under that threat, at least for a while. So they're fat and happy and capable of change. The U.S. economy at large therefore, seems to be in better shape than one thinks.

Partly out of devil's advocacy, then, I would point out that you seem to be articulating almost the inverse of the old "Engine" Charlie Wilson line here: What's good for the United States is good for the middle tier, the manufacturing sector. I would argue that we have a problem with that particular tier of American enterprise rather than with the economy as a whole. You have offered at least a partial response, addressing one phase of the problem, the creation of technology. Putting all of that together, how would you respond to the "reverse Mansfield Amendment" question rephrased to address not the United States, but that tier which is at risk? There are still very few examples of the kind of private sector volunteerism or associative funding that we have for our program, drawing on 50, 60 companies of various sizes, and you have for yours, with 21 participants now. Can that example be helpful? You've been very silent about private sector issues.

McLaughlin: If I might add a comment onto Tony's question, it seems that, with the exception of IBM, the top 10 companies have all been in serious trouble for the last 10 years, whether it's U.S. Steel, General Motors, or Ford. They're reporting record profits but we all know that's a political fiction by virtue of voluntary export restraints in Japan. They are companies in serious trouble in the world marketplace. I mention that simply because I'm not sure I would exclude them from the general problems. I think the situation is as bad at the top of the heap as it is further down the pyramid.

Inman: On the private sector side, one of the areas that comes to mind is the issue of retraining. Assuming we invest more and more in automation, how do we deal with the displaced work force? That turns out to be to some degree an issue for state and local government as well as for the private sector. I still don't have a clear understanding of how large or complex that problem is going to be. However, I do

understand enough about what's happening in the demographics of the work force to know that as the requirements for very specific skills go up, the outreach needs are going to be substantially higher for developing such skills in those entering the work force throughout the whole range of automated factories, offices, and institutions along the way. That's clearly not something the federal government is going to do. That's going to have to be done by industry together with the local government.

As I get out and probe the major business organizations I find a much greater willingness to focus on limiting the competitiveness of foreign goods and services than on improving our own productivity. I guess one ought to wait and give a little time to see how this Corporation on Open Systems works, but if it does prove to be reasonably effective then I think it's going to open up a whole new area of activity in looking at how industries deal with creating standards and interoperability and accelerating the pace at which new technologies are introduced. You clearly don't want that to be done by the government; you want that to be done by the people and organizations that will be implementing the procedures.

Oettinger: I like your theme of minimizing the cost of change. In our dealings with some of the same institutions that you talked about, we have put that theme in terms of a continuing period of chaos. People then ask, "Is that a counsel of despair"? The answer is no, it's an observation of fact. The way you cope with chaos is to make your organization as flexible as possible. A foreseeable period of chaos puts a premium on the ability to react quickly, with more broken field running and less polishing of existing organizations. It means less emphasis on "That was our last reorganization and now that we've got it in place and working, etc., etc." Some of us seem to be comfortable with change, but the vast majority of folks cannot cope with it, and it's really not clear how one institutionalizes flexibility.

Inman: But doesn't some of that come in the education process of the people who will ultimately be the corporate leaders? Of course that's just the long-term part of it; that's not going to help your near-term problem.

Oettinger: To give you an example, I am the chairman of the faculty committee meeting on special concentrations, which is where undergraduates who don't think they could fit anywhere come as sort of

a last resort. We get some of the brightest and most energetic people, and they tell some dismaying stories of what it is like to avoid the constraints of an established major that has a long reputation of having been judged useful, retrospectively. And this is a fairly forward-looking, flexible institution.

On the other hand, when you look at the Japanese, they're not so damn flexible either. So before we go on to invent methods for instituting change ourselves, are we perhaps transferring the old intelligence error to the private sector and looking at the Japanese as 10 feet tall?

