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Acquiring C^3 Systems for the Department of Defense: Process and Problems

Thomas P. Quinn

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Acquiring C³ Systems for the Department of Defense: Process and Problems

Thomas P. Quinn

Since 1993, Thomas P. Quinn has been Deputy Assistant Secretary of Defense for Command, Control, Communications and Intelligence Acquisition (C^3IA). Prior to this appointment, he served as Deputy Assistant Secretary for C^3, a post he held since 1980. Prior to that he served as Special Assistant for Command, Control, Communications and Space Programs to the Assistant Secretary of the Navy for Research and Engineering. He was the U.S. Representative to the NATO Communications and Information Systems Committee, and the U.S. Senior National Representative for Command, Control and Communications. He has also been associated with the Ionosphere Research Laboratory, Bell Telephone Laboratories, the Stanford Research Institute, and the Office of Naval Research. Dr. Quinn, a senior member of the IEEE, holds B.S., M.S., and Ph.D. degrees in electrical engineering from the Pennsylvania State University, where he also served on the staff of the Electrical Engineering Department. He received the Arthur S. Fleming Award in 1967, the President's Senior Executive Service Distinguished Executive Rank Award in 1984, the Defense Meritorious Civilian Service Award in 1987, and the Defense Distinguished Civilian Service Award in 1989.

Oettinger: It is a great pleasure to *not* introduce Dr. Quinn. You have seen his biography and know that among his current responsibilities in the Office of the Assistant Secretary of Defense for C³I, he has some concerns over acquisition practices and policies, but in inviting him I asked him to speak about that or anything else in the command and control and intelligence realm that he cares to share with us from his long experience. He will be retiring shortly, but he is not a retiring sort, so I think we'll get some interesting comments from him. One last thing before I shut up, at least for the moment: Tom, are you willing to be interrupted with questions as you go along, or do just you want to speak?

Quinn: No, I think we ought to make it an exchange.

Oettinger: So please chime in. I will try to behave myself except that, if you utter acronyms, where I feel the class may be shy, I will ask you to spell them out.

Quinn: Okay, I'll stay away from areas where we already discovered we disagree.

Oettinger: Please, it's all yours.

Quinn: Thank you. I thought I'd start off by defining what we mean by the C³ process, which is described in figure 1. It turns out that it really is a closed system. It's a feedback system, and this holds true for a strategic system, in particular. But it's true in general, and it works kind of like this.

You've got a battle space (and you'll notice we've already changed the name from battlefield to battle space because now we're involved in several different dimensions in dealing with battles), so at any rate, there's a battle going on among the forces and the sensors in the C³ system observe what's happening and report that through a communications system back to the decision makers. The decision makers are in a command center or decision-making center of some kind, and they're getting inputs from other sources as well. There's national policy that is going to drive the decision, and then there is intelligence coming in from other sources. A decision is then made in the command center and it is communicated out to the forces and

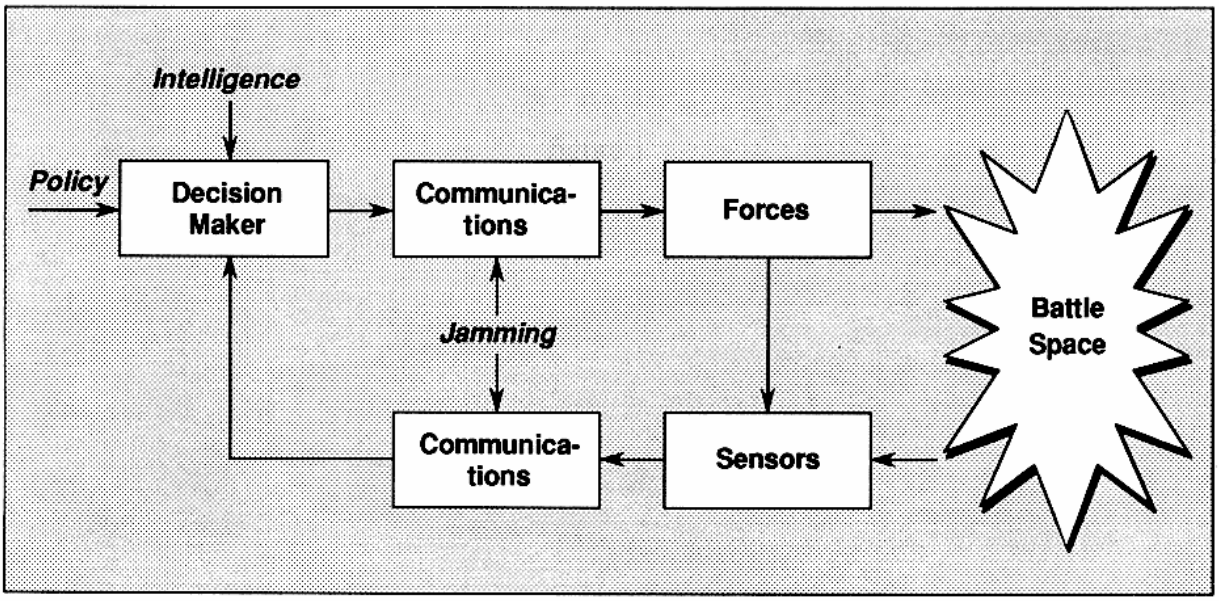


Figure 1
C³ Process

then the forces react. They do something in response to that command, and the battle situation changes. The sensors observe it and feed new information back, and that is a feedback system. That's done in the face of jamming that's trying to keep the process from working. There are also spoofing and other negative factors that come into the command and control process.

Now, there are a couple of different aspects of this. The operational features and the operational doctrine are the proper purview of the operational forces. The military services and the Office of the Joint Chiefs of Staff deal with that part of it. What we deal with is providing the wherewithal to the forces and decision makers to make this happen: that is, the design, development, and acquisition of sensor systems, communication systems, command center systems, and so on, and the policy that's involved in how that is done. What I was going to talk about today is how the acquisition system, which governs how the support equipment is acquired to make this happen, actually works.

Oettinger: Excuse me for one second. Before you leave that, I have a mild puzzle about the intel coming in out of nowhere (figure 1), distinct from the feedback from the battle space. Is that an accident of draftsmanship or is there a deep philosophical significance?

Quinn: That's just the way the chart was made. Intel comes from a whole host of sources. There's HUMINT, there's SIGINT, there's COMINT. So there is an intelligence set of sensors as well as sensors such as satellite observation and surveillance systems—the Defense Satellite Program (DSP), for example. Some of those come directly back to the decision makers, who in the case of the strategic systems would be in Cheyenne Mountain. There are other sensors that feed directly to the commander at the front, in the force at the battlefield itself, and then the other intelligence is coming from, as I suggested, HUMINT sources and SIGINT. Some of it is real time, and some of it is dated. Some of it is perishable, and some is not.

Oettinger: So obviously, what you mean is intel about other things than the immediate battle. It isn't that you don't regard any of that as intelligence.

Quinn: Oh, no. There is intel going on regarding the battle as well.

Oettinger: I wanted to make sure we understood that.

Quinn: I mean, in addition to the stuff that's going on at the battle itself, they have to be aware of things going on elsewhere.

Student: I don't want to interrupt you too much, but you've got intel coming in from both sides. Where in your diagram is any provision made for assessment of intelligence?

Quinn: I've more of less lumped everything together.

Student: So decision makers include assessment?

Quinn: There would be a fusion center of some kind within the "decision maker" box (figure 1). Intel may come from a number of different sensors, and you may have an intelligence fusion center that also feeds the decision maker, but I'm lumping all that together to make a simplified diagram of how it works.

There are a number of different things that go into the acquisition part of this, and I've just listed some of them in figure 2. In our particular office, the Assistant Secretary for C^3I is responsible for oversight of the major weapons and automated information systems to do these kinds of things. There are some other responsibilities that the acquisition system needs to deal with and to be in compliance with. Interestingly enough, the acquisition system has been under great criticism from all different sources, and rightly so. There are a lot of things wrong with it. So we're trying to change it and correct it and make it more responsive to the people it's supposed to serve.

When you ask people what places like our office do—what is our staff responsible for—people will tell you "oversight." So

Oversight of DOD major systems—both weapons and automated information systems—is established to:

- Ensure defense mission needs are met,
- Protect the public interest, and
- Ensure accountability of public funds.

DOD oversight process ensures compliance with congressional direction and public law, including:

- Competition in Contracting Act,
- Brooks Act,
- Paperwork Reduction Act and its amendments,
- Federal Acquisition Regulations (FAR), and
- Federal Information Resources Management Regulation (FIRMR).

These regulations introduce cost and schedule creep in the form of protests, reporting requirements, and increased oversight. While established in the public interest, they are a major cause of the problem.

Figure 2

DOD Acquisition

you say, "Well, if I'm going to change the system, what do you mean by oversight?" So one of the first things I said is: "Get me a definition of what oversight is." It turns out that it's in the eyes of the beholder. I believe that oversight is kind of simple. It means that the Secretary of Defense has to be able to account for the defense budget to the Congress and the people, and assure them that a couple of things are happening: (1) that the money is being spent legally and responsibly and there is accountability for it; and (2) the things that are being bought are being bought to improve the war-fighting mission. You're buying things that are contributing to improving warfighting and you're doing it in a responsible way, and there is accountability for what is going on. So as far as spending acquisition money is concerned, it's not terribly more difficult than that in terms of what oversight is about. The way that's done is to look over the shoulders of the services and agencies to see that the things they are buying, and the things they are developing, and the money they are spending are, in fact, meeting that test.

Student: Sir, there is a new organization at the Office of the Secretary of Defense (OSD) level called the Defense Aerial Reconnaissance Office, which I think was set up by Mr. Deutch, that, as I understand it, has a very similar set of functions in the acquisition field dealing with airborne reconnaissance assets, but it's not within ASD C^{3}I. Why is that? Is it because it's intel systems or is it viewed differently?

Quinn: No. We could put a diagram up here of the Office of the Secretary of Defense and how we're organized and we could spend the whole day talking about that and the anomalies in the way we do business. All acquisition in the Department of Defense is the responsibility of the Under Secretary for Acquisition, John Deutch—and he certainly believes that because I've had several discussions with him about it—except in the case of information resources. In that case, there is a thing called information resources management (IRM) and there are things called federal information resource directives, and I will talk about those a little bit later on.

The ASD C^{3}I is the senior information management official in the Department of Defense and he is responsible for the acquisition of all things that come under that definition. In addition to that, the ASD C^{3}I reports directly to the Secretary of Defense. He doesn't report through John Deutch. All the other Assistant Secretaries, except the Comptroller, report through Under Secretaries and, in fact, ASD C^{3}I *used* to report to the Under Secretary. When Duane Andrews was in that position (1989–1992), he managed to move it out from under the Under Secretary and have it report directly to the Secretary of Defense. So that leaves a little bit of an anomaly in how the responsibility for acquisition of information systems is distributed.

The way it now works, is that I, as the Deputy Assistant Secretary responsible for acquisition, am responsible to John Deutch for all acquisition matters, although I don't report to him; I work for the Assistant Secretary for C^{3}I. But I chair the C^{3}I Systems Committee and I chair the Major Automated Information Systems Review Council (MAISRC), which is the one that deals with information systems apart from weapon systems C^3. I attend John Deutch's staff meetings, and of course the Defense Acquisition Board (DAB) that he chairs, and as chairman of the C^{3}I Systems Committee, I'm responsible to him.

