INCIDENTAL PAPER

Seminar on Command, Control, Communications, and Intelligence

Planning for Defense-Wide Command and Control
Hillman Dickinson

Guest Presentations, Spring 1982
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December 1982

Program on Information Resources Policy

Center for Information Policy Research

Harvard University

The Program on Information Resources Policy is jointly sponsored by Harvard University and the Center for Information Policy Research.

E-mail: pirp@deas.harvard.edu URL: http://www.pirp.harvard.edu
I-82-3

Planning For Defense-Wide Command and Control

Lt. General Hillman Dickinson
Director for Command, Control and Communications Systems, Joint Chiefs of Staff

The office General Dickinson occupies is not one with a long history or tradition. He is the first occupant: he created it, in response to perceptions like those we have seen in our studies. Command, control and so forth are meant to have an integrated function — in theory. In practice it wasn't necessarily happening that way. The Office of the Joint Chiefs, one of whose missions is to tap the old military establishment, set up a directorate to bring some harmony into such matters. We invited General Dickinson to reflect on that experience, as well as any other aspects of his career that help shed light on problems and opportunities in command and control. He has seen service as a commander in Vietnam, but the backbone of his career has been technology: nuclear test detection sensors, combat support systems, target acquisition intelligence, electronic warfare, and his springboard to his present post: the first command of the Army's C³ Research, Development and Acquisition command.

Dickinson. It's a real honor to be able to meet with you — very stimulating for me, and I hope it will be of some interest to you. I head the Command, Control and Communication Systems Directorate. It has responsibilities for interface with the intelligence systems, so I go over a bit into intelligence; but it is not a full C³I responsibility.

By far the most important word in that title is the word "systems." If you're familiar with our bureaucracy (and whether in defense or elsewhere I think it's the same), very few organizations in fact have systems responsibility; and it shows. In the Defense Department we're fairly well organized to develop a tank, a gun, or an airplane; but there are very few spots where you find anybody who's really responsible for overall systems.

But C³I is one problem that has to be worked that way. I guess the best recognition of that in the bureaucracy was the creation of C³I in the Office of the Secretary of Defense (OSD). That was formerly an assistant secretaryship, held by Gerry Dinneen. It is now a deputy undersecretaryship, held by Don Latham, but not really downgraded, in my opinion, because both the superior levels — Dr. Wade and Dr. DeLauer — are in defense research and engineering and are spending a great deal of their time on C²; while in the previous administration that really wasn't true, and the assistant secretary was about the only person who spent any appreciable time on it.

Well, C³I came into being in OSD with the start of the Carter administration, and has continued through in this administration. About three years ago this June we in the JCS separated over a hundred spaces out of the J3 and added fifty or sixty more spaces to it and created the directorate that I have. My own background is: I'm not a communicator, and I am not an ADP-er (automatic data processor). My prejudices may show occasionally if I'm not properly enthusiastic about those two areas. At least I'm not overboard on it, as sometimes people accuse C³I of being ADP mafia and so on. That is not the approach we take, and my background is about half physics R&D and half line — in

command of armored units in the Army.

I have two deputies. One handles basically the intercontinental nuclear command and control problem and he is neither an ADP-er nor a communicator. In fact, I guess he's the Air Force's fastest bachelor or something of the kind, having been one of the early U-2 pilots and then one of the first SR-71 group, and later an inspector general and an assistant deputy of operations in the Strategic Air Command. So his background is not very technical in detail either, but he has a real overall command and control viewpoint. And my deputy on the other side of the house, which is the theater and tactical world, is Rear Admiral Rich Fontaine, who has also been in line command of cruiser and destroyer groups, and various branches of the surface Navy. He does have a communications background, but only a relatively small amount of time in the job — he has been a fleet communicator and he has also had some development experience.

With that as a preface, at least you know who you're talking to. I can rapidly get out of my depth on some of the details, but sometimes I find that helpful, because at least I stop people in the middle of the jargon and ask them what they're talking about. I recommend that to you, as a matter of fact, because there are few people who communicate less well than the communicators. (They're occasionally exceeded by the ADP-ers.)

Oettinger. Could I comment on your point about not being part of the ADP or communications mafia? There have been uncharitable comments about the organization you head up — that it was created to give the appearance of coordination while in fact sitting on the lid, on the enthusiasts, and keeping them out of mischief. Is that something you care to comment on, or would you dismiss it as just beneath contempt?

Dickinson. I guess the latter. No, I really don't think that's just. We really are there to work the systems problems. Maybe I ought to give you the bottom line, the conclusion. We expected to find problems; the directorate was created because people thought there were problems in this area. But I must say that on both sides of the house — both the strategic system and the theater and tactical system — survivability in a realistic wartime scenario is the key problem.

We work on about eight or nine main objectives in the directorate. By far the most important is improving the survivability of both sides — the system for intercontinental nuclear use and control, and the system for theater and tactical wartime use. To make them useful wartime systems first, and then to supplement them, if necessary, for peacetime. A second objective is to make them interoperable with our allies and interoperable among our three principal services, because if we have to fight we will certainly fight with all three services involved, and the United States won't be involved in any major fighting without allies. So the systems must work together.

In trying to put all that together, there are a lot of factors that affect our planning efforts (figure 1), and they are relatively well organized and recognized. The threat, the force structure, the technological forecasts, are probably more predictable than the others. And C^3I planning, because it cuts across a lot of functions in the government, is really viewed from very different perspectives depending upon who's viewing it. It may be a program from the manager's viewpoint, while the commander sees it as operations. From the viewpoint of the technologist it's a collection of systems, including command centers, communication, ADP, sensors, and the people and procedures that support the requirements. As many people as there are involved in C^3I, there aren't many responsible for insuring that all those interests and needs and capabilities are brought together in some kind of coherent fashion, and are balanced in terms of needs, priorities, and resources. That is one of the responsibilities of my organization.

I want to talk a bit about our role in developing the policies, plans and programs for C^3I support for the national command authorities and the unified and specified commands. I'm delighted that you've got Dick Stilwell on the program later. He has other responsibilities, particularly in the broader aspects of policy; he's been a tremendous support to me. Out of the groups in OSD that we work with most closely there are two in particular — Don Latham's group on the research and engineering side and Dick Stilwell's on the policy side. Both have been extremely supportive. Both are voters in the final Defense Resources Board meetings that I will mention later, which are terribly important in getting our priorities accepted and funded — in addition to the chairman of the JCS, who votes in that arena. Their cooperation has been extremely good. Procedures and so on are terribly important in what you need in a program (figure 2), and the operational requirements should be driving the programs to the degree that they can be properly defined. Occasionally technology pulls, but to the degree possible, the C^3 business really should be primarily driven by the requirements.

We try to evaluate the needs, translate the needs into programs, and follow them through all the oddities of

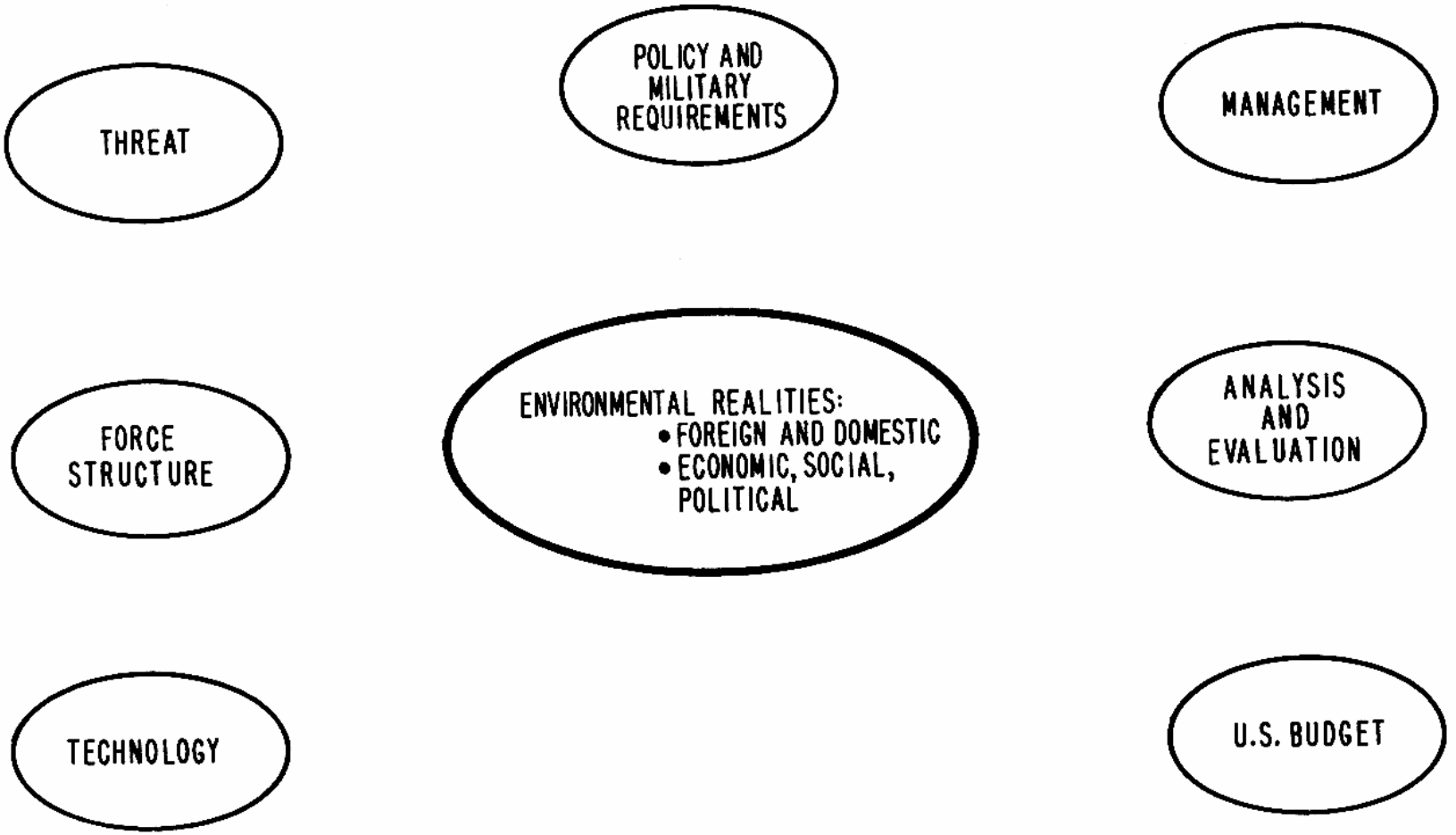

Figure 1. Factors Affecting Planning

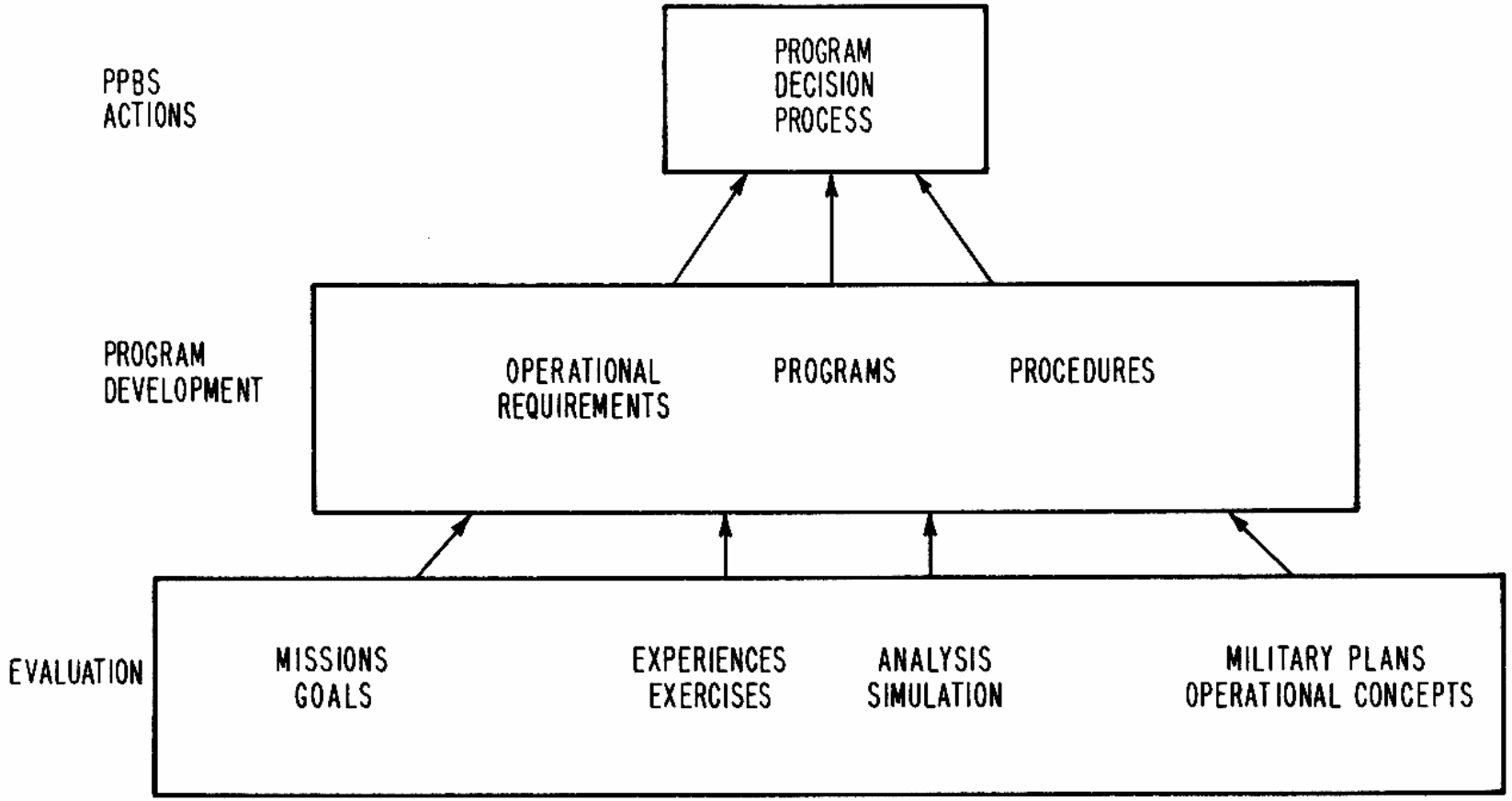

Figure 2. Role in Planning for Command, Control and Communications Systems

the decision process — which I guess I'd best describe as a series of poker games. Because very few decisions are ever made all at once in Washington. If you get a decision made it simply gives you the right to ante one more time in the poker game. That continues clear on through the process until the budget is final, and even then it's subject to additional reprogrammings, and things can fall out from under it later in the year even after you've had it approved by Congress. Certainly there are many, many fingers in the pie, and, as I say, very few have any overall system responsibility or authority. You don't find any of that in OMB, it's not handled that way; you certainly don't find it in congressional committees, and you don't find it, for the most part, in any of the service programs. So the little triumvirate that I mentioned — General Stilwell's policy office, the research and engineering office, and our directorate — try to put the system viewpoint into the entire problem.