Inman: I certainly don't propose to give a lecture on Japanese management. The cultures are different, and management has to be attuned to those differences. I think Japan's problems are going to grow. They've had a good long run on economic competitiveness and they're working hard at a lot of these issues to try to keep that going. They're trying to become creators of technology rather than just importing it. They've made a tremendous investment in the numbers of engineers and things like that along the way. But we tend to talk about Japan as a single entity, sort of Japan, Inc. As you know well from observing it, there are really three Japans. There's the large corporate Japan, with cradle-to-grave employment, great loyalty, high productivity, good focus on quality control. There's another third that's one of the world's most antiquated agricultural systems. The remaining third, their counterpart to our small business, is very chaotic. It has no loyalty or job security on the same scale as the corporate sector — it's better than some of ours, but it still doesn't begin to match the corporate side.

Political stability from 1952 to 1986 has rested largely on the collaboration of Japan, Inc. with the antiquated agricultural system. Hovering out there somewhere is at least the question of whether the push for change will alter that political stability, which has been so essential for that long-term growth, in ways that reduce their ability to stay competitive. In other words, will there be a political backlash or will that relationship become even more focused so as to pursue change even more aggressively? Can they resist pulling back from volunteer import quotas and things like that as the temperature gets higher along the way? I don't know where that's going to go, Tony. From what I can tell, that process of change is not coming along rapidly; there are problems.

Oettinger: Within the range of information industries and so on with which you're particularly concerned, perfection is not required, only an edge. You were talking earlier about the quicker Japanese rate of adaptation, the quicker conversion of technology to reality. Let me hazard an assessment and see if you agree with its implications. Part of the reason for Japan's success was that they were working within a fairly constant infrastructural context. In the areas that we're talking about, we are engaged in some major infrastructural convulsions that are going to last for an indefinite period. Therefore, bringing a Sony Walkman or something to market and bringing new telecommunications or computer-dependent products to market aren't going to be exactly the same thing. It's not going to be that clear and easy. I don't see any major Japanese advantage over the U.S. in bringing about an infrastructural transformation and in bringing as yet unforeseen new products to market.

Inman: I basically agree with that assessment. The only real advantage they have in their infrastructure is the cost of capital and the speed at which they can apply it. In the absence of a technology base of their own to create technology, they need to be faster with the later stages of the game in order to be reasonably competitive. They have evolved a very different approach to growth, focusing on exports as a vital necessity because the domestic market simply wasn't large enough to produce the standard of living necessary for sufficient consumption at home. We may see some shift to more domestic consumption or domestic demand; I don't know if it will open up new opportunities for us, but it will at least shuffle the cards a little bit for them, affecting their focus, even in this information handling age.

I also think we have to watch the other areas where they're going to grow. Not far behind information handling is the biotechnology area; a little further behind that is aerospace. They've been very skillful at devising a strategy of looking at which sectors of an international marketplace are growing, and helping to focus on the creation of economic growth in those areas. It's not quite as harsh as actually making the decisions of who's going to live and who's going to die, as is sometimes alleged, but they do give nudges in those directions.

McLaughlin: Ken Ohmae from McKinsey in Tokyo has argued that the most successful export industries in Japan are those that have been most fiercely com-

petitive at home, such as the camera and automobile industries, whereas industries like cosmetics where there was great domination in the local marketplace have had no success overseas. I think you can walk that back to some implications for our own industry.

I also wanted to pursue Tony's point for a moment about living with chaos. At a recent session where he started talking about broken field running and reacting to change, the vice president of a telephone operating company said, "Well, it's nice for you to be able to talk about that, but how am I supposed to put together my 20-year capital investment plan"? He was having a hard time understanding that he will never again have a 20-year capital investment plan in an industry dependent upon five-year life cycles.

Inman: In my first year at MCC I worried about attracting talent and getting research under way. At the end of a year it was very clear that that process was going to work, and so my attention shifted to technology transfer. How do we ensure it gets used? While I have lots of authority as the chief executive officer over designing what research will be pursued, who will be hired, what they'll be paid, and what bonuses they'll get, I don't have any control at all over which of the technologies that emerge will be used by the companies. I'm a supplicant in this case. It depends on how immersed and interested I can get them.