The only reason I'm describing this to you is that there is a similar situation with the reconnaissance assets. The reconnaissance assets were under the C^{3}I organization, but the acquisition of them is still the responsibility of John Deutch. What was done in this case was an attempt to collect things in one place because there were a number of different kinds of systems being developed with different operational needs at different places with different folks responsible. And there were different technologies having the potential to contribute. Larry Lynn,* in whose office that organization rests, was made responsible for all future advanced tactical demonstration

* Larry Lynn, Deputy Under Secretary of Defense for Advanced Technology.

programs that would demonstrate new capabilities. So, in their wisdom, they decided that they should move that whole operation to Larry Lynn's office under John Deutch. Emmett Paige* agrees with that. There was no disagreement on doing that to try to improve the efficiency, get technology more quickly injected into those systems, and bring some better order to the surveillance field than it had before.

There are examples of a whole bunch of surveillance systems, and they don't fit the description of having a lot of order to them. So, it's probably a good idea to collect them in one place and then the question is: "Where should I collect them? Under ASD C³I or under USD Acquisition?" You would quickly arrive at the conclusion of USD Acquisition because he has the more general responsibility for the airplanes, the platforms, the host devices that would serve these things. It makes more sense to collect them there. So that's kind of how that came about.

Now when we seek to acquire something where eventually we're going to have a production system put out in the field for the user to satisfy some mission need, we run through this process (figure 3). You start out with a determination of need, and this is the requirements part of it; you define what that need is. There's a thing called a MENS, a mission element needs statement, which can be submitted by practically anyone—one of the CINCs (the commanders in chief), a department of one of the services—anyone can submit a definition of a deficiency in a mission. Then there is a concept validation phase where you look at systems that might be used to satisfy that need or to improve that deficiency, and then narrow down to demonstrating and validating that the concept is feasible. Then you move into a real engineering development/manufacturing phase until you finally get a production system.

The formality of that, then, in the review process, is indicated here (figure 4), and this is what the DAB does. The Defense Acquisition Board is responsible for reviewing this process at these stages. You have a milestone zero, which says

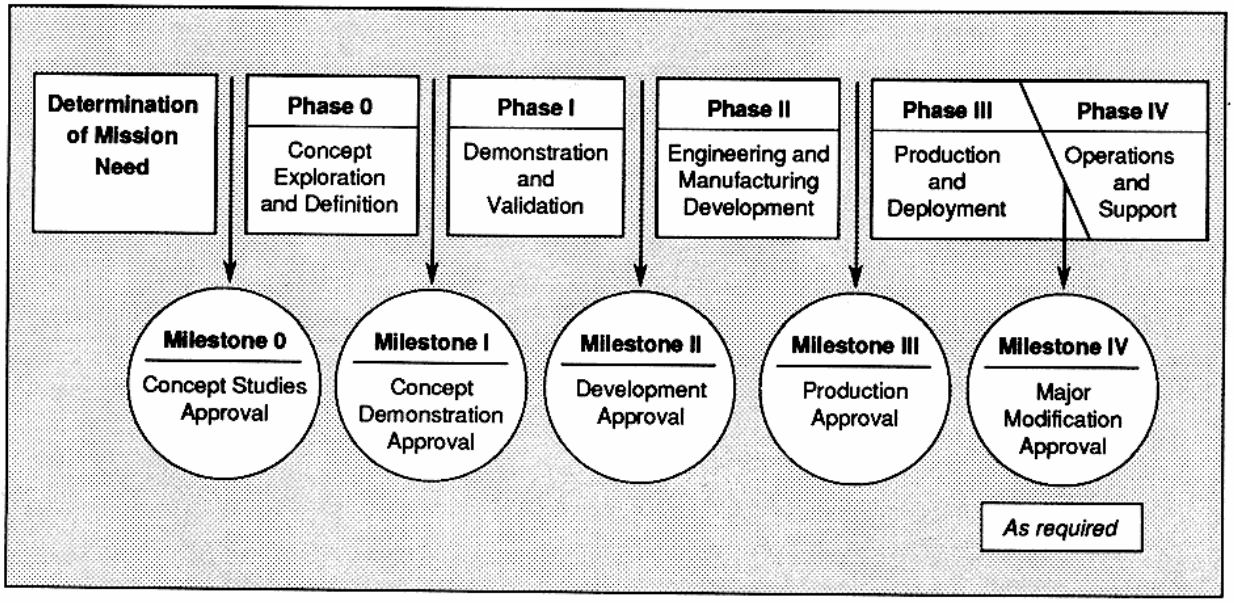
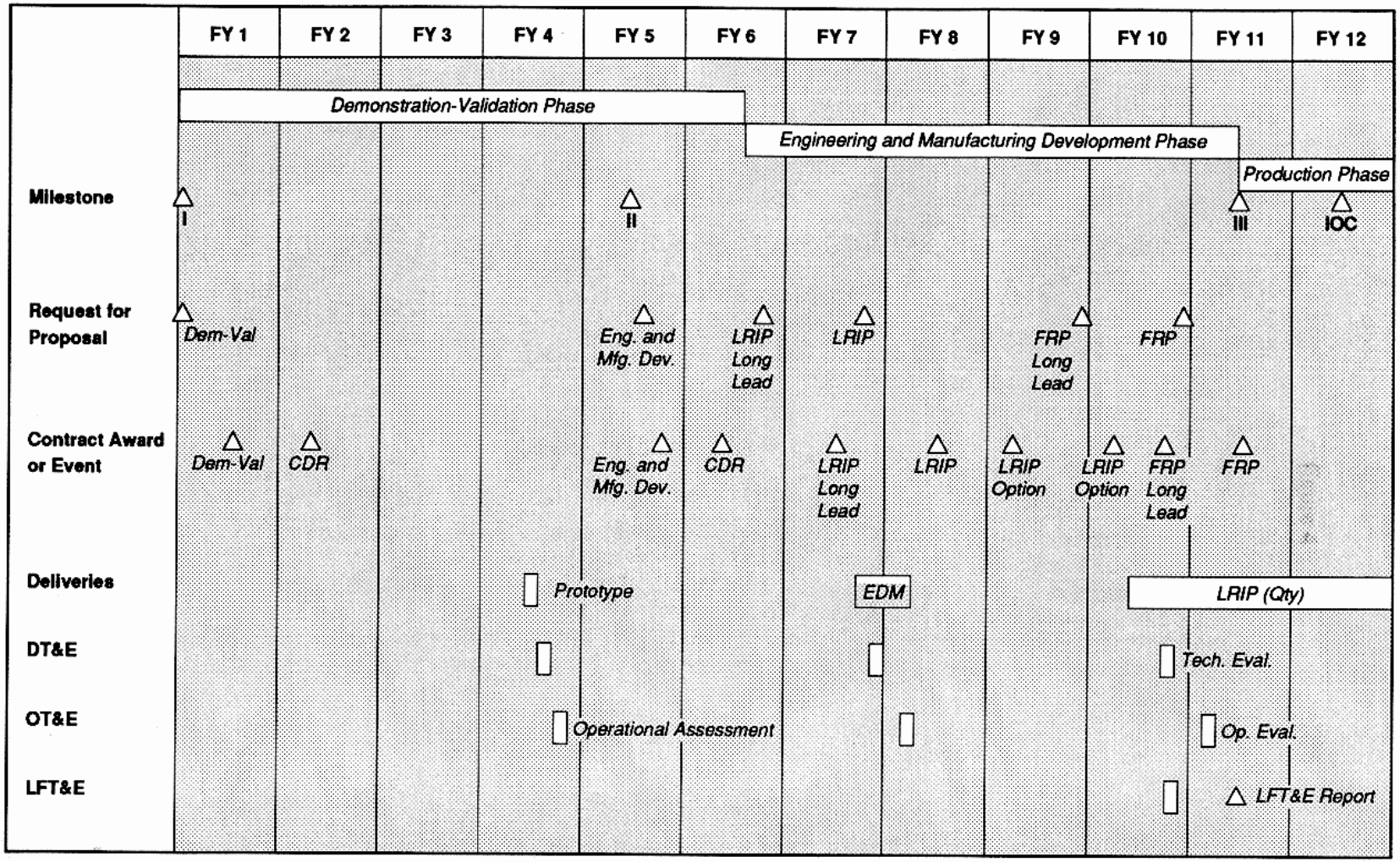


Figure 3
Acquisition Milestones and Phases

* Emmett Paige, Jr., Assistant Secretary of Defense for C³I.



CDR = Critical Design Review
DT&E = Development Test and Evaluation
EDM = Engineering Development Model
FRP = Full Rate of Production
LFT&E = Live Fire Test and Evaluation
LRIP = Limited Rate of Initial Production
OT&E = Operational Test and Evaluation

Figure 4

11-Year Acquisition Cycle

we're going to embark on looking at how best to do this. Then in milestone one, you neck it down to a couple of approaches. At milestone two, you actually get into the development of a particular system, a particular approach, and then when you reach milestone three, you actually are approving that system to go into the production phase.

Oettinger: Tom, could I just ask a question at this stage, going back to your point about oversight? So here you or John Deutch, depending on what kind of thing it is, exercise oversight over this acquisition person. As you said, the proposition for a need may be made by any number of folks, but classically, in the United States, the acquisition, et cetera, is by a service. Utilization is by a CINC, a commander in chief of one of the unified or specified commands, and then, as you said, a whole bunch of other folks. If not now, then maybe later, roughly speaking, is most of it service originated, or is by now most of it CINC originated, or the aggregate of all the miscellaneous categories or whatever? Where does it come from?

Quinn: It really can come from any one of the services or from one of the CINCs or some other source. It isn't quite as loose as I described it, where you can throw a mission needs statement on the table and somebody runs off and starts spending money to develop a system to satisfy that. There is a good deal more formality in this front end, where the requirement is being refined by a thing called a JROC (sorry about these acronyms—that's the Joint Requirements Oversight Council), which is chaired by the Vice Chairman of the Joint Chiefs of Staff. That council brings together the heads of the services and the CINCs to review a MENS and to confirm that it is indeed a validated requirement to satisfy a mission or a need that is indeed necessary to improve our force capability.

Oettinger: But that is the Joint Chiefs rather than the services?

Quinn: Yes. No matter where it comes from, if it comes from a service or a CINC or wherever, it must come through the JROC process. The JROC then validates it, and the Vice Chairman himself signs off on this, saying "The JROC has agreed that this is a valid requirement." That is then sent up to John Deutch. You say, "Here is a mission problem that needs to be solved. I suggest that you convene a milestone zero DAB and review how people might want to get on with satisfying this need." That's the theory behind how it should work in principle.

Then there is a choice. Suppose it's a strategic aircraft kind of problem, which would be an Air Force problem, and the Air Force is now going to take on satisfying that particular need dealing with that MENS. The first thing that happens is somebody has to put money in the budget. So they've got to fund the money to carry this through several stages in the budget in the out years and say how they're going to do this. Otherwise these folks are not going to waste their time by saying "We're going to go through all this validation of a DAB process and approve it," if somebody isn't being serious. So you then have to establish the seriousness of this by saying you are going to carry this through by putting money in the budget.

Oettinger: But now, if I hear you correctly, at that point then, the services weigh in because they've got the money and the CINCs don't.