Oettinger. Could you dwell on that a bit more? In our past presentations (and, you know, you alluded to it yourself), the question of who's responsible for the overall thing is kind of a critical one. Recently the papers quoted the chairman of the Joint Chiefs of Staff himself as pointing out some difficulties on that score. The JCS as now constituted — yes, it's better than nothing, but is it enough? Or is that something you want to comment on later, or not at all?

Dickinson. If I had my choice I would have implemented the recommendations of the Defense Science Board, which would have created a separate C^3 agency, with funding and authority in development. I think we're a reasonable second-best to that and, as a practical matter, may even have been the best answer. I'm not sure whether the world was ready to accept a separate agency, or whether it would have been bucked and fought and objected to so much that it would have foundered on lack of cooperation. But I think it could have been made to work. I think it would be better to have the funding authority and the tasking authority in the same organization. My authority ends, really, with recommending prioritization for funding to the final decision-making councils, the OSD council, the comptroller. We work P&A (Programs and Analysis) — that's one of the organizations at the top of the Defense Department that kibitzes on everyone else — we work policy, we try to get everybody who's voting in the final process conditioned ahead of time, and try to keep as low a profile, frankly, in that business as we can, as far as being viewed as the final decision-maker while still getting it done. That has worked amazingly well in the last two years. I don't know — as people recognize the role, we may provoke more opposition to it. But so far it's worked extremely well.

Student. What is PPBS?

Dickinson. The planning, programming and budgeting (system) process.

Oettinger. That's a McNamara legacy.

Dickinson. And P&A goes back to Alain Enthoven — one of the whiz kids who came with McNamara.

McLaughlin. This may be premature, but one of our speakers described how he saw your role: as the advocate of national command authority CINCs in the PPBS process —

Dickinson. I'll come to that a bit later.

So we help develop the programs that will fill the gaps between good survivable pieces of equipment and command posts, and the lack of survivability of the communications between, or vice-versa — a good survivable communication line in a non-survivable command post or command facility, or whatever the problem is. You see that there are often gaps in the system. It may be relatively simple and inexpensive to fill those gaps — that's the good news. The bad news is that there are a lot of gaps, and it's not always easy to get someone to respond to fill a gap at an early time.

We go as far as recommending changes in policies and laws. We have a relatively easy problem in changing a defense regulation, or changing — certainly — a JCS publication that governs the way a lot of people work, and sometimes can cause serious system problems in the field. If we can identify those problems in the field, then we can get the document, the procedures and the policy changed. In some cases we try to get the law changed. One of the greater successes I'll mention later is when we were able to get exemptions from the Brooks Bill, a very major accomplishment in which we had a major role, oddly enough, although it wouldn't have been guessed from our charter.

I am one of the directors of the joint staff (figure 3). The chairman is General David Jones and, of course, the JCS are composed, as a committee, of the four service chiefs of the Army, Navy, Air Force and Marine Corps, the highest-ranking members and chiefs of each

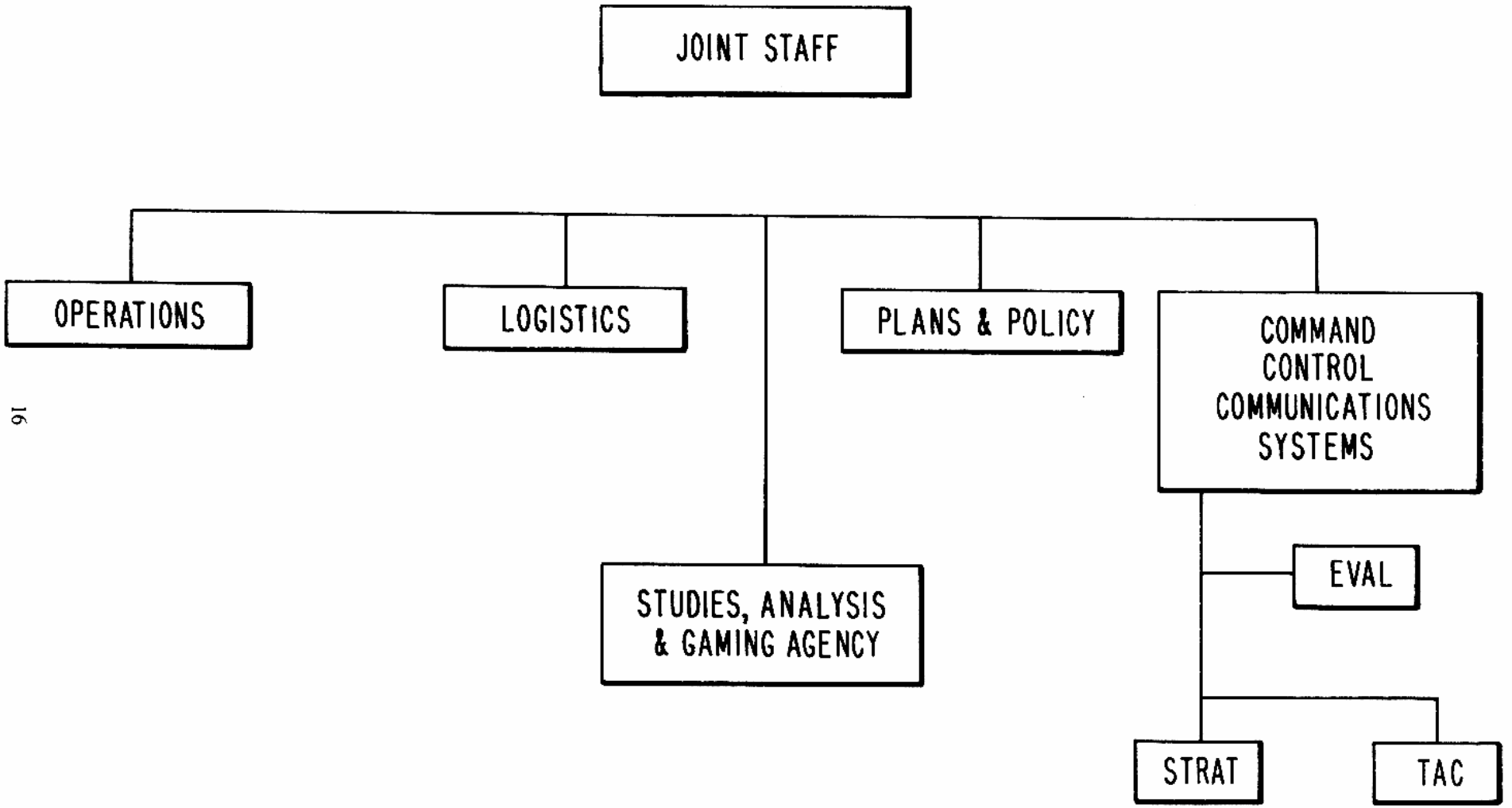

Figure 3. Joint Staff Organization

of their services. This group of directorates supports the joint staff, and we also support the chairman as an individual in some roles that can be separated from supporting the chiefs as a body. They are the principal military advisers to the secretary of defense, the National Security Council, the president and the Congress. And a presidential decision involving a military force flows from the White House down through the secretary and deputy secretary of defense, the only people in the OSD who are in the line of command, and then through the joint chiefs and on to the unified and specified commanders in the field. That's the organization that was created in the 1947 National Security Act, as modified in 1958.

From that stem a great many of the problems we have in C^3 systems, because C^3 system development was certainly not provided for in any very reasonable way in that act, in my opinion. I think eventually we will have to face that, or else we're going to begin to work around it more and more.

Oettinger. Is that a sentiment you had before you took this job? Or is it something that's emerged into your consciousness since you've been in this role?

Dickinson. Well, I certainly understood the problem before the same way I do now. I'm not sure I would have articulated the 1958 act as the root of it — but clearly the role of the services as the independent developers, essentially, of all the materiel is part of that problem. I'll come back to that in just a minute.

The joint staff then prepares the plans and orders which go out to be executed by the forces worldwide, and we give advice, alternatives and so on to the decision-makers as the execution phase of any operation goes on. In addition to being a staff, though, in that sense we are operators — we are the senior command post for the United States. And the National Military Command Post (figure 4), which we operate in joint staff, is the senior command post, just as the next-level command post is out with our commanders-in-chief in each of the theaters, or with the specified commanders in the case of SAC or NORAD.

Oettinger. Is this the same as the NMCC?

Dickinson. NMCC and its alternates, yes — the airborne alternate and the underground alternate. The National Military Command System is inside the dotted part of the figure.

Oettinger. I just wanted to make sure your choice of the word "post" as opposed to "center," did not mean that we were talking about some other entity.

Dickinson. No. I use "command center" or "command post" interchangeably. But our role is a little odd in that center, since we essentially are a user, while we are also a top-level staff getting requirements from the users in the field.

It's very rare that perturbations anywhere in this global society do not interest us in the Defense Department of the United States. There's no such thing as a normal or quiet day in any of those facilities, I can assure you. People do keep a very close watch on the world. And I think everyone understands why that's required. This command system has to be ready to meet the needs of the national command authorities, and the national command authorities are the president, the secretary of defense, and then in his absence the deputy secretary of defense has the same authority. And the joint C^3 systems are part of that business.

The J3, the director of operations, is operating today's system, and I'm trying to work on tomorrow's system. That's really the simplest way to describe our responsibilities, although I do have some responsibilities today in the communications area, along with him. And I think from our viewpoint the greatest challenge to us in the directorate has been to try to establish long-term emphasis on a systems approach to identifying the requirements, stating the priorities, and obtaining the programming and the budgeting support to develop the C^3 systems we think are needed, and to ensure they will be, in fact, survivable. And I emphasize that long-term approach. Every new fellow who comes on the block wants to put his fingerprint on the system, but that is simply impossible with systems that are this large and take this long to develop. Because the half-life of a decision-maker at the top of the Defense Department, or for that matter of an administration, is shorter than the development time of the system.

So there has been an agreement and a constancy, in my opinion, that will endure across administrations, and across individual decisions. We can't all bring our own pet ideas into the system. We have to resist the great desire to re-engineer the system all the time, even though it may not be perfect. This is the mission of the directorate.

Oettinger. We've heard a number of things in the last year or two — and I'm not sure if what you just said agrees with or contradicts them — with regard to the

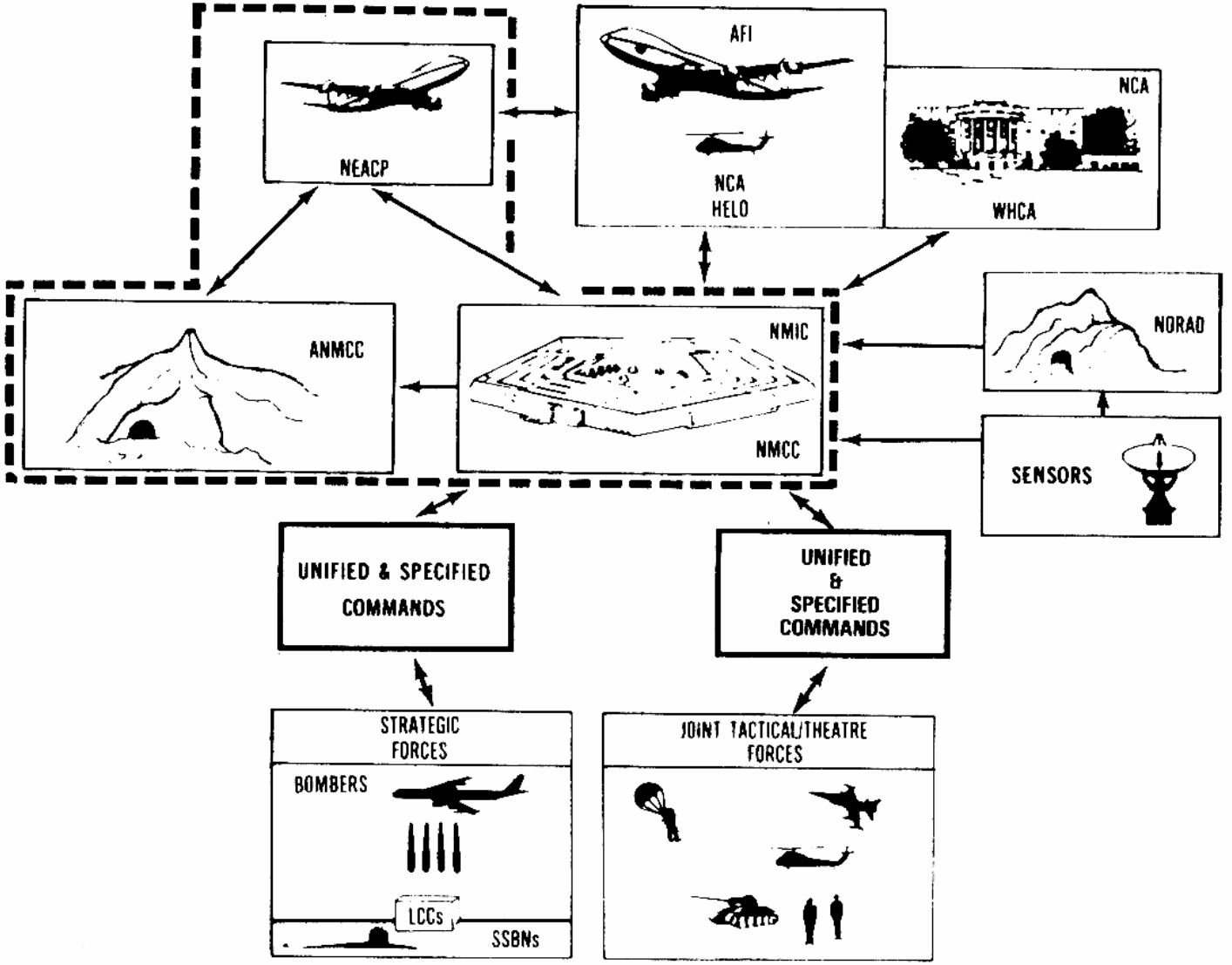

Figure 4. Joint Command, Control and Communications Systems

need. You have stated that the systems need to be responsive to requirements. Now since, in the military rotational scheme of things, commanders change and personalities change and the ways of doing things change, their individual requirements change, in a sense, but not necessarily the formal requirements. How do you reconcile the need to be responsive to requirements and to commanders, but also to preserve stability and not let things get out of whack each time an administration changes or a command changes? I mean, there's a built-in tension there.