With 21 companies, I find essentially 21 different approaches to technology transfer. Some of them are becoming more and more interesting to me as they become increasingly innovative. Some didn't nominate very many people to come for full-term assignment, but now that they've seen what's under way and seen the nature of the talent, they've rented office space and apartment space in Austin, and they want to send some of their very best people to spend six weeks at a time working alongside the full-time researchers and absorbing what's going on. I see that process as at least likely to spark an earlier examination of emerging technologies for their potential application, which is clearly at the heart of making that transition from creating technology to using it. I see others where, if they have any kind of receptor organization or effort at all, they're keeping it carefully concealed from my view.

That variety is what makes me a little bit reluctant, Tony, to expound on what industry ought to do. I spent so many years in government that I'm never comfortable with making suggestions as to what they

can do. Judging from the diversity of approach in industry that I see even in my very narrow area, I don't find U.S. industry eager to be shaped and structured and told how to move.

Oettinger: Part of it, of course, is that industry is far more heterogeneous than even the whole collection of government agencies. The notion of corporate cultures has fallen into some ill repute, but ill repute or not, it's true that they're very, very different.

The topic of technology transfer brings to mind the genius that was incorporated into patent law in reconciling two opposite tendencies or concerns. Graduate students, especially in the days where there were more of them being sponsored by ONR, typically only worried about people stealing their results. The problem, of course, was of nobody paying any damn attention to their results; most of those Ph.D.s died on the vine. The problem in getting any kind of diffusion or transfer of technology is mostly one of openness, making people aware of it and so on. But then you have the dilemma that has been the subject of decades of debate within the academic community: Nobody will want to develop an idea, even if they know it in their heads, if they haven't got some protection. What patent law did was to grant some proprietary protection in exchange for openness in disclosure.

I don't know of anybody who is looking very seriously at a whole gamut of innovations — technical, political, regulatory, whatever — that might on the one hand facilitate the kind of diffusion and openness that's necessary to get things out of people's heads, while at the same time affording the protection necessary to attract an investment in turning the idea into some commercial reality. Maybe you can experiment with that area.

Inman: Again, my data base for comparisons or judgments is pretty small. The original concept behind MCC had been that researchers would come from the shareholder companies and be pooled to create new technology; at the end of that stage, they would take the technology home with them to their parent companies. That's how we'd get it transferred. Well, there are two problems with that approach. First, it depends on the quality of the people who come. Second, it's too late by the time they go home. The world is changing so fast that if you have not already got the corporate strategic planner and the production people interested from the start, when this nice neat

package of technology is finally delivered it's likely to be irrelevant.

So we totally changed the approach. Now, every phase of research must be documented; the program manager may withhold distribution for only one purpose — quality control. Once he's satisfied with the quality of the research, it flows to all the companies that have funded that program. Now there is clearly a risk in that process that one of them will elect to use it and go to the marketplace and not tell us. Since they've already paid for it in the first place, and what we're dealing with is the risk of not getting our share of the royalties for future licensing, I would rather run that risk than run one of being irrelevant with what we produce. My basic reaction to your point about patent law is that the timeliness of the information flow is the critical ingredient.

Oettinger: Presumably it's held within the bounds of the consortium, the members?

Inman: It is held within the member companies that funded it. It is not flowing outside that, at least not willingly.

Student: One of the issues that keeps coming up is the human element, the resistance of people to change in their environment. Now that kids are dealing with computers from age three and on, growing up in a more technology-oriented environment, do you think some of that resistance is going to disappear?

Inman: The things to which they're resistant will change. Clearly that trend impacts on what I'm doing now from the standpoint of the human interface. Right now, the primary factor in that interface is the problem of how to overcome adults' fear of using computers. But if you look out 10 years from now, when we're trying to work with the enabling technologies, you can envision a large number of people who have been using computers all their lives, and fear of using them isn't a factor at all. The main issue becomes the productivity of that interaction. Yes, I think the accelerated availability of tools for information handling will help a great deal in letting people deal with change better than they have in the past.