Quinn: That's correct. It becomes a service program at that point, and it may be satisfying a CINC need, in that the CINCs are supported by each of the services, but somebody has to put money in at this point. Now that doesn't always happen. As a matter of fact, we have some at the moment under great debate. About two years ago, the CINC Space sent in a MENS for a new surveillance system and the JROC validated this and said, "Yes, we should have that," and they sent it up to us. Deutch decided that it was a mixture of C^3I and Strategic Systems. I'm getting ahead of myself, but there are three committees that serve the DAB: Strategic Systems, Conventional Systems, and C^3I. As I mentioned, I chair

the C³I committee, George Schneiter* chairs the Strategic, and Frank Kendall** chairs the Conventional. A system that would go through this process normally would fit under one of those committees. There are some that don't neatly fit under one or the other, and the space surveillance was one. So Deutch told George and me to convene a joint session, which we did, and we examined this, but there wasn't any funding for it.

In addition to that, which used to be a more prevalent problem than it is now, the MENS was more specific in the solution than it really should be. In other words, what a MENS should state is that there is a deficiency in capability: "I can't communicate between A and B, and I need to because I have to be able communicate orders to forces, and I need a system that has this kind of capacity and this kind of range and so on." Then the development people should decide whether or not that's a satellite system, a trunking system, an HF radio, or whatever. But the MENS, the requirements document, shouldn't specify the solution. That was not formerly the case. The way requirements used to be written is, "I need a UHF satellite that has 12 channels, that has so much power and so on, and this is a requirements document," which is nonsense. There may be 15 other ways to serve that. Little by little, we're getting away from that specificity and Jeremiah*** has been quite good about it.

In this case, there were some specificities in that MENS about satellites of particular types. So we sent it back and said, "First of all, it's got systems in it rather than requirements. So you need to take another look at it." We're going through some growing pains, so we had some debates with the secretary for the JROC and so on, but they finally did agree to take it back and look at it again. Then they sent it forward again, about six or eight months ago, and now there is a new debate in that there is no money. This would be an Air Force program, and they have sent it forward. But although the Air Force had proposed money for it in last year's budget submission to the DRB (the Defense Resources Board that handles the money), it was in a category called "above the line," and it didn't succeed. So there isn't any money.

The proponents of this program would still like to see a milestone zero established to get somebody on to develop this, and we in Deutch's camp are resisting that and saying, "You haven't met the rules. If somebody puts the money in, it will demonstrate where the need is. Until there is money, we aren't going to do it." So, as in every other endeavor, the next thing that happens is a memo comes forward and says, "You know, the system is screwed up in requiring money at the front end. We ought to revisit that. You shouldn't have to commit money in all cases, because there are exceptions and we think that you ought to have more flexibility." So people have tried to change the system by saying, "In this case, we ought to get away with it." Well, the answer went back and said, "No, the system seems to be working all right." This one doesn't fly until somebody puts money in it. So it will sit here until somebody really gets serious.

You see, there's a prioritization process in every budget cycle, which occurs every year, that decides among all the things that one could spend money on. Incidentally, there are far more validated requirements than there is money available to be spent by all the services. So in next year's POM cycle, when the services submit their budgets, the space surveillance proponents may convince the Air Force to put money in the budget to start a program.

Student: What's POM?

Quinn: POM is a program objectives memorandum, which is the service's submission to the Secretary's office of what they want in their budget next fiscal year. It arrives in the Secretary's office about May of the previous fiscal year. The theory is that the Secretary's office will review it over the summer and in the fall timeframe

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* Dr. George R. Schneiter, Director of Strategic and Space Systems.

** Frank Kendall, III, Director of Tactical Systems, Office of the Under Secretary for Acquisition and Technology.

*** Admiral David E. Jeremiah, Vice Chairman, Joint Chiefs of Staff.

have a dialogue among all the competing things in the department and then come out with a budget in the December timeframe, which goes to the Office of Management and Budget in January and then gets submitted to Congress in late January or February of that year for the next fiscal year.

So you start out with a POM submitted by the service. It gets reviewed by the Secretary's office, and it gets sent back to the individual services about October, or in the fall timeframe. The services are now being told, "We've looked at your POM; it misses the boat on fiscal guidance that was provided last year regarding priorities, so take these things out, replace them with this, that, and the other, and submit your budget." Then the budget is submitted by the service in the November timeframe. Frequently you iterate it because it will come back and the gold watches and the other things that they want will still not be in the budget. That doesn't happen with all of them, but you iterate it, you neck it down, and there's always a dialogue and a debate until about December, and then on some Friday at ten o'clock at night it's all settled, and you make decisions about what you would do with $50 million if you had it, or how you're going to accommodate $50 million that we're going to take away, and then the budget gets put together and goes on its way. So that's the way the budget part of it works.

Student: Sir, just a question before you get off that. There's one camp that says as a result of the 1986 DOD reorganization that while the CINCs were given greater authority, that they've not been given enough authority in the resource allocation. Although they participate in the JROC process, it sounds to me that you're arguing for that camp of thought because, in fact, while they have O&M (operations and maintenance) accounts, if the CINCs don't convince one of the services to POM their requirement, they're not going to POM at all. In effect, if I understand you correctly, it suggests to me that unless the CINC can come up with one of the services to front the money, the process will never begin.

Quinn: Okay, that's a good point, and I don't have a diagram to show how that works. What I described was the budget process, and I said it comes to the Secretary's office, gets reviewed, and you either agree with it or disagree with it, and send it back. At that point in that process, the CINCs are allowed to submit disagreements with those POMs, which are called "issue papers." Our staff in C^3I and the staffs in PA&E (Program Analysis and Evaluation), the Comptroller, anyone in the secretariat can submit what's called an issue paper. So you look at the Navy POM and you say that, for instance, "The Navy was supposed to support something that we want—the terminals for the Milstar system for 100 ships were agreed upon as a thing that has to be done, and it's not in the budget." So we would submit an issue paper, and we would say, "They need to put $100 million in this and the place to take it from is over here where they wanted to build these command centers to put on carriers that really aren't needed, so take the money out of that and put it over here." Or, preferably, we'd say, "Take it out of these F-18s and put it over here in C^3." At the same time, other people are writing issue papers and saying, "Don't buy that stupid C^3 satellite because they don't need it and we do need these new pods to put on F-18s, or new carrier systems."

So, there's a whole process of issue papers being written by people challenging the POM and changing things around. The CINCs play in that. The CINCs can write issue papers and disagree with the POM. These go to the Comptroller and PA&E, and eventually to the Defense Resources Board, which is the final adjudicator in how the budget is actually allocated. There's a limited number of people on that Defense Resources Board, and in fact, the C^3I Secretary is not one of them. John Deutch speaks for all the acquisition, and so if we want to raise an issue at that final budget process, it has to go through Deutch. He has to agree with it.

Now, everybody plays games. The fact that we report directly to the Secretary means that we can send a paper to the Comptroller at the same time we send it to Deutch, and you play both routes. Some-

times it works and sometimes it doesn't. But anyway, he's the spokesman for all acquisition, so he goes to the DRB, and the CINCs attend these meetings and they can be heard. If they have a case for this surveillance system, for example, and the DRB believes that what they're saying has a higher priority in the mission deficiency that they're describing than something else that's in the budget, they will just write a program decision memorandum, a PDM, and send it back to the service and tell the Air Force to fund it.

Student: So in fact the DRB establishes the priority.

Quinn: Yes, the DRB is the final arbiter, and that is one of the disconnects in the system: that they decide where the money is to be spent. Disconnect may be too strong a word; I mean that's the way the system is. They decide the priorities on spending the money. Deutch decides the priorities on whether the system is mature, whether it is prepared to move forward in the acquisition process and is competitive within that framework that he controls. But the DRB decides where these priorities are set in the entire scheme of things, including all things that must be funded in the entire department. They make the final judgment on what will be funded and what will not be, and then they decide the budget and direct the services to put these things in their budget when it comes forward.

Student: Is the DRB chaired by the Vice Chairman or the Under Secretary?

Quinn: No, it's chaired by the Deputy Secretary of Defense.

Student: Can I ask what is probably a very naive and un-military question? It seems to me that both C^3 and I are areas in which other parts of government, outside the services and outside the Department of Defense, have a potential interest. Now, clearly, that interest is not going to be very high when you are dealing with specialized military communications systems. But if somebody is defining a major, say, global communications requirement, in which the Foreign Office in our case, or State and some of the other agencies in your case, would have an interest, is there any mechanism, as there is in the U.K., for factoring their views into this process? It strikes me that, particularly at the requirements stage, there is a pretty key set of coordination questions that need to be addressed there.

Quinn: There are several, yes. There is no one place where all of the cabinet-level departments come together and make this kind of an assessment as to whether there is common interest, except at OMB. When the budget finally goes forward, as I mentioned, where it goes when it leaves the Defense Department is to OMB. OMB takes the budgets of all the departments and puts those together into the President's budget. So, when the President submits the budget to the Congress in February, it has the budgets for every department in it. For example, with the LANDSAT satellite, which is funded partly by NASA and by NOAA (National Oceanic and Atmospheric Administration) in Commerce, OMB might come back to the Defense Department and say, "You need to put $100 million in for it," and they can arbitrarily do that. So there is some leveling done at OMB on those kinds of things where there are national and international interests involved.

In addition to that, there are other separate mechanisms, like the National Communications System. The National Communications System is a collection of 22 departments in and across all the cabinet levels of the government to look at common interests in general-purpose communications systems, not tactical radios or antijam on the battlefield, but telephone systems, data distribution systems, general satellite communications, and so on. The Secretary of Defense is executive agent for the National Communications System, so he chairs it. There is a manager for it who is the ASD C^3I. There is a deputy manager who the head of what used to be DCA (the Defense Communications Agency), which is now the Defense Information Systems Agency. They try to coordinate on what needs there are among all these departments for communication systems. FEMA (the Federal Emergency Management Agency),

for example, has a lot of disaster communications systems that are similar to those in the Defense Department, and assets in this arena are brought to the table, and the Defense Department and FEMA are the two major players. The budget is essentially paid for about 80 percent by Defense, 20 percent by FEMA, and the rest of them contribute tips and that's it. There is a committee of principals who govern it all, and there are great debates on what should and shouldn't be done.

In addition to that, we have bilateral organizations with organizations such as the FAA. You probably read in the papers recently about the NAVSTAR GPS (Global Positioning System) satellite system, for example, which will become an inter- national navigation system. The FAA has now accepted it as a general navigation system, except for terminal landing phases, and we have been working with the FAA for years on that. There is a committee between DOD and FAA that works that kind of problem. In the case of LANDSAT, we have committees involving NASA and ourselves and Commerce and NOAA. So any place where there is a common interest, there is some mechanism set up to deal with that, but it may not be the same one across the government.

Oettinger: Let me add something to that because you asked your question also in terms of intelligence. I remind you that Dr. Quinn is Deputy Assistant to the Secretary of Defense for Command, Control, and Communications. His coordinate, Dr. Hall, will be here a bit later. He is the intel guy, and would have, I think, addressed the same question in a somewhat different way. Instead of mentioning the FAA and some other places, he would have mentioned the Central Intelligence Agency and the role of the Director of Central Intelligence as a coordinator for government-wide intelligence things, to which you might have countered that the Director of the Defense Intelligence Agency now styles himself as the Director of Defense Intelligence as a countermeasure to the Director of Central Intelligence, and there is a man named Rich Haver, who sits on a committee which is supposed to coordinate that. For everything he just said today, there is a parallel question that I urge you to pursue in more detail when Dr. Hall is here, and then you can complete, in terms of this course, the intelligence, command, and control story.