Dickinson. Part of it is, you try to document and institutionalize that planning process, and particularly a good command and control system five-year plan. That is one of the accomplishments we have now gotten institutionalized. I think that's terribly important. Because then a burden of proof is required to change it. There are times when you clearly want to change it: if the enemy threat changes, if your mission changes markedly within a theater.

Generally those sorts of changes are not first-order changes. I suppose a good example of the biggest sort of push is as we begin to meet the threat from the fall of Iran and the new focus on the Middle East. That's about as traumatic a new area as you could find; you know, it has really created a new commander-in-chief, since the command of that rapid deployment task force will shortly be a commander-in-chief. He has been a new user on the block, for whom we have new requirements, and those are added to the plan.

But you don't see major fluctuations within the European theater, in the change from General Haig to General Rogers for example. That's a large enough operation, and requirements for working with NATO are pretty constant. Nor have I seen changes in the real requirements for improving command and control systems in Korea with the succession in command from General Vessey to General Wickham. They both saw the problem in about the same way. Change could happen, I suppose, on the basis of personality, but you ought to try to institutionalize it so that it is more difficult to change it for just personality reasons. Now, if the enemy threat changes, you have to change. You've got to react.

We are there to represent the interests of the highest two echelons of the command structure, particularly. One reason we were created was that it was apparent (you'll find it stated in the Defense Science Board report, and so on) that those top two echelons — the national command authority itself, the president's and JCS chairman's echelon, and the next echelon down, the unified commanders in Europe and the Pacific, and SAC and NORAD and so on, but particularly the unified commanders — the ones overseas, in Europe and the Pacific, for example — were under-represented and were disadvantaged users of the whole system. It's hard to understand how the president could become a disadvantaged user, but he really was. His presidential airborne command post was removed from the Air Force budget time after time because the programmers in the Air Force were more interested in fighter squads. We are now a counter-balancing force there, but even so, the requirements for the upper-level command and control systems of Europe, the Pacific, Korea, and so on have a very tough time in the budgeting and programming process within an individual service — those who are worrying about Army things, or Air Force things, and properly so because that's the way they were set up within the national security organization.

We are, then, the focal point for validating and prioritizing the requirements coming in. We presented them first to the services, telling them, "We believe these need to be funded by your service." Secondly, we fight them through the budget process; if the service has not funded it, it is our job to tell OSD, "We believe this is needed, you must tell the service to fund this." And finally, in the last of the voting processes where the chairman votes for himself in the Defense Resources Board final meetings and so on, we tell the chairman, "Yes, you should vote for this particular priority for funding these kinds of programs." And we try to make recommendations to the other voters in that process. So it would be neater if we had a little firmer handle on that, but as I say, we've probably been able to do more than we had any right to expect.

Figure 5 shows the command structure and the unified commands I've been talking about — read "President" for "NCA." These echelons basically did not have a clear voice in the programming and budgeting process until the C^3I organization was installed in the office of the Secretary of Defense and our directorate was created within the JCS. I'm talking about a lot of programming and budgeting where the joint staff has never been involved. I have a full programming and budgeting division within my directorate and I follow more than sixteen billion dollars worth of 1982 programs down to what's called the programmed element level of detail, which is a very specific thing, like an individual aircraft, satellite terminal or radio. In some cases I follow them further, down to the project level. So in my set of priorities that I personally pay attention

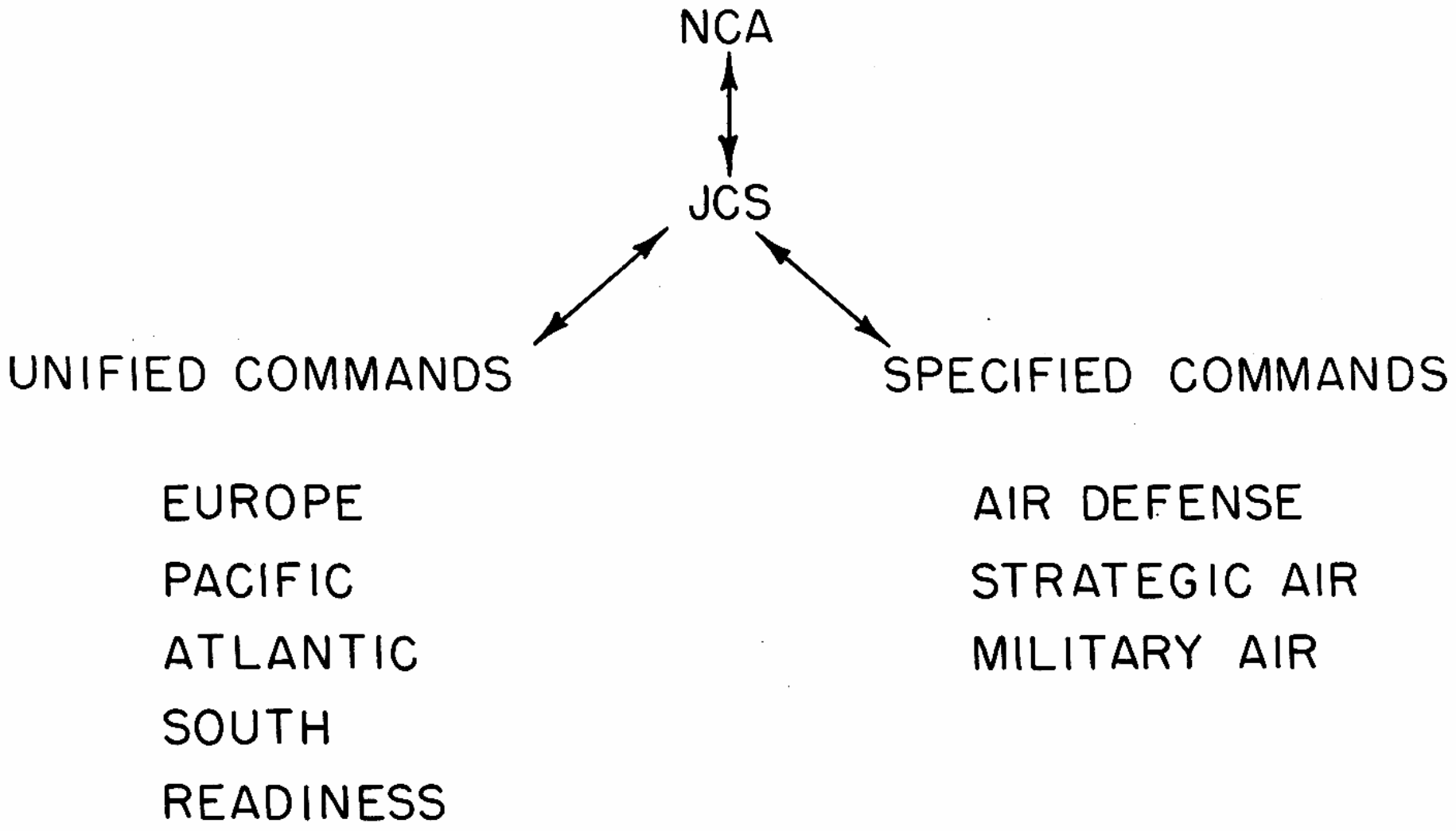

Figure 5. Command, Control and Communications Flow

to, we've got three or four hundred kinds of priorities that we think are important to get fixed — system problems. We try to be the middle man, the honest broker in this process.

We also have an innovation, a modest fund for each of these commanders to use as they see fit. It doesn't go through the service process at all; it's a separate fund. They come to me and say, "I would like to have a certain amount of money." The ground rules are: it must be less than $400,000 per project, it's got to be a one-time effort, and the services have 30 days to look at the request and say, "We object, because we aren't going to be able to train the manpower that's going to be required to man this particular thing, or whatever." If they have no objections, the CINC is allowed to proceed with fixing the small holes in his system where small amounts of money can do a great deal of good. And in a number of remarkable cases over the last few years that little bit of flexibility has meant a great deal.

Oettinger. How many of them have been subject to the 30-day objection rule?

Dickinson. Almost none. Not any this year, a couple the first year. So the process is working. In fact, it's worked well enough so that it's one of the models for a much larger fund this year, about a hundred million dollar fund to be used for improving CINCs' readiness, not with C^3I items, but in other matters.

Student. You said that for a commander-in-chief to do one of these fixes, the services would have 30 days to object.

Dickinson. Silence is consent. They don't have to coordinate, they have to make a positive objection or else the CINC's word carries.

Student. You said that you tracked sixteen billion dollars. You don't own that — that's service-funded money and you're just monitoring it?

Dickinson. It's service-funded, or defense agency money, or whatever — everything in the joint C^3I area that has cross-service C^3I implications.

Student. How often have you had to get in and have OSD direct the service system fund for C^3 stuff? Because last week we heard from General Ellis about the new improvements that the Reagan administration announced in October. His concern was that down the road, when that money is to be spent, the services will have diverted it, or it won't be available for the desired projects.

Dickinson. That's exactly what I'm watching. And that money wouldn't be there, I think, had we not recommended the priorities. That program is very much a reflection of the priorities that we recommended, and the words that are in the Reagan announcement are the words we recommended.

Student. So that's not fenced money, but you're monitoring it?

Dickinson. It's not fenced per se. I'll try to come back to that a little later. I want to go on to figure 6; it makes a point.

The most important message I have is that the command and control network has got to have a systems approach. There is a pretty good analogy to a living system. A living system has sensors — eyes, ears, nose — it has a nervous system which carries those sensings to a decision-making brain, and it has an operating system which carries out the decisions of the brain by means of the fists and the feet. We mean the same kind of organic interconnection when we talk about C^3I systems. There's no way to disassemble that, and have a living organism that can evolve successfully. Equally, there is no way that a living organism evolves into all fists and feet. And the message that I have from each of those unified, and to a lesser degree, specified CINCs is that my system is out of balance: I've got more fists and feet than I've got the rest of the system. An air component commander says, "I'm going to have more aircraft in here by the third day after the operations plan is executed than I can possibly have command and control and efficient targeting for. I've got to improve that area, it's the first order of business." Those are the messages I'm listening to. And as a result of those messages, I am prioritizing for funding the proper things to correct the situation.

I might say that in the living system an energy supply falls to each of those elements, too. And that is a very major concern, it turns out, in the C^3 systems, and I think has been grossly neglected. My rule-of-thumb, applied to both the intercontinental strategic system and the theater tactical system, is: fifty per cent of our problems come from bad power. And you really have to think "system" to get to work on that, because you have to work on the civil engineers of the Air Force, the civil engineers of the Army, and so on, and put in better

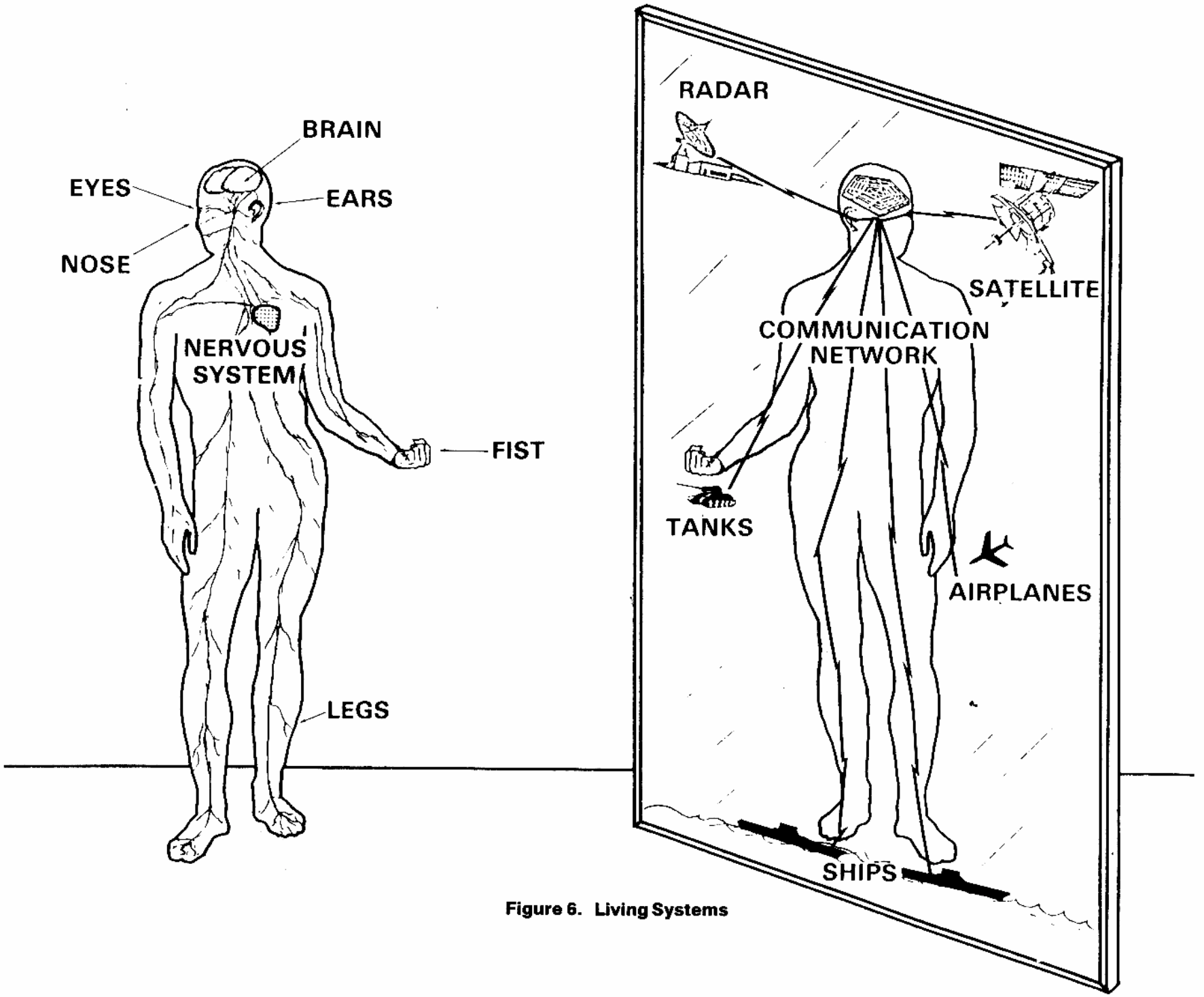

Figure 6. Living Systems

power systems. And the civil engineers are about the least knowledgeable about the more sophisticated survivability problems of power systems. Interestingly, that rule, as nearly as I can tell, goes clear on down to the portable generators that are notorious troublemakers for anybody in the field, in either the Air Force or the Army. We have programmed consistently to do something about that, and create a center of excellence that will understand how to engineer survivable power for critical facilities. Strangely enough the Defense Department had no set of regulations covering that — in contrast to the Nuclear Regulatory Commission, which has very strict regulations as to precisely what the power system of a nuclear power plant has to be.