For other societies, there's a different range of problems. The Soviets have acquired technology from the U.S. and western Europe and Japan to accelerate their military buildup, but they permitted

no technology transfer inside the Soviet Union from heavy industry to light industry. Now they've decreed as of last fall a computer literacy requirement for all Soviet students. If that means turning them all into programmers, they're going to have chaos. But if they're really serious about getting on with literacy, they've got different problems. If they think it's been tough controlling the flow of books in that society, wait till they've got their own hackers available with access to a wide range of computing systems and data bases. There are fundamental impacts to be expected from computer literacy. So there's a whole series of new changes that are indeed going to be facilitated, though they may be very unwelcome.

Student: You made an observation about the inadequate exchange of information in the U.S. on both technology and markets. That's very difficult for me to reconcile with the fact that the U.S. is so open and the information flow in general is very free. Is there a lack of mechanisms, or is there a lack of will? Because the information does seem to be there.

Inman: We're not attuned to moving with as much speed as we need in actually implementing the change. But I believe — and again, I'm still trying to learn in this area — that the cost of capital plays a significant role in shaping attitudes in our private sector, about the pace at which they should move to use new technology. Indeed there is a great openness in the bulk of what's happening. Yet you also find that, within industry, there is a relatively small number of people in the upper echelons of leadership who have great depth in absorbing and using new technologies. The route for success has been through financial management and marketing management, and less through the other fields. That arrangement has worked in creating the large structures; it has created great economic opportunity, lots of jobs. In the years ahead, however, I think that's going to be tougher because of the pace of change in technology. The breadth of skills among the top leadership is going to have to be somewhat greater.

Oettinger: That cuts both ways. Companies like AT&T and Nippon Tel, where tradition is based more on technology, are just as arteriosclerotic.

Student: I'd like to return to the question of Gramm-Rudman, or the perception of "less government is better" that seems to be running rampant. Doesn't this notion of less federal government, David Stockman's belief in the revolution, run counter to at least

some of the things that you're saying government needs to do more of, such as funding basic research? And the same kind of arguments can be made in lots of other areas, that more is needed.

Inman: It would certainly be easier to deal with all these problems by simply gearing up taxes and having it done by the federal government.

Student: But such things as tax incentives are in effect subsidies; they're not government money, but government policy directions: "You will do this"!

Inman: They have a somewhat spotty track record, but on balance I would still judge that they are generally effective in leading investment. I don't see tax policy and things like that being impacted by the size of government. What I was getting at was the sense that we're going through a period where the size of the federal government and the role it plays are shrinking. It's still going to have to provide the national security, and it's still going to have to set overall federal tax policy. Nobody else is going to do that. But as for seeking out innovative start-up ventures, that responsibility is moving away from the federal government, and it's going to continue to do so for an extended period of time.

McLaughlin: Let me try to put that in a broader context. Two years ago, when Leo Cherne was here talking about how TV evening news as theater had eroded the public's faith and confidence in the federal government,* we got into a discussion afterwards. What Leo saw as the *status quo ante*, when the average citizen really trusted the government and took it at its word, I saw as a historical aberration. It was a product of the Depression and of World War II, and by the mid or late 1960s it was starting to decline. I think that's what Bob was referring to when he talked about a history of keeping government close to the governed. This is a country that was built on distrust of government.

Inman: Then you went through a period of despair when the only hope you had you put into a large government.