One last footnote, and then I'll give it back to Dr. Quinn. You asked this from a British point of view. I remind you that with all of the ancient charters from 1215, the year of the Magna Carta, on, that Britain remains a much more centralizing authoritarian society than this bumbling democracy. So you are witnessing one of the strengths or weaknesses of the American form of democracy in these structures.

Quinn: Correct. There is also the National Intelligence Board. One addition to that, though: in the area of acquisitions, for the DAB and so on, I am responsible for the intel systems. If somebody's going to buy a system, it still comes under the DAB and/or MAISRC or whatever it is. In the C^3I arena we reorganize faster than you guys can keep up with. We don't have a diagram that can really tell what we're about. So we've changed the whole system, where the acquisition comes under my office. I did not have responsibility for information systems; they were under Cindy Kendall* until about four or five or six months ago. We reorganized it and put all the acquisition in my office. The C^3 telecommunications stuff was in the office of Johnny Grimes, whom we talked about earlier, but his organization has gone away. So all the C^3 stuff we've collected under the Deputy Assistant Secretary for C^3, who is now Deborah Castleman. She is at the moment more of a counterpart to Keith [Hall] than I am, although I used to have all of that responsibility at one time.

This depicts one of the problems (figure 4). One of the criticisms of the acquisition cycle is that it takes so long to get anything developed, and what I show here is why that is. You have, on the previous chart I showed you (figure 3), the process and then the management overlay with the milestones that implement that process.

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* Cynthia Kendall, Director, Office of Defense Information.

Here I've shown in a time phase roughly how these things occur. You start at milestone one, having passed that milestone zero, the concept formulation/concept definition phase. We are now talking about developing something and producing it in the future.

The first thing is you've got to put together an RFP, a request for proposals. One would think that's a simple enough process. You know, we'll start today and, for a new system, we should have it written by the end of March. I would submit that if you suggested a major system, where you are talking about spending a couple of billion dollars, that process alone takes 18 months just to get the RFP because of the number of people that have to agree to it in what's called the coordination process before it can be released. So you get a request for proposals and you put it out, and this chart is saying that in about six months you'll have a contract, which is very optimistic.

Then you have a critical design review on how you're going to proceed, and then you actually do some work, and then there's another review. It takes about two years to do the development, and then you get prepared to move into the next milestone, which is engineering and manufacturing development.

Incidentally, until just not too many years ago, this used to be called engineering development, and a great deal of time and effort was put into doing just that—the engineering development and demonstrating the feasibility of the idea—and not nearly enough attention being paid to whether you can produce it. So where all the trouble occurs in the systems is not here, where you're trying to convert the technology into some operating system; you can usually do that. It's only when you try to produce a hundred of these, and make them all work and make them reliable and make them people-safe and people-proof and operable by the soldiers and the sailors and so on that you run into trouble. Then you frequently will not pass the operational test phase and you go back and you iterate at this point. To try to improve on how we do that, this phase is now called engineering *and manufacturing* development, so that along the way here, you need to pay attention to how you're going to produce this thing. Is there any characteristic of it that requires some special treatment or special manufacturing process, and so on, that hasn't been done, and so more attention needs to be paid to that?

Eventually, as early as possible, you get into some limited additional production. LRIP means limited rate of initial production, so you're going to be allowed to produce a few of these things to be used for test and evaluation. Operational test and evaluation must result in a certification report by the independent tester. This guy essentially works for the Congress. He does not work for the Secretary of Defense. He's an independent tester and must certify that an operational test has taken place and is satisfactory in the sense that the system is producible, operable, and meets the minimum requirements. He has to certify that to Congress before you can actually go into full-scale production.

Student: The world looks a lot different today than it did a decade ago. A decade ago, when you knew who your enemy was, and you presumably had some intelligence and some idea of what was on his drawing board, an 11-year acquisition cycle might have been workable. But today when you're looking at the world, you don't know who the enemy is, where he is, what mix of assets—naval, air, whatever—will be required, or what the size of the conflict will be, so how can an 11-year acquisition cycle ever hope to equip the military for the challenges that they're going to face?

Quinn: I said I was going to explain this. I didn't say I was going to defend it.

Student: Is that under consideration?

Quinn: Absolutely. That's one of the things we're trying to get away from. It's folly to take this long to develop something. Incidentally, I was just saying to somebody that one of the difficulties when you reach the engineering and manufacturing development stage after having worked for six or eight years and the testing doesn't quite work out, is that what frequently hap-

pens is the user says, "Well, it doesn't do all the things it was supposed to do, but it sure is better than anything we've got. Nothing we've got is anywhere near this good, so we really ought to press on with this." But then the testers will say, "But that's the spec (specification) you have on it, and it doesn't do what it's supposed to do, and as a matter of fact, if you wanted to do half that, we could have done it for a lot less money." So there's a lot of criticism about, "Why did you produce this thing if you're willing to settle for less? Why didn't you say back here at the front end that you would settle for less?" You get into a whole lot of debate on that at this point here. One of the things that we're trying to do to get away from that is what we call "evolutionary acquisition," and buy things in smaller chunks and get them out to the users to try to alleviate this problem.

But the way I describe this difficulty with the 11-year cycle, or any cycle that's longer than a few years, is that there is a curve that goes something like this (figure 5). I don't have a name for this scale except maybe it's maturity or something like that. You have an axis that goes along here, which I'll call technology, and there's always an increase in technology in our business occurring with time on some slope, and whether it's linear or not doesn't really matter because what happens in our business is that at some point you decide to build something. You're going to build a communications system or communications satellite or processor or something, so you have to pick a technology. So point 0 is the maturity of technology when you decide to do that. You're going to go through some process to develop and it's going to take more than zero time, so you're going to work on producing this thing, and time is going on and you're building it to a particular technology.

Now in the meantime, the technology itself is going up this curve, and you're working along the horizontal axis, and

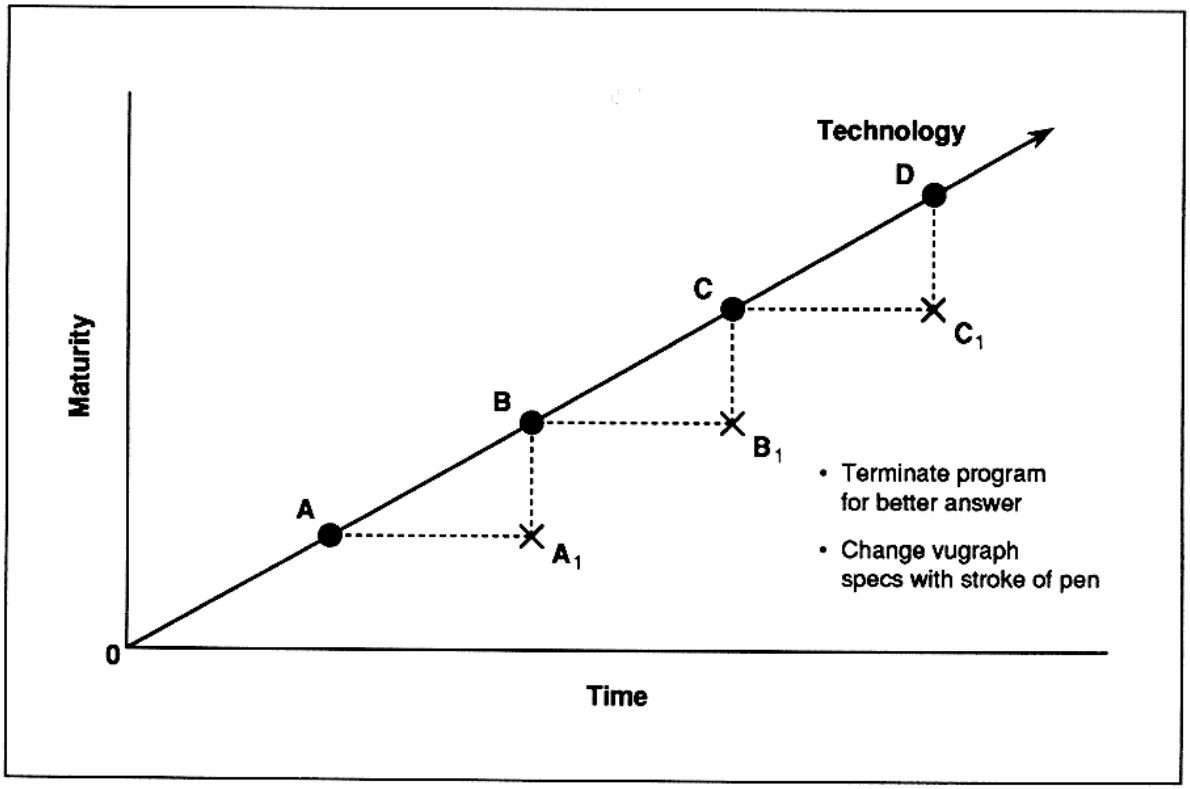

Figure 5
Accommodating Advancing Technology

maybe this scale is in years. Then, you get to about point A and you start to have trouble in making this meet the specs it was supposed to meet, and the criticism sets in, because there was a lot of money spent and it doesn't pass the test. You're trying to defend it, and so your progress begins to slow down as you move on. In the meantime, technology is continuing to grow.

At some point, a guy enters the picture and says, "Look, technology has improved so much since these guys started back here seven years, or two years, or five years ago, it's incredible. We can now produce a machine—a device, a workstation, a processor, whatever it is—that does all those same things in half the size for half the money, and so let us have a go at it." So a debate ensues, and sometimes it's accepted. What this new guy has, you see, is a set of vugraphs. This is what I call cinemagraphs.

So the guy with the block diagram wins because he convinces people that he's correct. So you shut the old development system off at point A_1, and you move to point B (figure 5), and then the new guy starts. Technology is going on, and maybe he gets to B_1 before he runs into the same thing. And now another guy comes in, or maybe the same guy again, with a new set of charts, and he's got a block diagram that does the same thing, so you move to point C. So now you can go on for 10 years and never get anything, because you keep shifting to try and capture the new technology and listen to people who are telling you the current development isn't going to do it. This is one of the problems in technology that moves as fast as it does in our business, which is what makes it totally unacceptable to have an 11-year cycle.

Student: You also are going to lose the advantage of the smaller, agile firms, because there is no small firm that can afford an 11-year process in terms of betting the company on it.

Quinn: Some people have taken small companies and made them into big companies on this.

Student: Not lately!

Quinn: So it works both ways.

Oettinger: Let me be a little bit contrary in here because I worry again that this looks so painfully ridiculous that there is a tendency to throw it out. In a more mature and widely accepted technology with broad applications, such as space and electronics have become today, it is indeed ridiculous. But I would maintain that if you're dealing with a brand new technology that has no visible applications and no one willing to pay for it, other than say the military or some other aspect of government, one will sooner or later have to reinvent something like that and pay that price because there isn't much of an alternative.

I'm throwing this on the table to get a reaction in case I'm just being completely nonsensical, but let me add a couple of other points on the spectrum and see if our guest agrees. At the far end of the spectrum, where this is patently ridiculous, you have some of the current electronics represented à la personal computers and the like, which people are taking to the field. In Desert Storm they bought workstations at the store and they brought them with them, partly in exasperation with the patent ridiculousness of an 11-year procurement cycle on something where the commercial life cycle is 18 months if you're lucky—most of the time six to eight months.