Student. The other side of that coin: is there some assurance that besides worrying about designing more reliable power, a problem that never seems to get resolved in the Navy too, people are also looking at designing electronic systems that can survive with power that's going to fluctuate? Given that the power's going to fluctuate fifty percent of the time, how much effort goes into looking for a system that can absorb that kind of problem?

Dickinson. Not very much. Putting power conditioners into the Defense Communication System, for example — stations that have them, worldwide, are having a fraction of the damaged equipment and the failures experienced by those that have not yet installed power conditioning equipment. It's terribly important to do that in the installation; that's part of the whole-system approach. You have to decide how much you are going to put into the power system. You're going to make it plus or minus one percent voltage, plus or minus a tenth of a cycle fluctuations allowed in the power — and if you do that uniformly across the system, then designers know what kind of computer protection to put in, for example. You have to decide where that tradeoff is, that is part of the system design. It ought to be done on some reasonable basis, and there ought to be guidelines for that. There have been none.

When you really take a system approach, it isn't all the technical ADP aspect so much, it's often much more mundane. But the strict system viewpoint, I think, pays off tremendously, so — if I can leave you with no other lesson — that's the lesson for today: "think system." And make sure, when you design the system, that it's global enough to be really the system, and not just a subsystem. From that sort of philosophy come the goals we've established for the directorate over the last couple of years. As Tony said, we created the directorate, and nobody told us what to do; we had to decide what to work on and get on with it. Our list of goals looks like this:

- Improve survivability of C^3 systems
- Improve joint and combined interoperability
- Improve current C^3 systems effectiveness
- Provide effective wartime C^3 systems
- Provide effective crisis management
- Develop capability to degrade enemy C^3
- Improve management and operation of C^3 systems
- Realistically evaluate C^3 systems

Numbers one and two are by far my most important priorities: to improve the survivability of both the intercontinental nuclear command and control system and the theater and tactical command and control system. And then, secondly, to improve joint interoperability, because the services have to work together if we have to fight; you can't fight separately. As for the combined interoperability — to explain the jargon for those of you who are not familiar with it — "joint" means among the US services; and "combined" means between the US and its allies. So we talk about joint forces and combined forces.

Student. About improving combined interoperability — in 1978 I was a company commander in joint maneuvers with the British and French in Berlin. The three of us, through several machinations of our VRC-47s and hand and arm signals, could barely manage to talk. Now, that was the lowest field level, and we had a hell of a time, we weren't even close. I know it's three or four years since, but is someone looking at that problem, apart from the satellite picture going down to the VRC-47 — the keys and things like that for shackling?

Dickinson. Well, you're asking several questions. For the FM radio there is a NATO standard, the modulations are common, and I can assure you that in the clear the NATO family of radios — British, German, US — will interoperate. In the secure mode, with Comsec (communications security) equipment on them, they will still interoperate. The NATO organization is very suitable for prescribing that. We are working on the problem of making them interoperate in an anti-jam mode, and while that standard has not yet been adopted by NATO it is being very actively pursued. The new Army family of single-channel radios is addressing that, and will go into tests in a year with NATO observers, and we hope that the NATO standard will be the same. We are in the lead at the moment among the

NATO countries in introducing anti-jam mode capabilities. At a similar level the battery computers and the field artillery system of the German and the US armies are working bilaterally to interoperate at the battalion level, and the same with the British and the US. So all three of those will interoperate together, and that's a very complicated thing, and the same thing for the operational systems as they're put in.

Student. Then, just an adjunct to that: Do the French, British or Germans have a directorate or a high-level staff like yours to interoperate with, to bounce your ideas off and function on their side?

Dickinson. Not precisely in the joint staff arena. Generally we go into their ministries. You see, they are organized differently for development work than the United States is. Basically the development work is on the civilian side, so it's not a one-for-one match. But certainly, program by program, you can find it, and within NATO there are some 32 committees that work on standards that have to do with C^3I. We try to keep on top of those, so that we speak with one voice in our many arenas.

Student. Are your efforts to degrade enemy C^3I capability bearing fruit? Or is that an area where a lot of research is going on, but, perhaps, we're not getting effective work done?

Dickinson. I think "beginning to bear fruit" is the stage. I can't elaborate much. Obviously an example of what you're talking about is ECM — our jamming of enemy communications and so on; those are well known, well understood and well publicized sorts of programs. How to put it all together so you don't jam yourself, and control it at the same time, and do it against the targets you really want to do it against, and so on, is a little tougher job, and we've got a way to go in that business. I think we are not well organized to do the same sort of jobs that we did during World War II. We have a long way to go to get back to that capability, or even to begin to create it.

Student. Comparatively speaking, at what level of effectiveness would you evaluate the Soviet effort to throw a spanner into our C^3I operations?

Dickinson. Radio electronic combat organization under the Soviets is very extensive. A tremendous amount of resources is put into it, they clearly intend to have a very major effort, and they appear to be pretty well organized.

Going back to my list of goals: the third one, improving systems, I would like to print in smaller type. I am much less enamored of all the good things the salesmen want to sell us than I am of telling them: "Let's take the new technology and the new advances and use them to accomplish the first and second objectives." In other words, as we get the wide-bandwidth systems, as we get the tremendous memory capabilities and so on, let's use them for survivability rather than give people ten more telephone circuits. We've too many people talking already. Cutting the total reporting systems down to size is another very important part of that survivability. And we are doing that. There's one particularly onerous report called "Unit Rep," very voluminous, in which there were, in one computer file, some 40,000 units reporting out of our three services, and up to four hundred pieces of information being reported about each of those units. We believe that probably only a thousand of those units are necessary in wartime, like, say, the 82nd Airborne Division. Not two-man well-digging teams. And about twenty-five pieces of information from each is probably satisfactory. You can see what it does for an ADP program if you can cut down to that kind of size, and for the communications that carry that information. We're working on those kinds of things too. That's not a dollar item, but it's a survivability item, I'll guarantee.

McLaughlin. It strikes me that in some of the declassified World War II material, in the battle of the Atlantic, for example, the most valuable decrypted information for the most part, by some assessments, was that of the individual submarines, U-boats, reporting back nightly to meet standard reporting requirements on status of supplies, crew, and so forth. I think that may just suggest that the problem you're mentioning is not just for efficiency's sake and survivability. We do see the unit reporting, but there might be other considerations...

Dickinson. That's survivability. Very much. We're trying to cut down the emissions, because the Soviets do have a very efficient radio electronic combat capability. They will be listening. And emitters will be located.

I'll just comment on the fifth goal, crisis management — yes, I guess that fad is going away, but everybody wants to solve the Mayaguez crisis or something else. I'll show you later on the number of crises we've had in the last few years, but that is one piece of busi-

ness that's working very well, we have not had major crisis management problems. It does work. It works rapidly, and it works almost any place we want it. Crisis management basically implies that you're not in a major war, so you don't expect major jamming, major wrecking attempts against your system and so on. You can use things for crisis management that would not be useful for wartime. I can happily say that they work very efficiently.

Management and operational improvements — those are personnel improvements. Training our people; improving the C^3 course at our war colleges and staff colleges, that sort of attention is all-important in improving the management and operation of our systems.

And C^3 system evaluation — realistic evaluation — is very difficult. The reason survivability is up there in the number one position, in my opinion, I blame on the operations research community and the evaluation exercise community. Because it was always too tough for either of them to simulate the damage that would realistically happen to the C^3 system in wartime. And so in all our exercises and almost all our games and studies and analyses, perfect C^3 connectivity was assumed. And therefore the briefings from those studies and analyses were extremely erroneous, by very, very major factors.

Now that is changing. You will see C^3 degradation in exercises, and support for funding is beginning to materialize, because we have gotten into the major war games that are really briefed to the top decision-makers. In all our exercises now we are removing the satellite communications for a period of time. The Navy does that well. Their ships are very dependent on UHF satellite. They just remove the UHF satellite for three days at a time, so they have to get the message by HF radio or courier it by COD, carrier on-board delivery. That means a small aircraft flying off the deck with a small bundle of papers. Or they signal each other by light. Those are very important exercises.

An interesting sidelight: working with degraded C^3 is not easy to do. We found it exceptionally difficult when we first started taking the satellites out of the exercises, as we did for the first time about a year and a half ago. Because there are vital peacetime channels mixed up with the other channels — deliberately. We have high-priority channels carefully mixed with low-priority channels, for obvious reasons if war occurs. Now, you try to take out the low-priority ones that are going to be used in the exercise, but don't touch the vital day-to-day channels, and it is a major technical challenge. It took the Defense Communications Agency and some of the best engineers some time to learn how to do that without fouling up intelligence agencies and others that we can't foul up.

Oettinger. In fairness to the exercisers, though, it seems to me that in the past, if there was anybody lower in the budgetary hierarchy than C^3I, it was the budget for exercises. So the failure to do that is to an extent part of the same picture as the failure to take the command and control element seriously.

Dickinson. Maybe, but we spend an awful lot of money on gasoline and aircraft hours for exercises. Huge expenditures at times.

Oettinger. Yes, but that's fun, and you can take congressmen on board and so on, and the rest of the stuff isn't nearly so visible.

Dickinson. Though it is interesting only to sadists, I think, figure 7 is a diagram of what happens in the current programming and budgeting process. If it looks confused it is confused, to some degree. A program objective memorandum (POM) comes in from each service and each defense agency. It is submitted about May, and is the important document that will eventually result in the president's budget, presented to Congress the following January. The POM covers five years, but the really important years are the two immediate years — that's real money that you're dickering for there.

Oettinger. I just want to interject: those of you who have not experienced the terror of the middle-level military or civilian manager talking about missing a POM cycle, I think, cannot appreciate the depth of what he is talking about right now.

Dickinson. Then issues are created, and that's one of the places where our directorate comes into the process. We call in the overseas CINCs the minute these POMs are released. The services meet with me, and we brief representatives of each of our commanders-in-chief all over the world on what's in their C^3 portion of the POM. The CINCs then look at it. We've already, further back in the process, the previous December when the services started working on the stuff, said what we thought ought to go in. But now we look for what isn't in there that we think should be in there, with the help of each of our worldwide commanders, and go into issue books, saying, "This ought to be changed,"

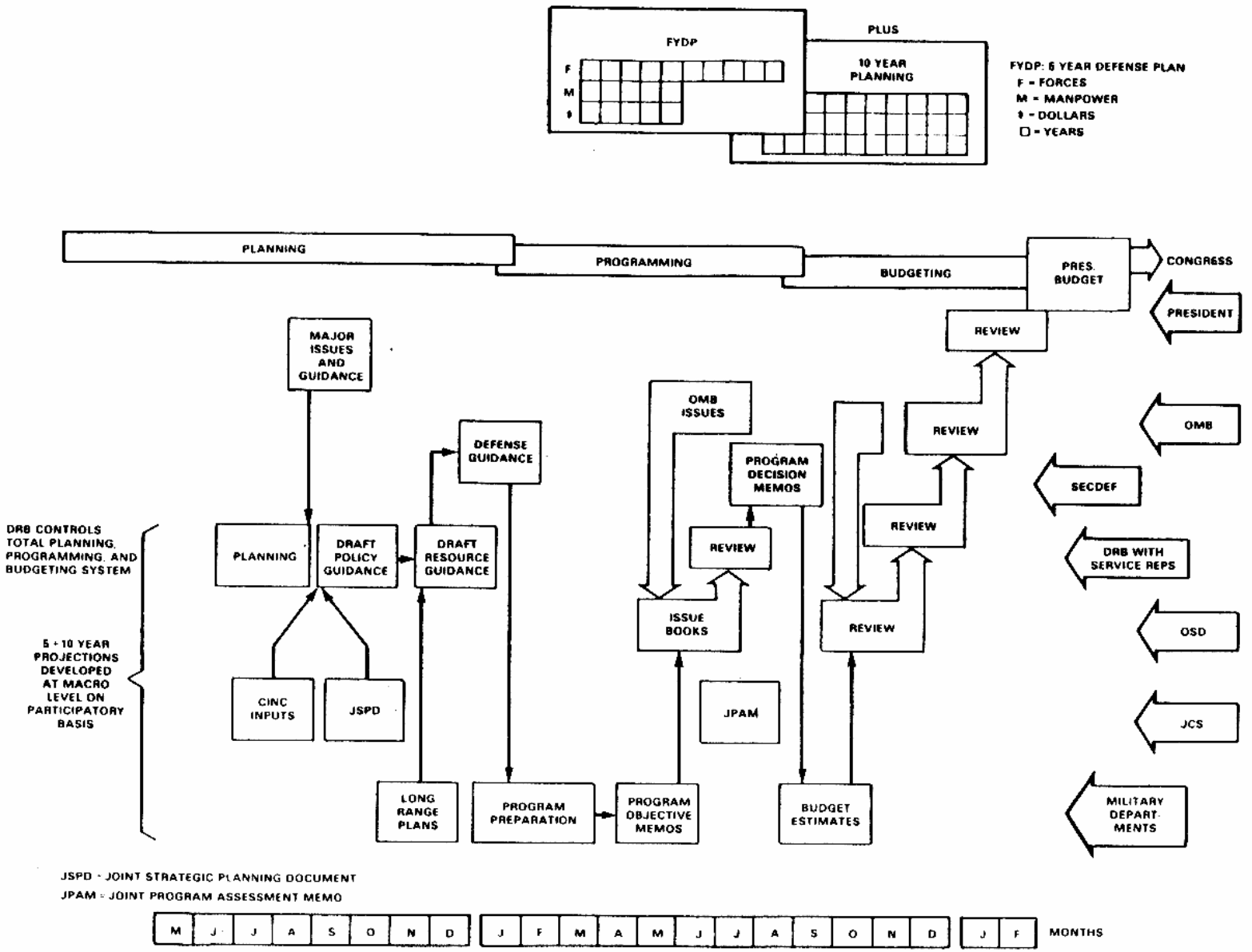

Figure 7. Defense Planning, Programming and Budgeting System

and we try to get OSD and the Defense Resources Board and so on to direct, in the final decision memorandum, that the services include those when they submit their budgets. That happens in September, and it's the next round of the same process.