Oettinger: Let me divert you for a moment to talk about some national security issues, in light of your government background. This morning there was a

*"Television News and the National Interest," in *Seminar on Command, Control, Communications and Intelligence: Guest Presentations, Spring 1984*. Cambridge, MA: Program on Information Resources Policy, Harvard University, 1985.

piece in the *New York Times* complaining about covert actions and the replay of Vietnam, etc., etc., and I want to test a hypothesis on you. One of our people did a study that concluded that the War Powers Act would lead to an increase in military operations under the intelligence label, simply because they couldn't be carried out by the military *qua* military without invoking the War Powers Act, but they wouldn't exactly be your classical covert operation, either. And so we have this overt/covert kind of thing going on. I was wondering whether, in your judgment, this trend had anything to do with the War Powers Act.

Inman: The War Powers Act may slightly add to it, but I watched six of the last seven administrations at fairly close hand, and whether they arrived very enthusiastic about covert action or arrived saying they would never do it, they all turned to it. They turned to it not out of the belief that it was the best way to do something, but in most instances out of frustration. They weren't achieving the objectives they wanted from diplomacy, and they were unwilling to face the political consequences of using overt force. They certainly weren't prepared to go the route of declaring war, and going through that whole process.

It's in that context that the War Powers Act has made overt action even more difficult than covert, but mainly as an echo — with perhaps a little additional emphasis — of prevailing political circumstances. The basic thrust is that they turned to covert action out of frustration. When you do something out of frustration, and not because you think it's the best way to do it, you end up proceeding down a road that's not very promising for the long-term outcome. It's better to have to face right up front the full consequences of your action, and either be fully persuaded that you have to do it or else not do it at all.

Student: I agree with that. The real shortcoming that I see with the War Powers Act is in the consultative provision, and it's easy to fix. It's simply a question of defining the natural leadership of the Congress in these matters. Over the last 40 years, and certainly the last 10 years, we've known what that is: the majority/minority leaders and the chairman and ranking minority member of the major committees involved. If the Congress took that last step of identifying who is to be consulted, I think they would close that loophole in the War Powers

Act. Presidents would in fact be forced into what Admiral Inman thinks is a more advisable, up-front way of dealing with these things, where the leadership of the Congress would meet with the leadership of the Executive Branch on a regular basis to discuss the important issues. They've been ducking that fix in a shadow game of chasing one another at one step removed. What we've managed to do in the last 10 or 20 years is to reduce the time of chase.

Inman: And to shift it to press conferences and TV interviews.

Student: Yes, forcing it out in a constructive way. It seems as if, institutionally, they're just about at that point.

Inman: To come at your question from a different angle, several speakers have talked here in the past about the impact of overview of covert operations on the intelligence oversight process. It was clear in the mid-1970s that we were suffering from a substantial loss of confidence in the performance of the intelligence agencies. Because of the need to protect sources and methods, it was very important to be able to rebuild that confidence and to have an oversight process that protected the sanctity of classified information. Two select committees were put together, and really worked pretty effectively at that process for about three years. It began to fray as you moved into a political year. But, predictably, what has brought the greatest strain on the process isn't the intelligence side, where you're looking at the collection and analysis and dissemination of information, but the covert action side, where you're talking about operational measures by the U.S. as a substitute for diplomacy, limited to only a single agency's activities. As long as you have those two conflicting oversight requirements put in the same committees, you're going to have great trouble.

McLaughlin: In one of your earlier visits, just after becoming the Deputy Director of Central Intelligence, I asked you about the joining of information analysis, etc., with the covert role.* Your view at that time was that it might not be the most desirable setup in the world, but of all the windmills to tilt at, as a practical matter, you wouldn't choose that one. Would you now, as a private citizen, rest on that judgment?

*"Issues in Intelligence," in *Seminar on Command, Control, Communications and Intelligence: Guest Presentations, Spring 1981*. Cambridge, MA: Program on Information Resources Policy, Harvard University, 1981.

Inman: I think we've gone about as far as we can in the rebuilding process. Gramm-Rudman is a reality. We went through five years of trying to recover from those long years of drawdown, where we concentrated on rebuilding resources and people with a minimum of turf fighting. Now that we're at the end of that phase, we can start shifting our focus to deal with some of the organizational issues. Should the Director of Central Intelligence also be the head of the Central Intelligence Agency (CIA)? Should you have covert action done by CIA? I think it's a good time to look at some of those issues. I would not allege that the current organization and current approach to either of those are the optimum ways to deal with them.