Now in between, and this is a Desert Storm example, which is public, the secure telecommunications unit, the STU-IIIs, which were widely brought in, were a somewhat intermediate point. Yes, it has a certain measure of commercial viability, but the damn things were produced initially, essentially, with Defense Department bribes. The private sector would not have made highly secure, reasonably sized telephone units, and it did not take 11 years. If you look at STU-I, STU-II and STU-III, in fact it took more than that. The cycles were somewhere in between, but the private sector would not have taken off on it.

Now today that again would be different, so there is an element of maturity of the technology and also breadth of its use. To throw out the notion of a long-term commitment, when it's the only thing you've got, even if it's got perversions of this

kind, I think would risk throwing the baby out with the bath water. I've talked too much, but does this make sense?

Quinn: Yes, of course. Please understand that, to make a point, I'm exaggerating these things to a great extent as to what the impact is, and I am over-simplifying. These comments are terribly over-simplified in terms of what really happens, because there are many things where the technology did not exist, where you don't have a choice.

I would offer the Milstar satellite system as a prime example—extremely high frequency, millimeter wavelength devices. When we embarked on the Milstar satellite back in 1979, 1980, there wasn't any technology for EHF. People didn't know how to make cavities that small and reproduce them and all of the difficulties that one gets in dealing with wavelengths that small had not really been attacked because, as Tony said, there was no real commercial market. There was no real motivation for people to do that until we got into it. For military purposes there was a great attraction, because of the opportunity here for extremely wide bandwidths, measured in hundredths of megahertz. We weren't interested in capacity. You can buy capacity off commercial satellites in terms of getting lots of channels and lots of bits per second. We were interested in antijamming. So we took the millimeter-wave satellites and we took all the bandwidth, and we devoted it to processing for antijamming. So, even though we have tens of megahertz of bandwidth, the channel capacity of the Milstar satellite is 2.4 kilobits. It's a narrowband system from an information transfer viewpoint.

We went about trying to produce that satellite at great cost and difficulty, for which we are getting all kinds of criticism right now. However, the satellite was launched three weeks ago and is working magnificently. So thank goodness that part of it is over, and I think it will be demonstrated. The other thing I would also predict is that, now that the commercial people know how to build EHF things, more and more uses of it will come about, and there will be a commercial industry developed for those military wavelengths. I think that the cost of the terminals and all the rest of it will come down to where that system will be much more attractive than it is now.

But it took that long to build that one for a couple of reasons, and one of them is that the requirements weren't stable. People kept changing their minds. "We want it to be hardened." "Take the hardening off, it's too much, it's too expensive." "Make it wider band." "Make it narrowband." Continuously, the design specifications were changed along the way by both the DOD and the Congress. It had a great deal of help from congressional suggestions on changing the design. So the satellite design kept changing, the technology was rather immature—not that it is terribly mature now, but it's a lot better off than it was. So, in that case, it does take that long when you are doing the first one. Where this doesn't make any sense is when you are doing something where its technology exists, but maybe needs to be refined.

The counterexample I will give is the JTIDS system, the Joint Tactical Information Distribution System. It's an L-band system, which dates me; I haven't gotten away from that yet. That was begun, again, back in the late 1970s, and the technology for it is very mature. We have a system now under development called the Multi-information Distribution System—same waveform, same system and all, but it is to be used in NATO. We just approved embarking on that system, which we are going to revisit, because it is going to take JTIDS technology and repackage it into a smaller box, which is about a half a cubic foot, and they are going to take eight years to do this.

I balked at that. That is ridiculous. I mean, we are starting with a technology in a box that has already been designed, built, tested—it's out there. It's being produced for use by the Navy, and to a lesser extent, the Air Force. There is no software development, which is where we used to get into great difficulty. The software is transferable from JTIDS. So we are basically talking about repackaging. The engineers don't like me to overemphasize that simplification either, but that's what I call it. It merely is taking this functionality and designing it into smaller boxes for which the technology does exist. It's a matter of putting it together and demonstrating it. How, in

God's name, that should take eight years is just beyond me. But that's the schedule they are on.

In eight years you go into LRIP, and then spend two more years before the first one of these is produced in the year 2000 to be put into an F-18. I submit that so much change will take place between now and 2000 that we won't even know if F-18s are the things that we want to put it in. So, that's the case on the other extreme where it really doesn't make sense to have this cycle, whereas I think EHF is a good example where it does take a long time to get the thing developed. We've launched the satellite now, so it was 14 years from conception to when the satellite was actually launched. We have, however, now delivered to the commercial marketplace a new technology, which they can now build on and find other things to use it for.

The secure telephone is another interesting example you bring up, and I don't want to miss the opportunity to give the credit to the guy who deserves it, who is no longer with us. Harry Daniels was the guy at NSA who actually did this, and he, again, looked at the way we build secure telephones, secure systems, and he said, "This is crazy. What we want is a crypto chip on a telephone and we're spending all this money developing it and so on." He called in the commercial community and he gave three contracts to people. He said, "Here is a performance spec—not a design spec, not a production spec—a performance spec. Now, you guys go build it. I don't care what it looks like, except I don't want it to be bigger than a breadbox, but it has to deliver this performance and you've got 18 months or two years to do it, and then we are going to have a shoot-off on which one we want to buy, and even give us some options." That is what he did. GTE, RCA, Motorola, and AT&T went and built these things, and they delivered them in the required timeframe. I think he paid several million dollars each to these developers. He didn't give them any restrictions, it was like, "Use your technology, however you want to do it." It was a tremendous success story because they do work, and they're of a much higher quality secure speech than anything we had before, although the interesting thing is that now people are upset with the quality of speech because it is not as high as they're used to in commercial telephones.

Oettinger: This is worth pursuing a little bit further. First of all, the late Harry Daniels—he's no longer with us is not a metaphor—presented some of that story here in 1986, so if you want to pursue that a little bit further, read up Daniels' account in the proceedings of the 1986 seminar.* I agree exactly with what you said, but that was the number three in the line. The STU-I and STU-II never took off that way, and STU-III succeeded in part because STU-I and STU-II had proven out a number of things.

Interestingly enough—and what triggered this intervention was your last comment about how they're now com-plaining about the quality—before STU-I was built, there was an agonizing and protracted debate over whether the damn thing should be broadband or narrowband. It was evident that one could have great quality by having things that require enormous bandwidth and lots of stuff of the kind that Vice President Gore is talking about now for the information highway, which isn't even here yet and won't be here in the foreseeable future. What I'm sure of is it wasn't here 15 or 20 years ago and somebody then wisely made the decision that you wanted this thing to operate on ordinary telephone lines, anywhere from San Francisco to Timbuktu, and that immediately said that the quality would be no better than that of an ordinary telephone. It's fascinating to see that the thing has been successful. You see how this is routine now. We want one that sounds better than the telephone, and maybe over the next decade or two, its time will come.

But some things ripen slowly, and so that's again one of the reasons I didn't want

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* Harold Daniels, "The Role of the National Security Agency in Command, Control and Communications," in *Seminar on Command, Control, Communications and Intelligence, Guest Presentations, Spring 1986*. Program on Information Resources Policy, Harvard University, Cambridge, MA, February 1987.

you to walk off with the notion that 11 years is, per se, ridiculous. It is ridiculous under many circumstances, but there are others where it requires essentially a political act of faith, in the best sense of the word. So, yes, he sold it with foils. I remember reading an Air Force history where a guy in the Strategic Air Command said, "They sold them the sizzle, not the steak." But when you have only an idea, that's all you've got.

That's exactly what the Vice President of the United States is trying to do right now with the national information infrastructure, following on the heels of his daddy, who was the chairman of the committee of the U.S. Congress that, with President Eisenhower, put through the interstate highway system. Senator Gore Senior put more interstate highways in Tennessee going from nowhere to nowhere than anybody else because he controlled the committee. Now that's what politicians are supposed to do, and he would have taken the rap had it not worked. Twenty years later, something is working well that, in its time, by the way, was defended as necessary for the strategic survival of the United States by President Eisenhower because the interstate highway system was going to be the means whereby we'd prevent the Russkies from bringing us to our knees by bombing the hell out of all the railroads. In a way it sounds completely lunatic, but it isn't all that lunatic: George Washington defended the building of post offices and post roads as a national security measure against the Brits coming back. It really turned out to be an amazingly useful thing. So when politicians do it, it's called "vision" when it's successful. When the military do it, sometimes it's stupid, but at other times it is an excuse for the politician, and at still other times, it is simply a gamble on something that doesn't exist yet.

So, I think discriminating here is awfully important, because we're going into an era where laughing at 11-year cycles is going to become the excuse for stopping every new idea on the horizon. That can be as dangerous as devoting 11 years to something you could go buy in five minutes at Radio Shack. End of sermon.

Quinn: I think it's a far more complex issue, but I'm glad you reminded me of that. The STU-II was the one that was most widely proliferated, and the STU-II was a very unfriendly device. It was about the size of a two-drawer filing cabinet, maybe two two-drawer filing cabinets, and it had one instrument, which was very large, and it only worked about 50 percent of the time. So if you put a call through, it might or might not go through, and while you were on the call, it would probably fail. People were just terribly upset with this thing. But it had been developed from scratch by the government, by DOD, to provide that secure telephone service.

What Harry did is what a lot of people are talking about today. He said, "Challenge industry. Don't try to develop it yourself." Incidentally, the STU-II had to have its own conditioned and separate lines, and so you couldn't plug it in. Harry said, "I want to plug this damn thing into that wall outlet. That's all I want to hear about. I don't want to hear about any changing cards or anything else." It does have a key, but the key is a little tiny plastic key that you can put in or take out, and when the key is in it is classified, but when the key is out it's totally unclassified. In fact, the key is the only thing that is classified. It does what he wanted. He succeeded. If you challenge industry, they will respond.

Oettinger: You've got to look at the cycles. It is an important point, I think.

Quinn: Yes, we have to be careful that we don't use clichés to stymie initiative and that sort of thing. There are cases where development is very appropriate, but not in our cases. We are most susceptible to this criticism because much of what we do can be accommodated by commercial devices. We used to make excuses why that is not the case, why you can't use a commercial switch or you can't use a commercial workstation or a PC or something, but much of that has gone by the board.

Reliability used to be a big factor, and the commercial devices weren't as reliable and they couldn't meet the environmental conditions. That was one of the big factors,

in that if you took a commercial device and you stuck it into a military environment it would fail because of the temperature variations in many cases, because of the vibration, and so on.

That's no longer the case. Take a CB radio in a car; you can stick that same aerial in almost anywhere. As a matter of fact, the environment on an automobile engine is far worse than almost any military environment you find electronics in, and yet we have electronic ignition systems and most of the cars have computer devices under the hood now and they all work. In our kind of weather, the car starts out at –20 degrees and in not very long it is up to something considerably higher than that, and so it has to be able to work in both environments. So the commercial stuff has come a long way in terms of reliability. It is much more acceptable than it used to be, and the functionality of it has far exceeded what the Defense Department needs or has proposed for our own kinds of systems.