So when I say there's a poker game with continuous ante, this is one of the hands. First you try to get your ante in the POM, that's the easiest time not to fight it uphill. But things are going to be taken out, and levels are going to be forced down, and so on; so there are going to be a lot of revisions through this process. You fight it again as it comes in on the budget, it's reviewed, and again decisions are made. Through September the review goes on until finally it's got to go to the printer. It should go in December, although it made a historic leap this year by not getting there until the third week of January. Normally what happens here is the well-known Christmas Eve crucifixion, in which the last person who's gotten his hands on it, the comptroller, puts his own pet items in and pulls somebody else's out. Literally it has happened several times on the 24th of December. We watch like a hawk through this entire process and try to make sure that the sets of things we're looking for that are most important get put back in.

Now, how does this work practically? Having gotten the POMs in and had our CINCs' review this summer, we look for example at the strategic connectivity issue. We had a set of items that we felt were absolutely vital to improve in the area of strategic connectivity. They were presented to the joint chiefs, each of whom is a service chief. When their budget came back in, it reflected about 80 percent of the recommendations I had made. Now, that happened as a result of our seeing that budget and acting. The joint chiefs had a reputation for never being able to address these sorts of things, but in fact, in recognizing things of this importance for cross-service use, I think the process works, and I've got to compliment all the chiefs on their responsiveness to the problems we saw in connectivity at that time.

It culminated in October with a presidential decision memorandum. The announcement was made on the second of October. It said, among other things, that C^3 is even more important than the other pieces of the strategic improvement program, which included the MX and the B1, the advanced technology bomber and so on. C^3's importance was recognized through this process. We were able to show, in fairly simplified diagram form, where the gaps in the system were likely to be as a function of various kinds of threats and scenarios. We were able to present the problem, and we were able to get action.

Another example. The Air Force is a good example of the budget crush, with those three big programs: the MX, the B1, the advanced technology bomber. They were pretty well choked to manage those kinds of programs and come in on target. A number of other things came out of the budget in various places, in particular for cross-service C^3. From a decision made at the upper OSD level in the DRB for about a billion dollars of cross-service funding, by the time the budgets came back in the services were able to fund only about $175 million. Well, that's a tremendous gap in other essential improvements in theater and tactical C^3. We went back with the most important of those gaps in a list of some 20 items as late as November, and again, about 80 percent of them were funded by the services before the budget was finally produced. So that's the way the process has worked: a combination of pressures, of presentations to the chiefs and the opsdeps — their operational deputies — and recommendations to OSD and the chairman's own voice in some of the final councils. That's the practical role — what you have to do, when you don't control the money, to get other people to understand the problem.

Next, the joint strategic planning document, another fairly important document which precedes the defense guidance for the POM that will be presented in May, is issued in January. In the previous year you try to get into the guidance as much as possible on what you need. You will see a very marked change in defense guidance because of the items that we have been able to get in over the last couple of years.

Oettinger. Before we leave figure 7, there's one point perhaps worth adding. There's an arrow at upper right which goes to Congress. There does remain a last dark alley not shown here: the congressional committees where, again, both advocacy and quiet murder remain possible — and probable.

Student. This then is a two-year cycle?

Dickinson. It's really a three-year cycle. This shows a two-year cycle, but the long-range plans go even farther back than that. But yes, the joint strategic planning document comes two years before the defense guidance which precedes the preparation of the POMs. Actually, you're working three years at once. You're working the two years shown on this chart, and you're working the current year. You get through Congress at the end of the second year, and then you're working the

current year's money to be sure the services don't reprogram it out from something and put it in something else, or fail to execute it. You're working the execution, and that makes it a three-year combination.

Oettinger. Correct me if I'm wrong, or if this clarification is obscure. I think we can now appreciate the importance of your remark that watching this is very much next best to controlling it, in that if it is not watched, the number of dark alleys in the process is immense. Hence I believe your earlier comment that watching it is a *major* asset.

Dickinson. And it's of major importance to have people who have played in that kind of arena on my staff helping people watch it. I just must have people who have been in the development process and the congressional defense process and so on. Because good congressional committee relations are part of it, and so on. You've got to get someone to tip you off to the problems that are going to arise before they are a *fait accompli.*

Student. How well do congressmen, and people on the congressional staff who are reviewing this, understand the process? And are you really able to talk to them fairly openly and freely?

Dickinson. It varies among the different parts. In the strategic connectivity part, the subcommittee of the Senate Armed Services Committee has taken almost a system approach — and when I say that nobody in Congress takes a system approach, that one subcommittee has almost now got a system approach on strategic connectivity, and it's a tremendous help to us. Other committees, much less so.

Student. Does the constant changing of congressmen make it more difficult for you? For instance, with this change in control of the Senate. And is it a constant process of education as the committees change?

Dickinson. Well, of course the Senate isn't so bad with its six-year term. The House is clearly the more volatile. And I think you would find, if you asked somebody their perspective from back in the fifties and so on, with the long-term seniority built in, particularly from the South, that no longer resides there, that that process was much less difficult than it is now. There are an awful lot of people you have to reconvince. All of them have various perceptions of the whole body, including the fact that everybody in the process is nuts. That's part of what you're doing. You start over each time. Persistence is the answer.

Student. A true lobby —

Dickinson. *No*, we do not lobby!

Next I'd like to talk about some of our plans and programs. The first is one of the major accomplishments in institutionalizing the process: the command and control system five-year summary plan (figure 8). It's very difficult to get the services to agree to have us in their programming knickers. Service programmers particularly object, of course, to the joint staff coming into this arena with significant effect. So there was a good deal of resistance in trying to create what seems very logical: a command and control master plan. If you really want to work systems it seems that you ought to have a master plan, it's almost self-evident; but there are a lot of people who don't agree with that. We now have agreement that we will work a command and control master plan and it might be interesting to look at the nuances of the sort of compromise master plan we have. We have one that does not include the prioritization. It does clearly expose, though, where there are overlaps and where there are gaps in coverage. And it clearly explains what each service's programs are in the areas that have joint significance — I'm not working things that are purely internal to one service; I stay out of that kind of business. I've got enough problems in trying to work the programs that affect cross-service or international matters.

This has now been institutionalized, and will be in process, and I believe we will begin to do the same thing for intelligence. The five-year master plan stems from authority sent down to us by the secretary of defense about last March asking the JCS to look at the cross-service programs in the areas of C^3 and intelligence. It does not include the priorities, and I think properly so, on the advice of one of our sager chiefs of staff, or CNOs — I will not divulge which — who said we would have the same kinds of problems that joint chiefs do when they address certain other financing matters: we would be arguing forever over the details of the prioritization if we tried to do that in the joint process.

So we will not do that, but we will have everything right up to there for my own use in recommending, as I've described to you, prioritization to the elements of OSD and back to the services in our own name, and to the chairman as an individual on the Defense Re-

- COMMAND & CONTROL SYSTEMS FIVE-YEAR SUMMARY PLAN

- NATIONAL MILITARY COMMAND SYSTEM FIVE-YEAR MASTER OBJECTIVES PROGRAM
- COMMANDER IN CHIEF AND SERVICES COMMAND & CONTROL MASTER PLANS
- MINIMUM ESSENTIAL EMERGENCY COMMUNICATIONS NETWORK MASTER PLAN
- WORLDWIDE MILITARY COMMAND AND CONTROL SYSTEM OBJECTIVES AND MANAGEMENT PLAN
- DEFENSE COMMUNICATIONS SYSTEM PLAN FIVE-YEAR PROGRAM

Figure 8. Examples of Command, Control and Communications Plans and Programs

sources Board, though not as the chairman of the group. For those purposes we will attach an addendum to the master plan which is not jointly approved but is our own prioritization process. I think that's probably a very workable compromise. But that's the sort of problem that you would not have to deal with if you had more authority or the extra bucks.

Oettinger. But once you had a change in incumbents, you might have a different balance in views on the importance of these matters.

Dickinson. I don't think so. I think it's institutionalized to the point where it can survive and/or its importance is recognized. So, that's rather important. We already had other kinds of things working over the past several years. We had gotten the commanders in chief to do their own master plans in a way they were never done — by theater. Europe has reorganized so that they have a command and control system directorate, they no longer have a J6, J6 being communications director in service terminology. They've combined the portions that worked in J3 and J6 to do that job. Pacific is organized the same way. REDCOM — the Readiness Command — just organized that way last month. So the major unified commands are all organized in parallel to the one I showed you earlier in the joint staff. They have a command and control and communications system organization working properly. And therefore their own master plans are getting much, much better, where none basically existed when they went into business. And that's what we need. Some examples of the kinds of things that have gone well include:

- Improved evaluation of survivability requirements
- Establishment of priorities for resources
- Improved theater/joint tactical C^3 systems
- Improved contingency C^3
- Improved secure communications
- Accelerated NATO and other allied interoperability efforts
- Progress in evaluation of C^3 performance
- Improved realism in exercises and system simulations

I think the budget results I implied — I didn't put them down in hard terms — are probably the most important. The presidential priority given to C^3 — I think it's the first time anybody every heard a president talk about C^3; I'm sure it is. Thank goodness he wasn't asked very many questions in press conferences. That's all right, though.

Our capability to handle contingencies has increased dramatically since the preparation for the Iranian rescue. We've developed a number of things we don't talk about very much, but that's in much better shape. All the unified commanders are in remarkable unanimity on their prioritization. The thing they want most is good, survivable anti-jam and secure voice communications that are improved all through their own theater level and down into their tactical forces. It's the number one priority of all the CINCs.

Student. Perhaps this is a bit touchy, but was there some feeling among people who put together the Iranian operation that the areas of failure, if they were to occur in the actual operation, would perhaps correspond closely with those areas of weakness that we felt might show up in that operation? In other words, do we have a good feeling about the problems in executing these operations where C^3 flaws would show up?

Dickinson. The C^3 worked beautifully, thanks to tremendous efforts by a number of people. It worked amazingly well.

Student. Okay. I don't want to pursue this to the point of tactlessness, but I'm wondering about the problems in air or ground tactical-level communications. Gunship-to-gunship kind of problems — coordinating the moving of gear and hardware. Are there any lessons to be learned from that at all?

Dickinson. Oh, I think there are a number of lessons to be learned. They were not failures of the C^3 systems. There's been reasonable publicity on some of those lessons, and I guess I'd rather not get into that. But the answer is: certainly all the upper-level command and control worked well, and the equipment worked well. There were no C^3 equipment failures.

Oettinger. Let's underscore "equipment."

Student. Yes, I think that may be the point he's making, but if you talk about command, control and communications you can't just talk about communications equipment per se, or that there may have been some mistakes made in how they were going to exercise control, the question was about using this C-130 Pathfinder aircraft to lead in the helicopters, or two-way communications with the helicopters to Nimitz. If that kind of thing happened during the operation, I mean,

that's a failure in command, control and communications to a certain extent — maybe the decision-making part of command and control, prior decision-making, as to what was going to be allowed and what was going to be followed.

Dickinson. I would say the chief problem was more that there had been no existing force. That force was created in a very short time, and those are the kinds of problems that come from a hastily generated sort of operation — but you're right. In the broadest sense of command and control we know that the question whether an individual is doing what he should do, and so on, in every case, is part of it.

The NATO and other allied interoperability efforts: we've markedly improved our capability to talk securely to both the Japanese and Koreans, including changes in US policy on what could be released and the way we could handle various kinds of Comsec materials over the last year; and that's a very major policy issue to work. That's been done successfully. The evaluation I've already referred to, and the exercises — I prefer, again, not to have it written down, but certainly our success in excluding the most onerous provisions of the Brooks Bill was a very major improvement.

Oettinger. We have had an account of that from the Air Force side, from Chuck Snodgrass,* so we've got some familiarity with that.

Dickinson. That was in our opinion one of the very major system problems — and we took it on and got the support of Congress, in spite of a relatively low chance of success, originally.