McLaughlin: Last year at this seminar the focus was organization of the Joint Chiefs of Staff (JCS). Do you have any quick reaction?

Inman: I have a worry about the onrush to reorganize and change things. I don't have any particular problems with a vice chairman who sits in the chain of command and who channels the messages, and the rest of it. The concern I have is what I perceive to be a thrust to put the unified and specified commanders into the systems acquisition process, and even some significant movement of the Joint Chiefs into that process. In my long years of service in the Department of Defense, I came to realize that while we can't do much about the vicissitudes of external hostilities, there is a cyclical process in the availability of funds that we can predict. A period of growth is always followed by a period of cutbacks. When you're in growth it doesn't really matter all that much how you organize; you just hope you do it efficiently. When you go into a period of draw-downs, the fight for resources becomes absolutely all-consuming. I lived through some of those periods and I watched the service chiefs, even in their JCS roles, come to view the number-one priority in their lives as protecting the resources.

If you bring the unified and specified commanders and the Joint Chiefs into that acquisition process, who's going to be paying attention to operations? Who's going to keep an undiluted focus on combat readiness? That's the only real worry I have about the reorganization. For the rest of it you can sort of redraw the boxes as you like. But somebody's got to mind the store, and you need to draw those boxes in such a way that the commanders' attention can-

not be diluted by getting pulled off into different priorities.

Student: This question goes back to what you were saying earlier about basic research. I see a lot of criticism about the Strategic Defense Initiative (SDI) here that I don't see back at my agency. One of the criticisms is that there's going to be a tremendous drainage on the R&D talent; academicians are making a big deal out of this and they're banding together to oppose SDI on that basis. There's also a criticism that the focus is on too narrow an area and that other areas of R&D will be neglected. My question is, how do you feel about that kind of criticism and how does SDI relate to your organization, if at all?

Inman: We have no relationship to the SDI. We take no government contracts, at least in the current environment. We don't respond to requests for proposals. We're entirely privately funded. Obviously a number of our shareholders expect to get large SDI contracts based on their applications of the technology that comes out of MCC's research, but that is far away.

My concern would be, where does the money come from that flows to SDI? I don't see it coming away from NIH or the National Science Foundation, so I believe a lot of the concern about it being drawn away from other research areas is exaggerated. But I am indeed concerned about the degree to which SDI takes money away from DARPA and the other Defense R&D programs, particularly the ones that support basic research. I already see some signs of that occurring. So it exacerbates that part of the problem, the base for the creation of technology.

My other worry has to do with the flow-through of the technology. Looking back, one could have made the same criticism about the surge to get to the moon. It did draw a lot of talent away from other areas. There were many people who argued that instead of trying to get to the moon we should have been dealing with a whole range of other more pressing domestic problems. Yet a lot of technology flowed out of that effort into broader applications for aerospace and other areas that impacted on the economy. My worry is, will SDI operate on the cycle of 12 to 13 years before the technologies it funds become available for commercialization? If so, then it is a real disservice. If, on the other hand, they take a much different approach and get a faster flow-through or faster availability, then I don't see

where that research concentration presents a great problem. That kind of focus tends to give you surges, and there is likely to be a significant impact from that investment on information handling processes for a whole range of uses unrelated to SDI, so long as the results can be made available. It goes back to Tony's openness issue.

Oettinger: I wrote my first paper on artificial intelligence (AI) in 1952 and abandoned the field im-

mediately thereafter, and have watched it with a jaundiced eye ever since. But the fallout from AI for software techniques over the years has really been quite helpful, and today it is going through another peak. So the labels sometimes don't really matter, provided that somewhere in the programs there is some money that can flow to people to work on new ideas without having too damn many questions asked.