And yet, a very key feature is that our share of the market is so small that we have no leverage in determining where this technology goes. So we can't direct how the technology is going to occur and we have to ride this commercial technology horse to satisfy our needs because we don't have any leverage.

Student: Sir, I think you almost answered the question I was going to ask. I've been looking at foreign ministries as opposed to defense ministries and their requirements. The more I think about this, the more there is a distinction between technology and application. Certainly in the diplomatic case, you don't need leading edge technology usually, but you do need pretty good applications. Is a similar thing happening there in the defense establishment, post-Cold War? Is the importance of new technology as high as it was? Do we really need to develop something new, or is it the "bolt-on" system again?

Quinn: No, it's the implementation of current technology, or in many cases the application in software of current technology, rather than the software technology itself. It's the application software that you put on the device that is important. That's where we lag. We don't have enough applications.

Now, you have to be careful because the technicians, on the other hand, will try to convince you that what you need is new technology. You need far more speed and far more features and so on. You don't need speed at all. What you need is reliability and you need functionality that isn't there. Not that you don't need any speed, but the speed that's available is quite adequate. But on the other hand, the development engineering community would try to convince you that what you need is something more sophisticated, so that you will continue to support the development. We need to do that, but we need to do it, maybe, off-line in some cases where we are developing the technology for technology's sake, while at the same time trying to get these applications developed, because you are quite correct: it's the applications where we lag in trying to get the technology.

Oettinger: The sophistication of the answer that Dr. Quinn gave you should, I think, be underscored, because if you screw around with technology development in trying to get an application done, it's a recipe for disaster in that you never get anywhere. But if, at the same time, you are too cheap to support what he described as off-line technology research, then sooner or later you will run out of resources because the next application will not be feasible with the old technology. People find it very hard to maintain those two threads. I think again, in terms of my litany to you about tensions and balances and so on, in an ideal world you would do these two things, but the reason people live with application systems that are also test beds for new technology is that in the real world it is awfully hard to persuade people to put money into two tracks. You are better off on your watch selling it as sizzle and hoping like hell it will be steak before too long, and then seeing what happens.

Quinn: In fact, that is depicted on the diagram (figure 5). What you want to do if you started at the beginning and you managed to get this thing developed, and say at

point D you hit production, and now you are using this device, you get it out here, and it is going to be in existence for some 10 years, perhaps, or in the case of Army radios, 20 years. But you need to have your eye on this curve, and you need to have somebody watching this, so that at point B, instead of somebody leaping up with a vugraph, you deliberately start on a program here to replace this. But it isn't done because somebody has persuaded you; you have done it deliberately because you know technology has now advanced, and you are going to take up more applications you couldn't get here and so on, and now you start down this path and at this point you're ready to proceed. You shut this one off and now you go here. That's the correct way to follow this curve.

Oettinger: This is also why I rail, as you've heard in the past, at the technology perfectionism, which would have you riding on this whole track forever. That is both unaffordable and stupid, because you can make the technology work in the laboratory, but you can't guarantee that it will work in reality. So, in order to keep things on an even keel, the technology guy always wants you to be perfect, but that's the reason for my stressing that all you need in reality is to be better than the other guy, and to watch how long you stay with where it is. The other guy is on this curve to see whether he can leap-frog you and your timetable, whether that's competition in business, or competition on a battlefield. You need both kinds of intelligence so that you can see where you and the other guy are, and make that transition faster than the other guy does. The techie will try to convince you that you have to have this perfect and ultimate technology all the time, and that's nonsense. You're either competitive or your opposite number will bankrupt you in a competitive or a military world or any kind of foreign ministry world. Does that make sense?

Quinn: Yes, it does.

Student: Isn't that what we do with major weapon systems in the military? You turn out an F-4G that comes out eight years after our initial concept development, but the F-4B comes out after six years, so between six and eight years you come out with three or four iterations because you're still working on the same basic airframe but you're applying technologies that may be upgrading now.

Student: Yes, and you're up to F-15Es or whatever ...

Oettinger: But you military service guys should also remember to tithe off the weapons so that these guys can be retained without lying as much as they usually have to lie. Part of the reason why they lie so much is that they're kept on too short a leash.

Quinn: When I said off-line, you should keep track of technology and make sure you're doing R&D and keeping abreast of it, and each of the services has a mechanism for doing that. They have R&D departments; they have laboratories. I was most familiar with the Navy; I used to be in the Office of Naval Research (ONR), and they tried to do basic research as well as technology development.

The most difficult thing to justify is funding basic research, because the outcome of the basic research has no application, nor should it. The other thing that people forget about basic research is that failure is a perfectly acceptable result; otherwise you wouldn't be doing the research. If you knew the answer, you wouldn't be wasting time and money and effort to try it out. So, supporting basic research is very difficult, especially in a DOD environment, because people want results and they want predictions and they want projections and reports and so on, and so you try to invent on schedule.

Now, where it went awry was in a thing called the Mansfield Amendment, and the Mansfield Amendment said that military folks can't support any research unless they can project and demonstrate that a military system will be the result of this research project. So if I were supporting somebody at a university laboratory, or a university professor with some graduate students or something, and I wanted to give him

$100,000 to do some investigation in some technology application of information systems, I'd have to demonstrate that there's a military system at the end.

In my view, this had terribly disastrous effects. For one thing, it made liars out of researchers, which bothered me a great deal, and then, when the researchers started to lie by direction and by necessity, these things found their way into the Congress and then the congressional staffers would criticize the more realistic projects.

A major example of this is research on neutrinos. When I was with the Office of Naval Research, we had a number of things going on: ELF communications for submarines, VLF communications for submarines, antijam communications, and the like. There was a good deal of high energy physics research going on, particle research and so on, some of which was on neutrinos, and it was at the University of Chicago in that big accelerator out there. It was being supported by some other folks in ONR in the physics department, and in order to justify this, they had to show a product. So they suggested that since neutrinos have no rest mass and they penetrate sea water or anything else, unless you have some capture mechanism to stop them, so you can demonstrate that if I had a neutrino communications system, clearly I could penetrate sea water to arbitrary depths, so I could communicate with submarines and anything else. Of course, there's the minor matter of what the capture mechanism is to get the neutrino and the energy from the information on and off the neutrinos, but these issues are left to the developer and the applications guy. They would put this into a report and say, "The reason we're supporting this is that it has the potential to communicate with submarines at any depth and speed, totally uninhibited, and so on."

So here we are, looking for $10 million to build a VLF airplane, which has a wire hanging down from it, which is going to communicate with submarines, but which we know is going to work because we demonstrated it and we really need this to give survivability to the whole force. Then you get a staffer who comes up and says, "You guys are crazy. I mean these guys in Chicago have neutrinos and they're going to communicate to arbitrary depths, no big problem, and you want this damn wire hanging out the back of this submarine that's going to give away its location? Why should we give you another nickel? We're going to put the money into neutrinos."

Oettinger: I'm so glad that you brought this up, because we've gotten a lot of mileage out of this diagram and its fundamental importance. I cannot resist another anecdote on the lying that the Mansfield Amendment led to. Mike Mansfield is the former Senator, who's now Ambassador to Japan, an honorable man with excellent intentions. He was enormously well-intentioned, but the side effects were a massive corruption of the science establishment, which lasts to this day and, of course, gets Congressman Dingell* all excited, sometimes for good reason because there is a good deal of corruption.

It had a devastating effect on both this university and MIT some 20 years ago. I was on a committee that either the faculty or the President called to pull his chestnuts out of the fire. It was about a thing called the Cambridge Project, which was a bunch of social scientists at Harvard and MIT who were going to look into varieties of boondoggling basic social science things, that perhaps were totally harmless and perhaps might not have been, but they justified it in terms that would have assured a U.S. victory in Vietnam or some such thing. Then the students got hold of it, and they denounced both universities for being collaborationists in a sinister war, et cetera.

So, the first thing was: what to do with the Cambridge Project? You could admit that its work statement was simply a tissue of lies meant to beat the Mansfield Amendment, in which case both universities would have admitted official lying to the United States government, or you could persist in the notion that this was indeed a bona fide effort to win the Vietnam War by doing basic research, in which case the students would have burned down both universities. Our committee was given the hot potato of figuring out some story that the

* John M. Dingell (D-MI), Chairman, House Energy and Commerce Committee.

authorities might tell that would avoid both extremes of either going to jail for lying to the government or being burned down by the students. I don't remember how it all came out, but it was a terrible period to deal with that.

Mansfield's aim was to pull these things together by saying, "Let's spend defense money only on things that are defense-related." But that's neglecting the notion that what ONR had done superbly well at the end of World War II was to take a small fraction of the Navy budget and do hands-off stuff up here to prove out concepts and so on, with the understanding that failure was going to be at a fairly high rate.

Incidentally, something that is sort of ironic, because of the national information infrastructure in all of this Clinton Administration stuff, is that one of the last pre-Mansfield Amendment things that sort of came up was the ARPANET: this network that was created and that has become the Internet and so forth, a road littered with failures, but it was originally sort of mad money to try out a new thing. It happens to be one of those that 25 years later has borne fruit. Today's politicians are milking it without a full understanding that a long-term investment went into that, which had something of this characteristic. It also had some elements of the boon-doggle when you come right down to it. These things tend to be mixed bags by virtue of the fact that you hardly ever find the pure form of the perfect application with a stable technology, or the pure research that is totally out of synch with the real world.

Quinn: Yes, Mansfield's intentions, as I said, were good, and he certainly is an honorable man. He didn't intend to do what resulted, nor did the people who were trying to help him. The idea was that if the research was not military kinds of research, they felt it should be funded by the National Science Foundation, which would be great if that were possible, but the National Science Foundation budget is minuscule. So there were arguments that the military budget should not be devoted or diverted to supporting R&D, which is properly done in the civil side of the house and should be supported by NSF and so on and so forth. Had they increased the NSF budget by a factor of 10 at the same time that they put the amendment into effect, it might have been okay. For instance, if they had said, "Take all the people in ONR and transfer them to NSF or create another network"—ARPA was created before that—"and put them on in DARPA," I would have no problem with that.

When I was at ONR we spent a lot of R&D money at universities and university laboratories and so on, and the products in many cases were graduate students. I thought that cranking out Ph.D.s was just as valid a thing to do as anything in terms of later contributing to military research and so on. But there certainly was a measurable product you were getting, although it might not have been a better firing gun or tank or airplane engine or something like that. But what that amendment does is require you, at that basic research level, to say what that end product is: that it is in fact a more efficient engine, a wider bandwidth communication system, or something of that nature, and people didn't hesitate to write that down and say that's what it would be. They were well intentioned too, in saying that, "Well, that gets me the money, so it's okay." But I'm getting off this track by quite a lot. I'd just like to deal with the acquisition flow.

The Defense Acquisition Board is the group that I described that meets at those milestone levels and determines whether or not the system is prepared to proceed to the next step. It is responsible for this oversight of major systems, which I'll define in a minute. Certainly not all the systems and so on that were developed in the department are major systems. They are few in number. For example, the most recent three-year history of how many DABs there were shows 19 in 1992 and 16 in 1993.