Another example that's a very top-level problem — it may eventually require changing the law, or it may need a change in top-level OSD policy — is our problem with civilian contractors remaining overseas in wartime. Or worse, in the two or three days immediately before, when war is threatening and the question arises whether they're going to take their families and go home, feeling it's more important to evacuate their families than it is to stay on their jobs, and what that will do to our command and control and other sophisticated systems. We're working on that very strongly in this administration. But again, that's the survivability of the system in the biggest sense. Those are the terribly important kinds of things.

I think those of you who are close to it realize that we have our worldwide computer, sort of a general-use computer called the WWMCCS ADP family of computers — the Worldwide Military Command and Control System. That's 35 or so sites and 40-odd computers at places like the command headquarters that I've been describing: the commander-in-chief in Europe, the main Army command post in Europe, and so on. That's their general-purpose operational computer. It's going to have to be replaced some time in this decade. We have now created, under Air Force auspices, a new joint program management office. It is active. Its commander, Major General Evans, is setting out to make that an organized project.

Parallel with that we have in my own office, just being established, a pair of cells called functional program management offices that will try to make systems sense out of what, as nearly as I can tell, are some 500 individual ADP systems that are in various parts of our logistics, mobilization, deployment and readiness systems, in places like the Joint Deployment Agency. The military airlift computer systems that will ask for information from the sealift or vice versa, or within the government transportation agencies that are terribly important when one's trying to deploy forces overseas. So we're beginning to expand our efforts into system organization and systematizing those programs.

Student. Would you say more about the Joint Deployment Agency? The command side of it as opposed to the communications side?

Dickinson. Well, the Joint Deployment Agency is created, in part, to take a big chunk of the force deployment job and work it together. It is getting more authority and I think it's being viewed as a very successful and very useful effort; I think everybody now realizes that its creation was a very smart thing. Exactly how far it will grow, or precisely what its evolution will be, I don't know. But it is continuing to evolve. There is a consolidation underway that will combine what was the MTMC — Military Traffic Management Command — which basically ran the rail transportation in the United States and everything to get it to the ports — with the Sealift Command that was run by the Navy. Those are the most immediate movements. Both are major simplifications in the total command structure that deals with those kinds of problems.

*See Charles W. Snodgrass, "Funding C³I," in *Seminar on Command, Control, Communications and Intelligence, Guest Presentations, Spring 1981*, Program on Information Resources Policy, Harvard University, Cambridge, MA, December 1981.

Student. You mentioned your directorate's accomplishments in NATO. In your systems approach to managing the C^3 problem, specifically in Europe, what's your point of contact? I understand you have to work EUCOM headquarters on joint problems, but on the combined interoperability problems, is there a C^3 staff, say at SHAPE headquarters, that you work with?

Dickinson. There is not a C^3 staff — I wish there were. I discussed that with General Rogers, he's struggling with that. They have an ADP portion, they have part of it in the operations portion. Part is in the communications related portion. So there are about three pieces. Some other structures handle the air defense, including the major study group that has been established with a new air defense organization, and that's one of the important ones, too. Let me come back to that in just a minute.

These are the major players (figure 9) in what I call the intercontinental nuclear war scenario — players that have to be tied into a command system. Look at some of the pieces of that system and some of the problems you have to consider. Figure 10 shows some of the effects that were seen in Hawaii some 1200 kilometers away from the ground center of a high-altitude burst in the 1962 series. The point I make here is that the effects of some of the high-altitude nuclear bursts are rather dramatic system possibilities, and they have to be looked at very carefully because they are very wide-area effects. And wide-area effects have different kinds of effects on systems than small-area effects, creating very different kinds of systems problems. You can see the kinds of things that were disrupted in Hawaii; I don't think we ever confessed to the streetlight problem or some of the others. This was at our Navy transmitter site on Maui. Picture that over an area as large as Europe and a bit more. I think you can begin to get some idea of the impact of the potential system problems that can result if they're not properly designed against. So the answer is, you do have to worry about these things, this is a true part of a logical, possible threat in an intercontinental nuclear environment.

President Reagan, speaking about the connectivity problem of these forces, has called for us to "strengthen and rebuild our communication and control system" so that it is "foolproof in case of foreign attack." He has given it absolutely very high priority. We think that's correct. These things simply must happen.

Oettinger. I think it's important, unless we disagree, to articulate that this is the culmination of a long process, which you were part of in the earlier administrations, that eventually surfaced us to a flight of consciousness where these things could be articulated. It is not simply a Reagan phenomenon; the roots of it grew further back.

Dickinson. Portions of this were being worked at the time we came into being, yes, and had been worked rather well by both the Navy and the Strategic Air Command. We were able to take the results of their work and put even more of a systems viewpoint on it, find some additional pieces that needed to be worked, and net it in a way that could reasonably be described. We took a systems approach to it, looked piece by piece, sensor by sensor, through the entire system. Communication line by communication line from each sensor, command post by command post, and then line by line going back out to the forces. And down through all the things that could possibly happen to the system from bad electrical power, or power disruptions, through all the other kinds of vulnerabilities, down to the final physical destruction of the piece. And then we set about saying: is this okay, is it questionable, or is it bad? Piece by piece. And then: how are we going to net this back together?

From that comes a prioritization, and then comes the problem of describing it in a relatively simple way to the decision-maker. We found, interestingly enough, that this could be done with some fairly simple connectivity charts showing graphic pictures of locations and labeling them red, green or yellow, and connections between them as red, green or yellow — even though those were about fourth-order abstractions and there might be ten reasons that something was yellow. Nonetheless, that was the basic conclusion: you can, in fact, present something that's really very complicated and fairly technical in a pretty simple way. But that's the kind of thing that has to be done to get decision-makers to spend really substantial amounts of money on something that is not inherently understandable to them until you do that.

Student. Was this same kind of information available to President Carter, or was it done differently? Did he have different staff people recommending things to him? I'm curious that somebody who had no military background, like President Reagan, would be so much more willing to look at this and make decisions based

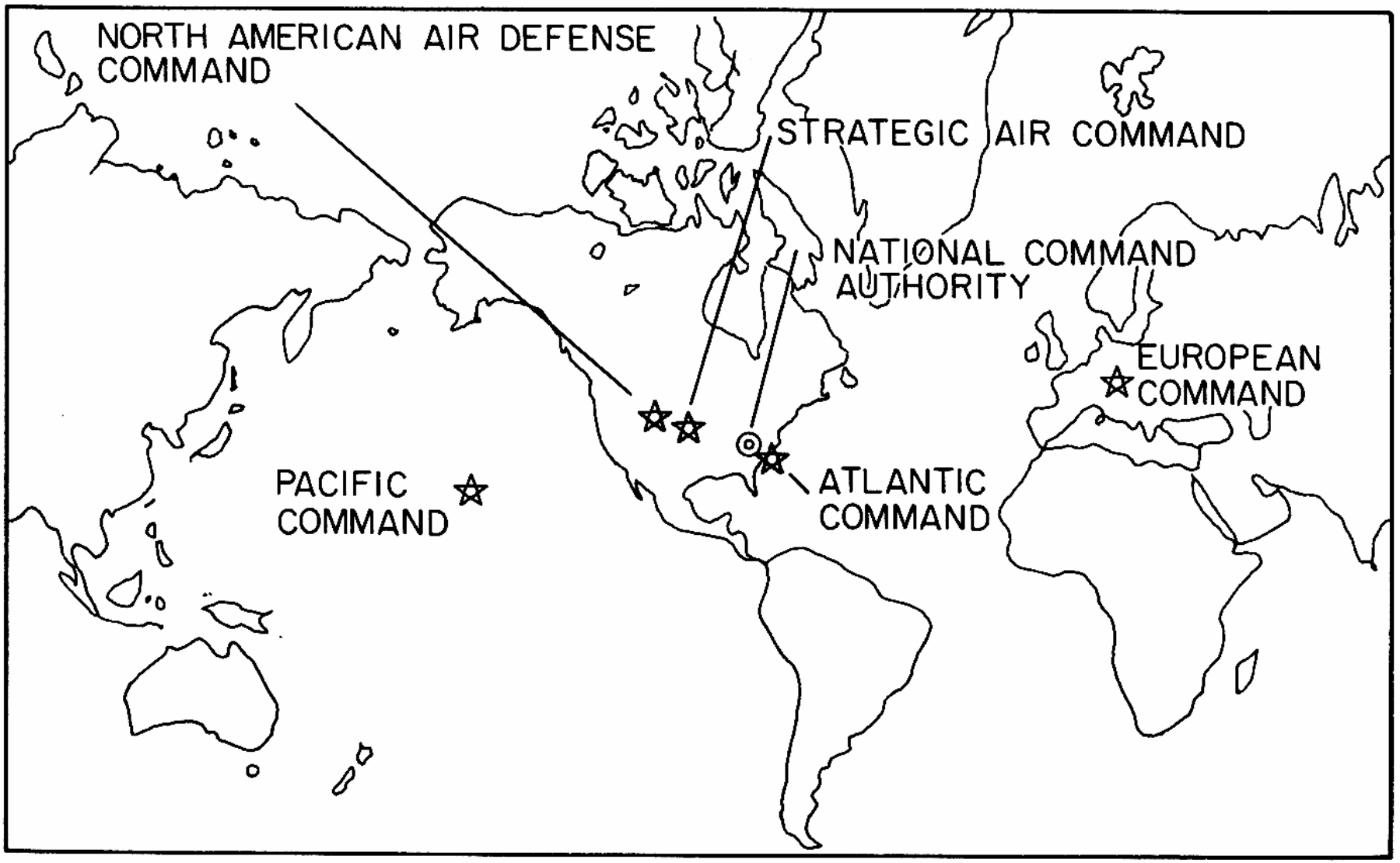

Figure 9. Strategic Command Structure

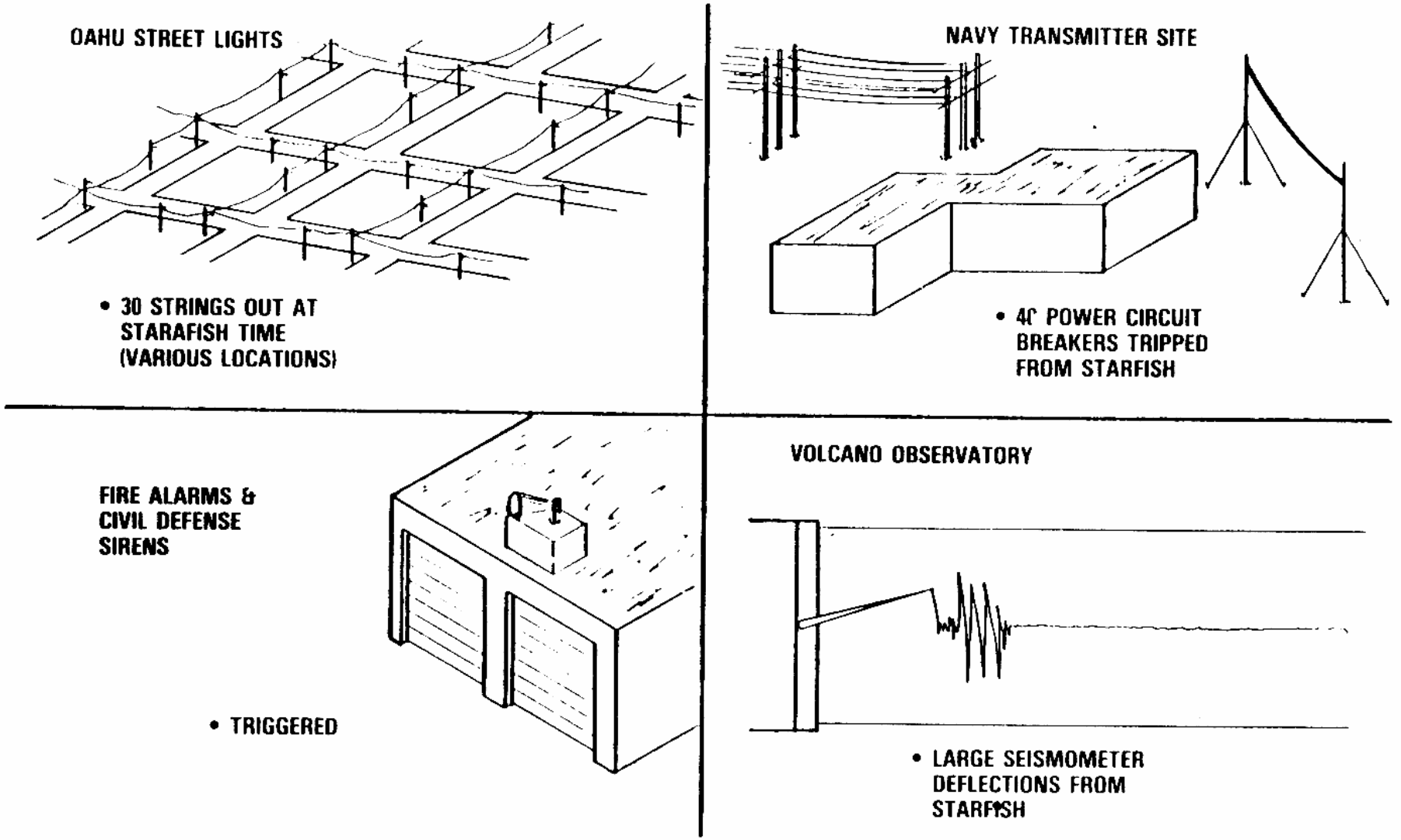

Figure 10. Electromagnetic Pulse and Other Fishbowl Effects In Hawaii

on it than President Carter, who had a Navy background.

Dickinson. A lot of this was starting even before the administration changed.

Student. Has there been a substantial enough change in people who are aware of what your directorate is doing?

Dickinson. It's been accelerated. It's a process of continuing education. Some of the key people, like the chairman of the joint chiefs, haven't changed. On the other hand, the chairman has understood this better year by year.

Oettinger. I think under the Carter administration there were three presidential directives directly relevant to this. You're looking at the culmination of a process that involved a lot of people over a lot of time, including at least three, maybe four presidents.

Student. That's what I'm wondering, that it's really just coming to fruition now...

Oettinger. I think you're seeing an iceberg coming up above water, but the rest of the pieces came into being and went back into the earth in the late days of the Nixon administration. So it's a very continuous process.