This is how a major program is defined. The procurement cost at the far end is $1 billion in 1980 dollars, or $1.8 billion in 1990 dollars, or the development cost is more than $200 million, or it's a highly sensitive program that needs this kind of close oversight, or it can be a special interest designated by the Under Secretary of Defense for Acquisition. At the moment,

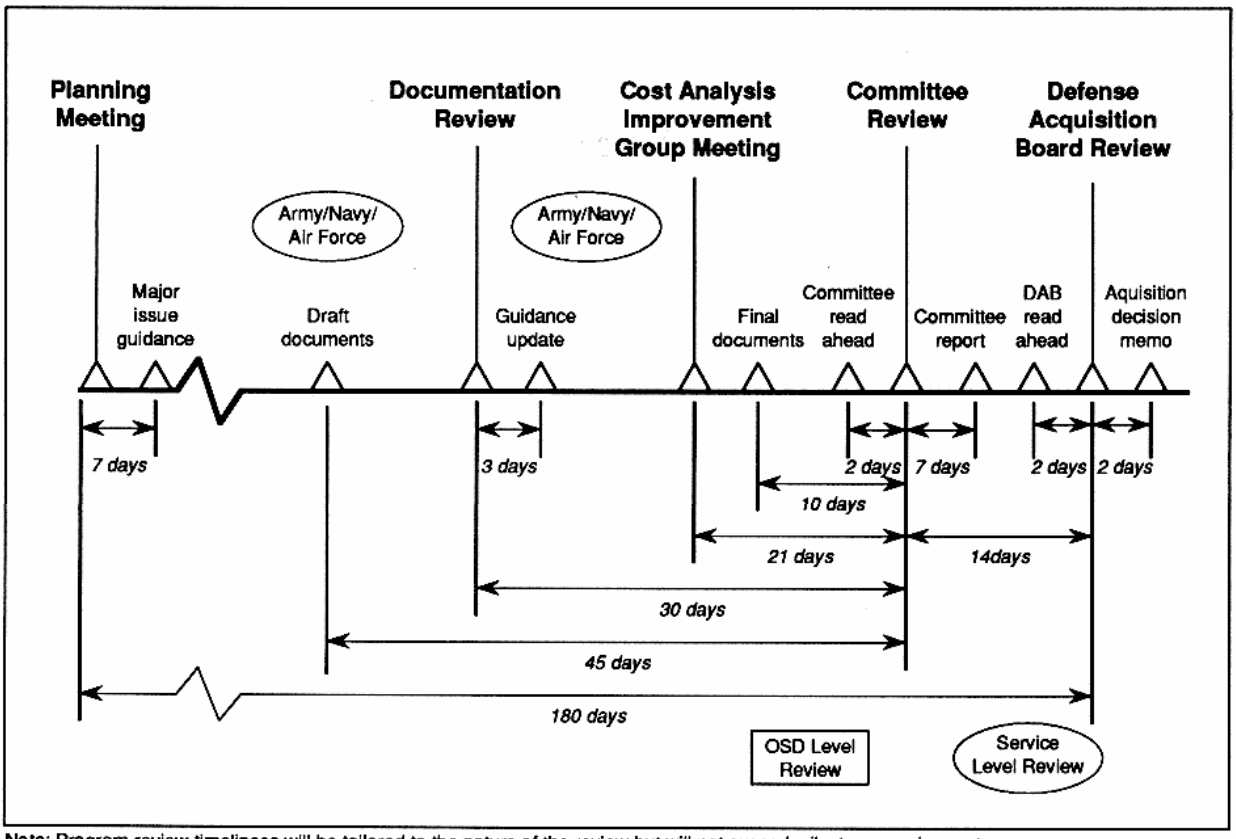
there are 109 of these programs in existence.

Now the oversight process that I described has two ways in which it can proceed. One is that it is maintained at the Secretary of Defense level and the DAB itself meets and John Deutch chairs it and makes these decisions. Or, if it is felt that the program is being well managed, is mature, and so on, it can be delegated to the service that is doing it, and the service will conduct these reviews at the service acquisition executive level. The service acquisition executive from each service reports to John Deutch, and they will make these decisions. Those that are delegated to the components are called "delegated programs."

The DAB is chaired by the Under Secretary of Defense for Acquisition. John Deutch has a principal deputy, who is Noel Longuemare at the moment, and Deutch chose to delegate this responsibility to Noel Longuemare, so Noel is now the chairman of the Defense Acquisition Board. The vice chairman is the Vice Chairman of the Joint Chiefs of Staff, and he is the same person I mentioned earlier who validates the MENS and chairs the JROC, the board that meets and certifies the requirement. So you have both the development acquisition community and the operational community represented on this board to ensure that this thing is meeting all of the requirements of their individual responsibilities. The invitees are the other folks on the Secretary's staff who have different responsibilities. The ASD C^3I is not a member, but he is invited to any programs that are ASD C^3I programs.

It's a very structured process, and for programs that are major and involve millions of dollars and years of development, you need some kind of a structured process. This is the way it works when a review is going to be conducted (figure 6). You have a DAB scheduled, and you say there is going to be a defense acquisition review of a given project. It could be a satellite program, an F-15, C-17, or things that have been in the news lately. Now you back up from that date six months, and there needs to be a planning meeting. The planning meeting decides what is it you are going to ask this DAB to do, because you don't bring this group of elephants together just to have a meeting. There has to be some issue with the program. Either it is ready to move from engineering and manufacturing development into production, or it is ready to move from one of the previous steps into that, or something has gone wrong and you need to readjust the baseline of the schedule or something, and this board has to agree to that. So you decide the purpose of the DAB meeting at this planning meeting, and then you also decide what documentation will be delivered so that that decision can be made.

There are documents that describe everything about the program. I already mentioned the MENS and the JROC process. There is a thing called the operations requirements document that the service generates that specifies what the requirements are that this system is going to meet. Then there is a test and evaluation master plan (TEMP). There is a baseline document, which is basically the contract between the requirements document and the developer, the program manager. The baseline says, "These are the things we are going to deliver or the specifications of the system that will satisfy these military requirements." For instance, if it is a satellite system it may be coverage that's described, worldwide coverage or coverage of certain areas, if it is a surveillance system; if it is an infrared system, it might be the intensity of the infrared signature that it is going to see, the spectrum, these kinds of things; reaction time, how long does it take to get the data—these things are all specified in the baseline. If, at some point, it looks as though you can't make one of these (and that's considered a breach), then you would have to come back and get DAB approval to proceed. So, at any rate, as you're moving along here, there are different meetings to look at the documents, make sure that the program is in fact ready to proceed. Then there is a committee review two weeks before the DAB, and that involves the three committees that I mentioned: there's one for Strategic Systems, Conventional Systems, and one that I chair for C^3I. That committee looks at what's been developed, and what the issues are.



Note: Program review timeliness will be tailored to the nature of the review but will not exceed milestone requirements.

Figure 6

DAB Milestone Timeline (Milestones I-IV)

Incidentally, this is an issue-oriented decision process. It's not just a routine process. We try to make sure that when the DAB is being asked to look at some issue, we give it some options, and they can make a decision. Usually at this point, there will be 10 issues. The issues may involve such things as funding, testing, or something, and what we try to do in this period is get those issues resolved with the individual offices and organizations that are responsible before we ever get to the DAB. So if it's a testing issue, we try to work it out. What is the issue? What can we change? What can we adjust, and so on, as we move toward having this DAB? So when we get to this DAB, hopefully we've gotten all the official documents that have to be presented.

As a matter of fact, the final documents have to be delivered in 10 days, so that's about three weeks ahead of the DAB. If the documents are not delivered at this point, an agreement on what the document will contain will be negotiated here for that final delivery. Then we slip the DAB schedule day for day until the document is delivered. So one of the disciplines in the system is that you will have a test and evaluation master plan that people agree to, and you will have a set of specs for a baseline that people agree to, and if you don't, we're not going to have the DAB because we're not going to bring these folks together to argue about whether or not we have the information to make a decision.

Oettinger: It's a serious process then, because the documents reflect a lot of phoning and negotiating and real work.

Quinn: Absolutely. The documents all have to be concurred in by all of these members, and it may be that you've got

agreement by all these people except one. PA&E frequently takes issue that you have not examined enough alternatives. They say that there's an alternative to doing this, which is a different approach altogether. It may be a UHF satellite versus an SHF satellite, and if you say, "We're trying to get antijamming by having an SHF satellite," PA&E would say, "Jamming is no longer a threat because we think that the Cold War is over and so you don't need that. You really haven't examined this well enough, and done all these alternatives," and they can hold you up. Then the onus is on you to demonstrate that you have examined alternatives and that sort of thing, and until you've done that, you haven't agreed on a baseline. So a lot of horse trading and negotiations take place at the action officer level. I have a colonel who looks after this for me and he chairs all these meetings.

Oettinger: But what I'm hearing you say, if I'm correct, is that this is real stuff, not Mickey Mouse.

Quinn: Oh, absolutely. There's a lot of money involved here. The reason the service wants this DAB, for example, is that they've got a contract that they intend to sign 10 days after this DAB. It happens, not infrequently, that the contractor who is doing this development expects to go into production. So the service says, "We're going to have a DAB on March 5, so we can have a production contract. It's all negotiated and ready to go and we're going to sign that on the 10th." So they've got this contractor salivating to get into production and it's all being worked out, and in here somewhere people say, "We don't agree with this TEMP," or "We don't agree with the OT&E. The results are not adequate and so we can't agree." So we start slipping this DAB.

Then the Navy or the Army or the Air Force starts pulling its hair out and saying, "Wait, a production contract is coming to an end; I've got an agreement. The proposal that the guy submitted has a 30-day deadline. It's no longer valid. The cost is going to double because he's now going to have us where he wants us, and the proposal he gave us is a really good deal and then he's not going to stand behind it." And the answer is, "I'm sorry, but, you know, if you can't define what it is you're going to buy, we aren't going to agree to buy it." These things do slip and you get into very serious debates. So, you're not going to do something here without a great deal of deliberation and seriousness. This is a conscious decision to slip this, fully recognizing that there could be a whole lot of money and a whole lot of interest and consequences of doing this. But now remember, we're talking here about billion-dollar programs, not small stuff.

In fact, we will go through all this negotiation—and this happened not too long ago—and we get right to this point. Now, before the DAB, what happens is we have a committee review and the committee decides that, yes, it is ready to go to a DAB, so we should proceed, or the committee can say it's not ready, and go back. The committee says we're going to proceed, and there are some glitches—some issues that need to be decided—and so that's what the DAB should deal with.

Now there have been cases where it gets to be very easy. You've got all the issues decided, and you reach this point and you say, "I don't even need to convene this DAB. We'll do a paper DAB." So you write a thing called an ADM, an acquisition decision memorandum, and you send it around to these officers, and you get people to chop on it. They sign it, and that's the end of it, and they never even meet. In other cases, where there really has to be a debate, some dialogue, then you do have to bring the DAB into session.

After the committee meets, the committee writes a report to the DAB chairman. Then two days before the DAB meeting I brief John Deutch and the OSD staff, or Frank Kendall does, or George Schneiter does, on what is going to happen at the DAB. All these other people are allowed to come or send reps, and we give them a preview of what's going to happen. The chairman may look at this and say, "No way! I'm not going to agree that we can move ahead without having these issues decided."

In the case I'm talking about, we had agreements on measures of effectiveness

that would be used for testing this system before it went into production, and the Navy and the OT&E people couldn't agree on these measures of effectiveness, and they wanted two months to do this. They convinced all of us that it was under control and it would take until April because there was another system, in this case it was JTIDS, that was in OT&E right at the time, and the OT&E results weren't in yet, but it was going well. But if they had the OT&E results, they then would have a better handle on how to write these measures of effectiveness. So they asked us to give them until April, but they said that in the meantime, everything else is in order, and they need to proceed because this is a contract that has international implications and all this, and they can go ahead. So the committee said okay.