Student. But I think that it is being generally understood in the country that this is a Reagan initiative, and that there hadn't been much background for it, that it's all of a sudden a change of direction rather than a culmination of a process.

Dickinson. Well, there are those who believe that in many respects there were at least two Carter administrations. The last year and a half was a very different administration from the first two and a half, too.

McLaughlin. I'd be willing to argue that a lot of these changes are the result of war-fighting plans the basis for which, I think, you can track back to Herman Kahn's thinking about thermonuclear war around 1960. And the shift from mutually assured destruction to flexible response...

Oettinger. Let's take up that point next time, including the context.

Dickinson. All right. Let me show you some pictures, quickly, of some of the pieces of the C^3 system. First, some of the sensors that come into the nuclear warning system. You've heard of the BMEWS radars; those watch for enemy ballistic missiles. Another radar watching for ballistic missiles is called the Perimeter Acquisition Radar Characterization System (PARCS) (figure 11) and is the one piece of the old ABM system — the Anti-Ballistic Missile development system — that's still operational. Seeing these kinds of facilities gives you a flavor. These (figure 12) watch for SLBMs — submarine-launched ballistic missiles off both coasts. One of these is on Cape Cod, there's one in California, and there will be a couple more covering some areas that aren't as well covered now in the southeast and the southwest that are part of the additional funding in the program, one of the things we prioritized: getting better coverage, 300 additional radars.

It's sometimes a chore to get the Air Force to continue the funding for the president's airborne command post (figure 13) in preference to fighter squadrons, but it has been done. This is the hardened version that will survive some of the high-altitude and other effects that damage unprotected aircraft. One of the nuances of that whole problem is that modern aircraft are even more vulnerable than old aircraft; they're plastic instead of metal, so the electric field penetrates the aircraft more. Also all of our neat, fine computer small parts are in many ways more vulnerable simply because they are small, they can't absorb the same amount of energy that an electron tube could and still continue to function. So we have to be careful as we modernize. Now this CINC's airborne command post (figure 14) is what the SAC duty staff is flying in right now. It stays airborne 100 percent of the time with a battle staff, including a general officer, aboard. That's one of the few things we do keep up.

The kinds of connectivity (figure 15) from fixed locations like the Pentagon, the airborne command post and the SAC command post out to the missile field give you an idea of the extent of this system. And I make this point, too: the system I'm showing you is the intercontinental nuclear war system. It's much simpler than the theater and tactical systems; they're much more difficult to work as system problems. This is actually a fairly straightforward system, and it's well diagrammed on just these charts. We use these kinds of communications (figure 16) to communicate with strategic air command bombers, to get them off the ground when they need to be. That sort of connectivity through