But when it got to Deutch, he said, "I'm not going to move ahead with that. I want things lined up, signed, sealed, and delivered. I'm not taking any IOUs. If you can't do the measures of effectiveness by the end of two weeks, we're going to postpone the DAB for two weeks. Go away and work them. If you can't work them, I'm not going to do it." So he held it up for a month, and finally we got agreement that they had them written in gross terms and we got past it. In some cases there's a good debate that takes place at the end game.

Now I'm going to shift gears. What I've been talking about are communications and information systems of the type that are in the command and control business, going all the way back to that block diagram I showed you (figure 1), or that are directly involved in weapons systems. Communications and information systems are treated just like weapons systems when they fit that description. There is a whole other set of systems called automated information systems, which are PCs, any kind of computers, information handling systems, and so on, whose acquisition, across the whole government, is governed by a thing called the Brooks Bill. Back in the early 1960s, when there were just a few computer companies in existence, and they controlled most of the computer market, Jack Brooks (D-TX) was very concerned that there wasn't enough competition, and that these companies might get control of this enormously growing industry and have the government boxed in so that you have to buy from them. He demanded that more competition be put into these acquisitions, so a thing called the Brooks Bill was written and put into effect. What it did, essentially, was put the General Services Administration, GSA, in charge of buying general kinds of information systems for the whole government. He said, "Only one agency will buy information systems, no matter what department you're in—Defense, Commerce, Interior, Agriculture, or whatever—and you get it from them. They will buy everything competitively, and that's the way it will be."

Well, that's clearly impossible in terms of establishing an agency that could do that given the size and scope. So what happened was that much of the authority was delegated. GSA said, "You tell us how you're going to do the acquisition. We'll set up a whole bunch of rules, and you respond to these rules, and we will delegate the authority to you to do that acquisition." So, in the case of the Defense Department, if we want to buy PCs or small computers, or even big computers, anything that has to do with processing information, we go to GSA with a request for a delegation of authority. It has a format to it, and it has to have much of what we talked about earlier. It has to have requirements in it. It has to have an economic analysis that says we've examined all of the options—which one of these things we want to buy, this one makes the most sense, and so we're going to buy it and it's going to cost $20 million, and we're going to do a competitive acquisition, and this is how we're going to do it, and so on and so forth. Then they come back and say, "Okay, you're authorized to do that and now you can go out and do this acquisition."

In DOD, this is governed by a thing called the 8000 series. There is a 5000 series of documents that govern the DAB. They are the directives that tell you how to go about doing DAB acquisitions. There is a companion set called 8000 that tells you how to buy automated information systems and do the life-cycle management for that whole process.

This is done in DOD through a thing called the MAISRC, which is the Major Automated Information Systems Review Council. It's very much like the DAB, except the chairman is normally the Assistant Secretary for Defense for C^3I, and he is the acquisition authority for these kinds of systems. He has delegated that to me in much the same way as Deutch has delegated the DAB to Noel Longuemare. In 1993 we had 16 MAISRCs, and this year we've had one.

What I meant by major automated information systems is that if it has a life-cycle cost of $300 million for the total program, or total program costs over $100 million, or total single-year costs over $25 million, it's a major system. Currently there are 52 of these. Again, this authority can be delegated to the component if everything is in order, and we've delegated 14 of those.

Oettinger: What kinds of contortions do you have to go through to keep them from breaking everything down in chunks of less than $300 million? I mean, I would have a strong incentive to make everything $299 million.

Quinn: People don't even try it because they know it's not going to fly. As soon as it hits my office it's too transparent. So we don't usually have that problem.

I might say that there are two kinds of things in an automated information system. There are systems that do in fact directly contribute to a weapons system or are used for a weapon system, even though they may be apart from it. So back in the 1970s, Senator John Warner (R-VA) introduced an amendment, which was called the Warner Amendment, that relieves the Defense Department of going through this process if the system is in fact used for a military mission; if it's associated in some way with a weapons system. So if you can show that the system is not a general-purpose system, then it is called a Warner Amendment system and you don't have to go through this process.

Now, with 100 percent predictability, you can figure out what happened right after this. Most of the systems in the Department of Defense became Warner Amendment systems. Even if they were keeping track of bowling scores and laundry, they would be written up just like the Warner Amendment. People wrote up ways to make them look like military systems, and what happened then is we had a couple of years of debate with Brooks' staff. Brooks, of course, didn't like this Warner Amendment at all. He still would like to get the Warner Amendment repealed, and, of course, there are a whole lot of folks who would like to get the Brooks Bill repealed.

Congressman Brooks has never really accepted that there is a Warner Amendment. So it really does have to be justified, and when it got abused, he created a huge staff to review these things and put a lot of pressure on GSA to make sure that any Warner Amendment system truly was a Warner Amendment. So there are a number of things that are Warner Amendment, but it's not abused anymore and the justifications are quite thorough.

The MAISRC, as I said, is a similar kind of organization to the DAB. One difference is that we have a reserve affairs component because there are large systems involved in the reserves, like a thing called RCAS, a reserve component automation system, that looks after the records, and so on, of reserves, particularly in the Army, when they're called up from inactive duty to active duty. The reserves have a lot of automated information systems that are in need of attention, and so they're a member of this board.

When I got involved in this, there wasn't any real process before a MAISRC. A MAISRC would be called, and then you would have the MAISRC. I discovered that they weren't really issue-oriented meetings. There were all kinds of things that were taken up. So we arbitrarily put a process in place that obviously parallels what the DAB had done in a little more loose way. It's not precisely 90 days, but we do have a planning meeting and try to make the MAISRC an issue-oriented meeting, and this seems to work okay. But it doesn't have the rigidity that the DAB system has.

Now, there clearly are two systems involved here in buying information kinds of devices, and that doesn't make a whole lot of sense to a lot of people. They say, "We

really don't need two systems." So, about a year ago, we started off to try and see if we could simplify the whole system as part of the whole business of re-engineering acquisition and trying to improve it. What we intended to do was merge the MAISRC and the DAB, and eventually have one system, which would seem to make a lot of sense, except that there still is the Brooks Bill, and there are still a lot of staff people on the Hill who don't share that view. So when they heard about this, they got upset that we were attempting to remove the MAISRC's authority and a lot of people liked the systems just the way they are.

There was a young staffer named Dave Roberts on the House Appropriations Committee, who suggested he was going to write language into the bill to give us a lot of help on how not to merge these systems. I thought I made a deal with him that he would let us see the language before he wrote it and maybe we could come to some meeting of the minds. But he first wrote the bill and then showed it to us and said that there wasn't a lot anybody could do about it at that point. So, written into the 1994 appropriations bill, there was language that says, "Thou shalt not tamper with MAISRCs." It says that there will be a separate system of oversight and management for automated information systems and it will be chaired by the ASD C^3I and then will report separately to the Secretary of Defense and all 9 or 10 yards on how to do this. So we were prevented from actually merging them, but we are still going to take the two processes and make them at least align in the way that the people have to deal with them, so that a program manager doesn't really have to think too much about whether he is dealing with a DAB, or a MAISRC, or whatever. The same kind of documentation would apply, but it would be tailored.

So the way I see it, it's kind of an upside-down pyramid. You've got the DAB at the top, which has all of this formality about it and all the rigid requirements for documentation and so on, and then as you come down halfway, you come to the MAISRC and it's much less rigid. Then we have something like 500 programs in addition to all of these that don't fall under either one, but yet we're responsible for them. So you need some system that has a continuity, I think, in how you review it, and you tailor the amount of material you need to review the program. The way I'm trying to make this happen is that in the services, the way they're organized, they have a service acquisition executive, and under him they have a guy called a PEO, who is the principal executive officer for acquisition systems. The program managers then work for PEOs. So, the Army may have, say, 10 PEOs (I don't know how many they have), and the Air Force may have 8 or 10, and then all their programs are under these PEOs.

It seems to me that the services must have some way of reviewing these programs, so the PEO looks after them once every six months or something, and therefore he must have documentation requirements. There's no reason why we can't get together with the PEOs and say, "Whatever you use is good enough for us." So we review this together and put the least amount of burden on the program managers, and try to make the documentation such that it is useful to the program manager and the PEO in the service also.

What's happening now is that you have a management process that is getting the development and acquisition done, and there are documentation requirements, reporting requirements, and all that within the services. Then you have the MAISRC over here just to look at that side of the house. When it comes time to do a MAISRC review, the program manager must generate a whole bunch of new documentation separate and apart from what is being used to satisfy his own management review. That's ridiculous. Then, when the MAISRC is over, they throw it away and go back to what they're doing until the next MAISRC. It seems to me that we should encourage them, and we need somehow to adapt to each other's needs and have them generate documentation such as a TEMP and a baseline and so on that they would find useful, so that the management of the program from then on could be according to a documented plan that we agree to.

We just did one of those on a thing called the Strategic War Planning System, which the Strategic Command is acquiring

out in Omaha. They are developing automated systems to do targeting and that sort of thing. What we did was tailor the documentation for the MAISRC, which would allow them to use the economic analysis that they used to prove to themselves that this was the right approach. There were some hard negotiations on how well it was done until we finally had it. But when it was over even the CINC himself (he's now the CINC, he was the Deputy CINC then) came to the MAISRC because he was worried about how this thing was going to go and how much guidance and help he was going to get in managing this system. But afterwards he was happy, and he and I talked about it and he was glad that we did it that way, because now he has something he can hold them to, and at the next MAISRC we're not going to force them to produce any new documentation.

So there is streamlining that can be done, whether you merge the two or not. Incidentally, that staffer got fired about a month after he wrote that bill, not because of his language, because of something else, but the shame is that he wasn't fired early enough—before he wrote this language. Apparently he wrote some other language that someone with far more power than we have didn't like and he's no longer there.

I think that once we get rid of that kind of "help," you can merge these systems and get a far better consistency among the way the different reviews operate. So that's what we are trying to do: reengineer this process, and review what the procedures are. As I have said, there are certain things that we can relax, and we can streamline, and that's the procedures, but there are laws that you can't change and you've got to comply with the law and that's the minimum we've got to insist on people doing.

Oettinger: Is this a convenient break point? We are getting at end of our time.

Quinn: I guess there was one last thing I was going to talk about in a formal way. There is another process called the DAES (Defense Acquisition Executive Summary), in which all the programs in Defense are reviewed once a quarter for the Under Secretary of Defense for Acquisition. This is also done by Noel Longuemare. We cycle through these programs to give him a heads-up. Is there something about this program that's going to bite me in the rear end in the next month? Is there congressional interest? Is there some disaster pending around the corner? You look at all the programs in this process over the period of a year, so that in the total year, you've cycled, in principle, through all the programs. It's informal. It's not a decision-making body, but it does give him a chance to see how every program is going and what its health and status are.

Oettinger: This is our normal ending time and I want to make sure that I release folks who have to go, and also make sure we don't let you miss your airplane. We also want to take a moment to thank you and give you a small token of our appreciation.

Quinn: Thank you. Well, the time seemed to go by quickly.

Oettinger: Yes, amazing. We wish you well in your next career, sir.

Quinn: Thank you very much.

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