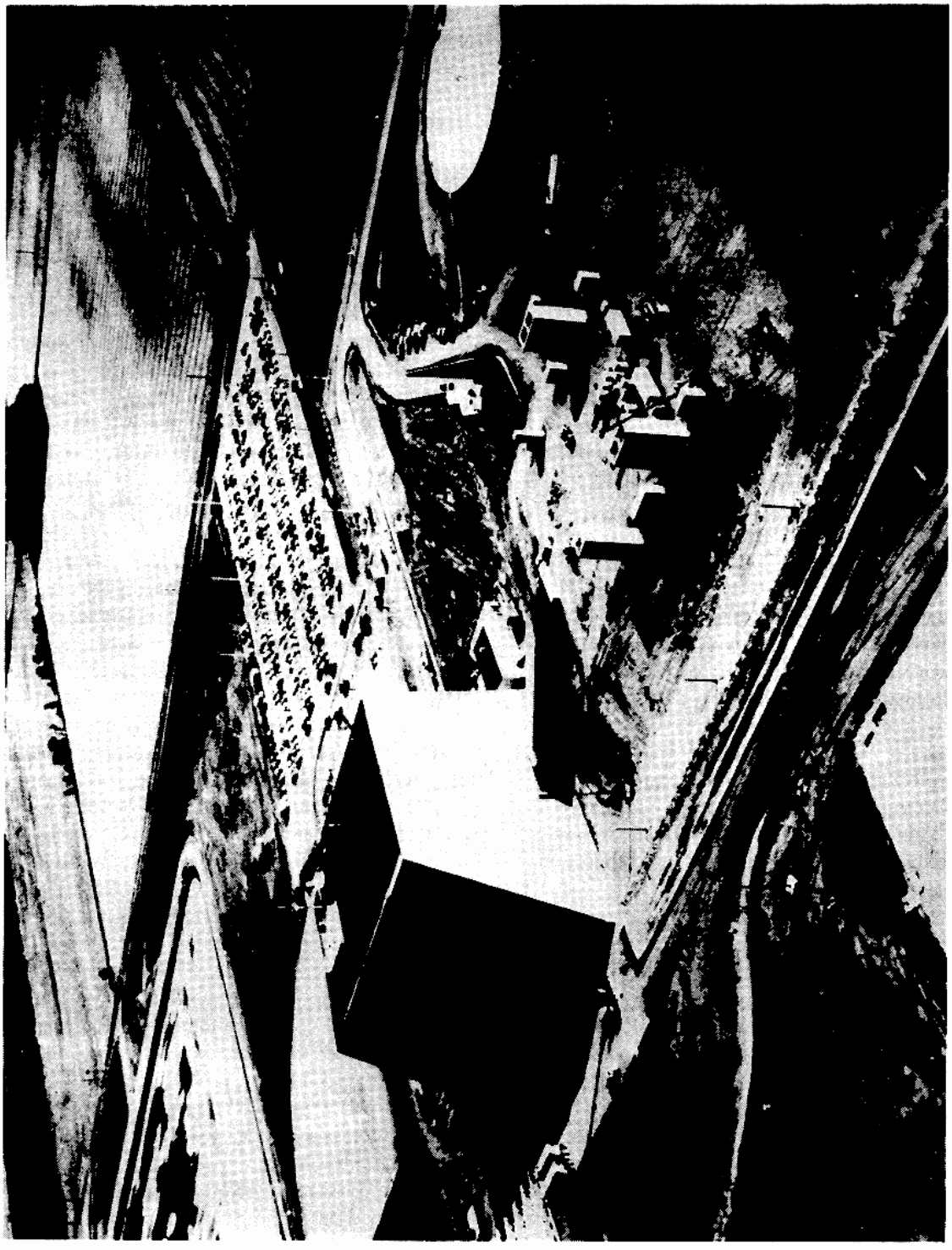

Figure 11. PARCS Radar

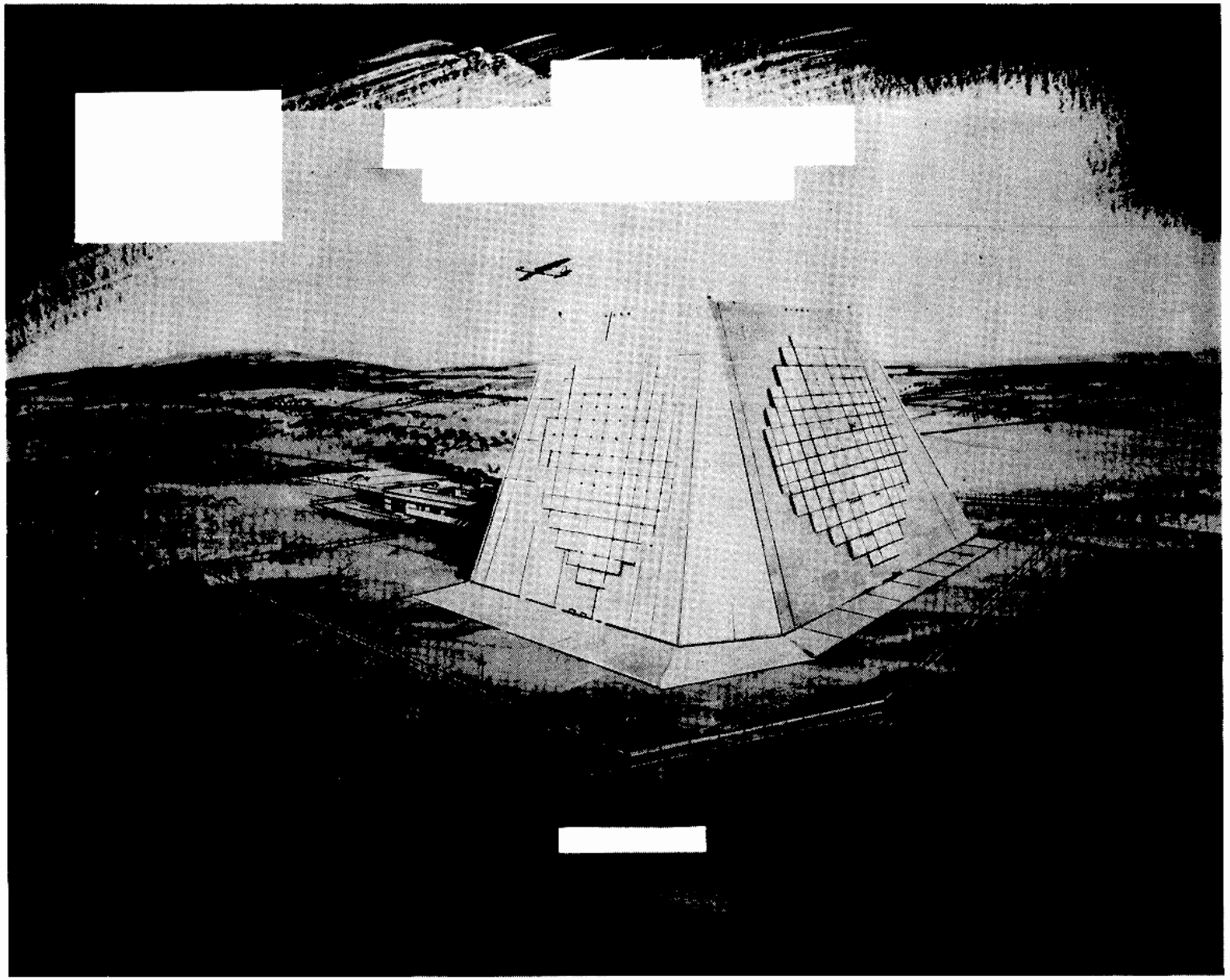

Figure 12. PAVE PAWS, East Coast Site

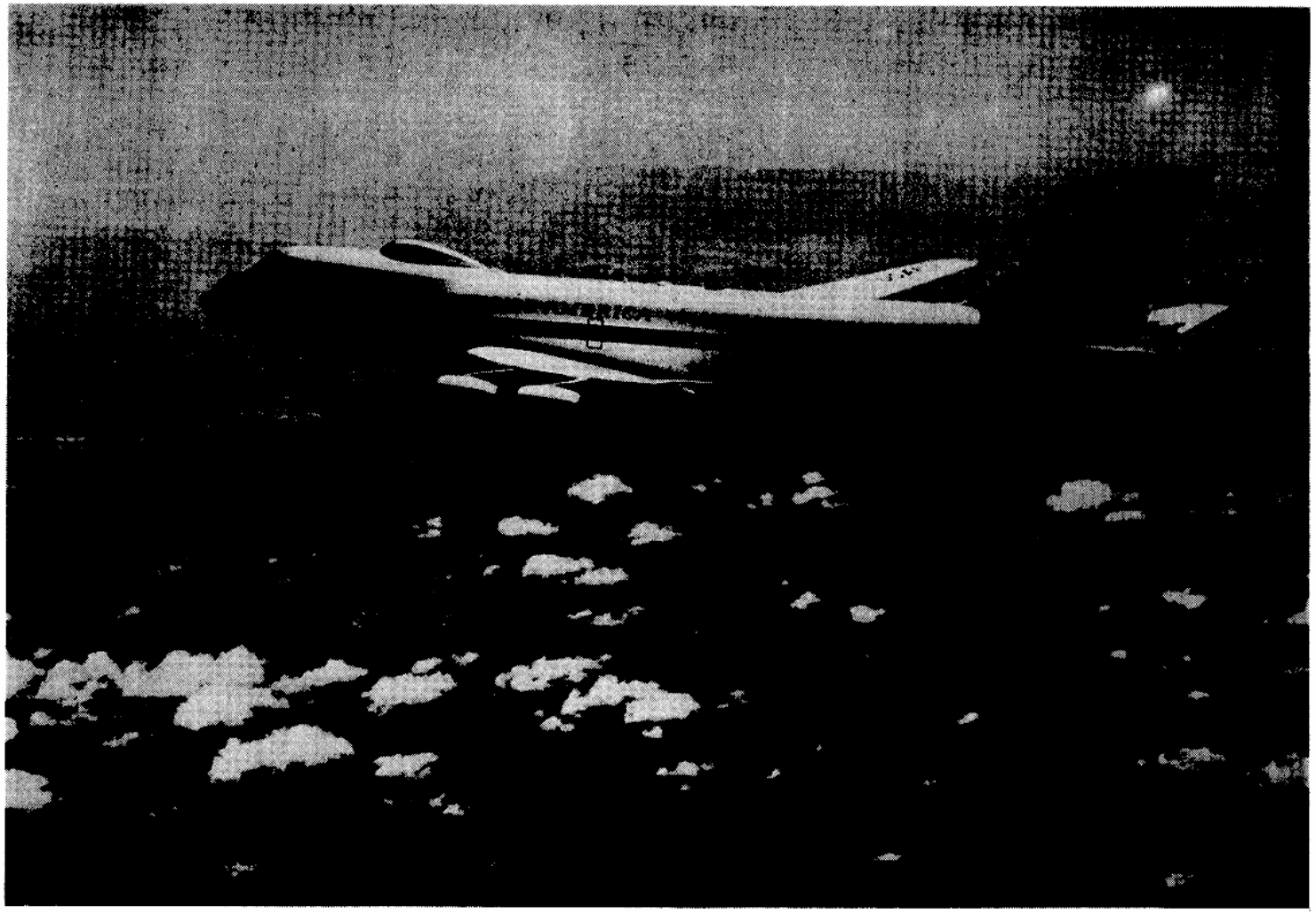

Figure 13. Boeing 747 E-4B Airborne Command Post

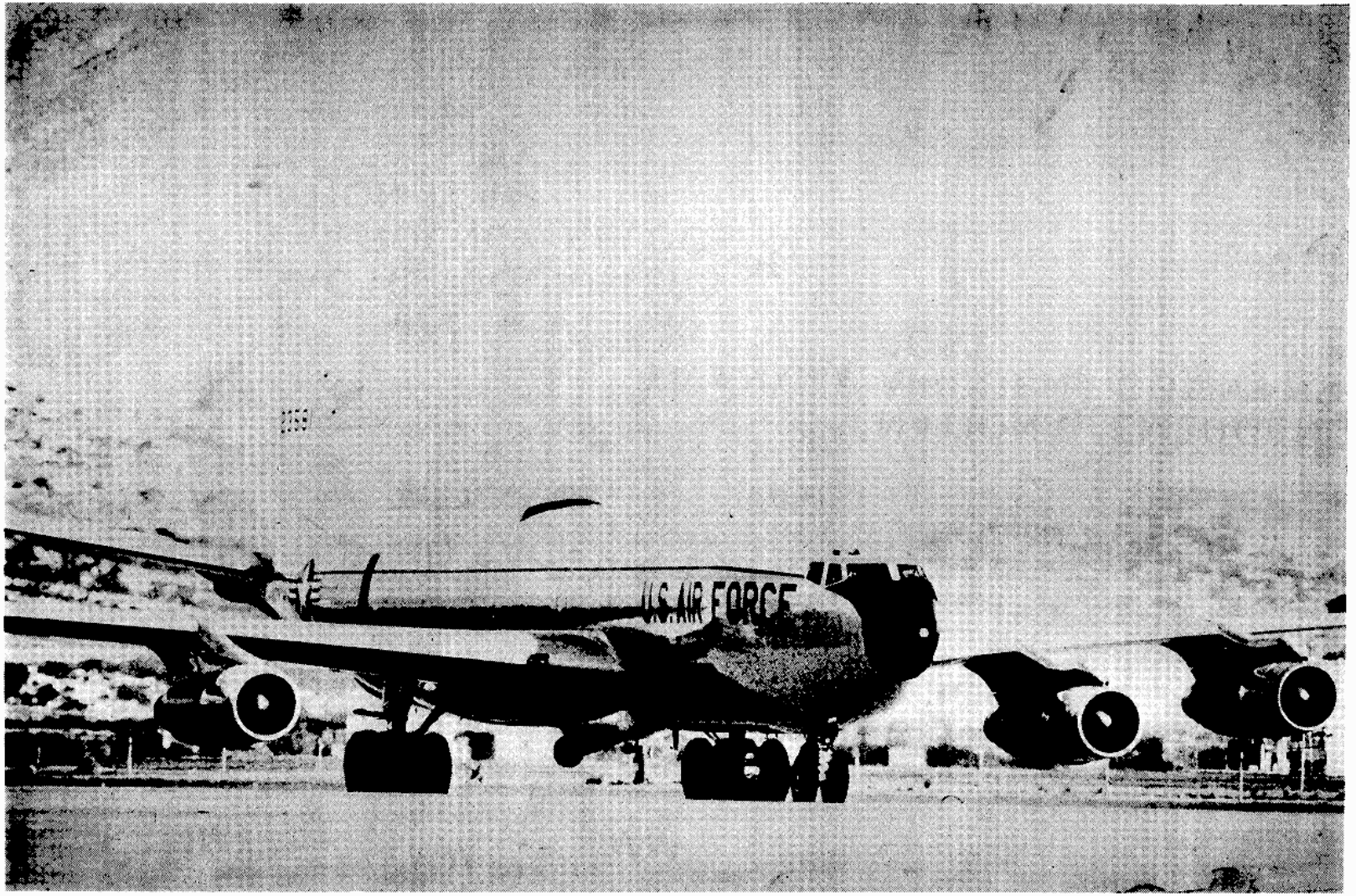

Figure 14. Commander-In-Chief's EC-135C Airborne Command Post

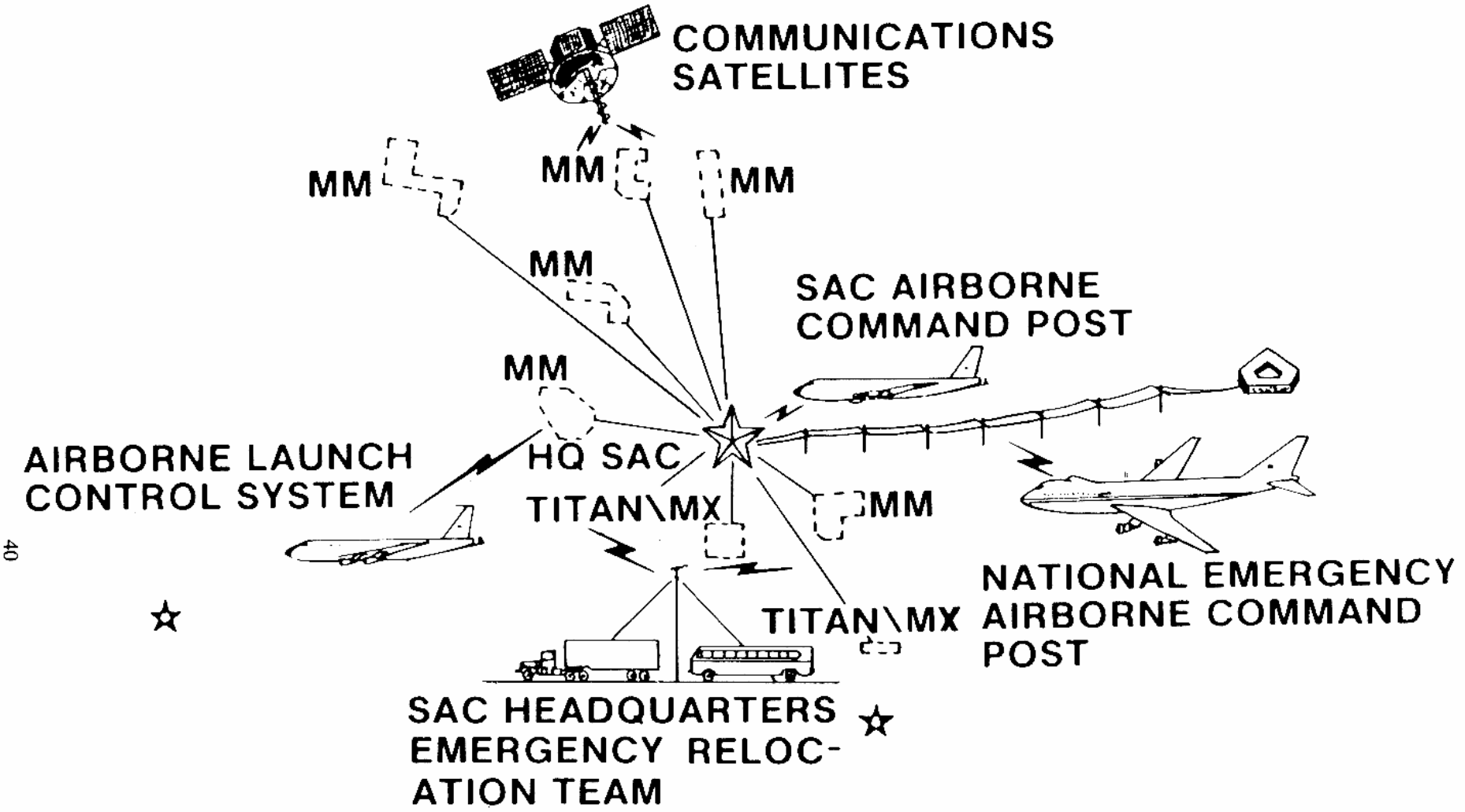

Figure 15. Connectivity to the Missile Fields

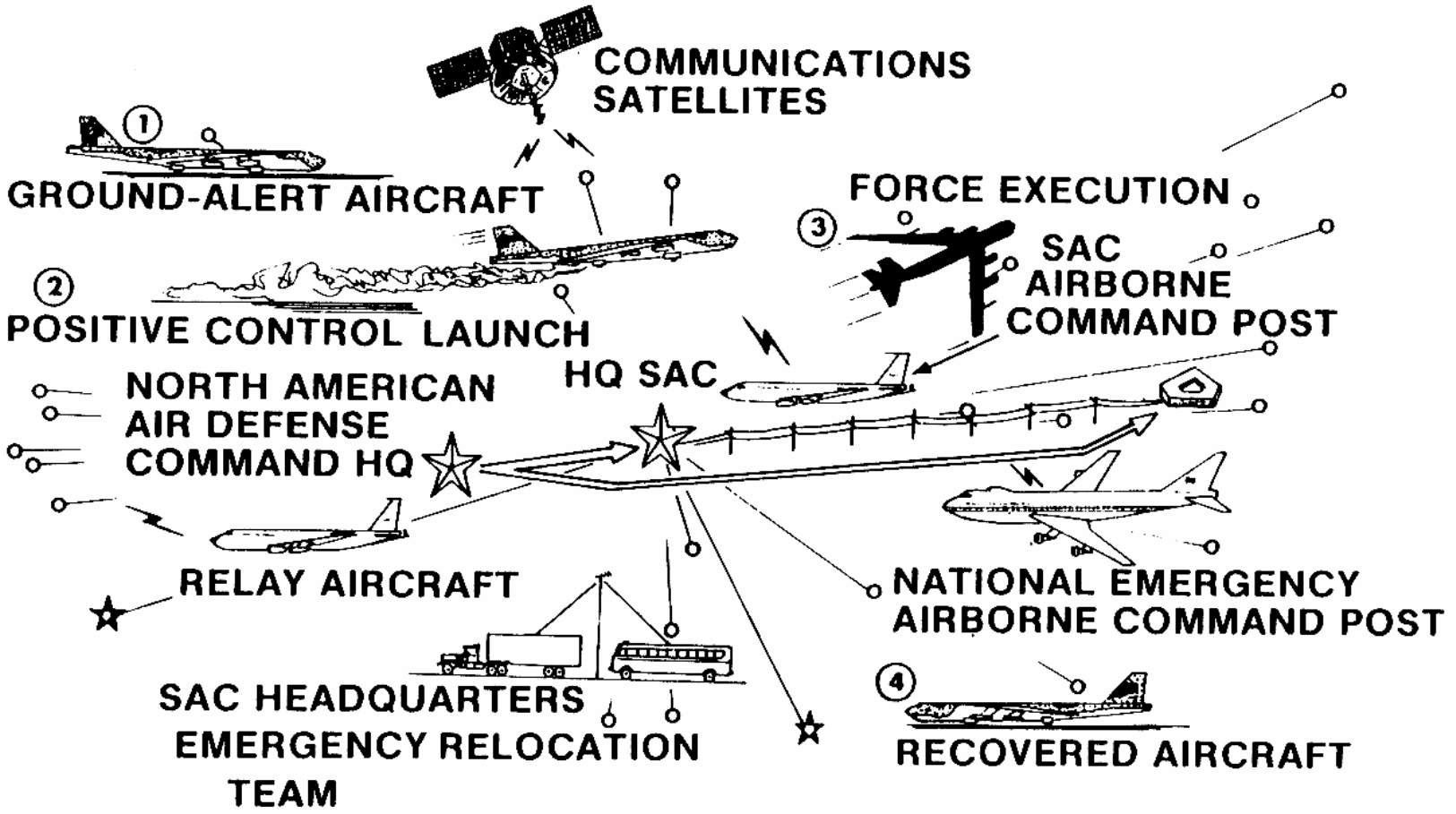

Figure 16. Connectivity to the Bombers

a relay aircraft called the TACAMO — that means, "Take charge and move out." Kind of a good acronym. Satellite communications to our submarines (figure 17) — very low frequency, broadcast and so on.

We will be improving the VLF — very low frequency — communications to the SAC bomber fleet (figure 18) to ensure their reception of orders to continue on course, turn back or whatever, and that will complement their UHF and other modes of transmission. Communications to the deployed submarines are being improved as part of the program. I think you know about the small ELF program, which is important in the pre-hostilities stage, in part as a bellringer so that if that transmission stops, they know they are to go someplace else to get orders by some other means.

Communications satellites are very important. The real news in the satellite business, particularly to enhance our survivability, is moving up to the EHF range, which gives us one tremendous bandwidth which can be used for anti-jammer protection even more than it would be used for additional channels. And that's the way we intend to use it, certainly in this system: to improve survivability features that are clearly advisable in the satellite business.

Now, at the other end of the spectrum, in the old messy, dirty war in the theaters, you find, first, the UHF satellite backpack radio, with a small antenna and a soldier in the field operating it. We all say, and we hope it's true, that C^3 is a force multiplier, and multipliers are great if they're bigger than one! These (figure 19) are examples of the army's ground mobile force terminals working with SHF satellites — the DSCS satellite family operates into those kinds of terminals, which you find at division and corps headquarters in the field.

We need to improve some of those tactical systems — make them more survivable, interoperable, enduring, jam-resistant and secure. The first two are the important ones; the other three are really subsets, particularly of the survivability. Let's take interoperability first. Joint message standards — we haven't talked about standards very much. That's a very important area. It's not a high-dollar hardware or software program (well, in a sense it is a software program). You've got to have uniformity in the standards for things we're going to interoperate together, if they're going to survive, if we're going to be able to patch them back together in different ways when they are disrupted. And they *are* going to be disrupted — pieces are going to be destroyed, we know that, particularly in the theater systems. If the operations computer is destroyed you have to be able to take a system that was doing the intelligence job and begin to do both the operations and the intelligence job on it — and vice versa. You can't do that without standardization.

So standardization is absolutely essential. It cost us about sixty million dollars and six years to get the air defense systems of the Army, Navy and Air Force working together, but they did it. When you take the AWACS aircraft anywhere in the world and connect it to a Navy ship, it works like a charm right now. And the same thing to the Army's missile command centers. But we have to do that over a much broader spectrum, with operations and intelligence and so on, and the program will be through its first phase by about 1986 — we work on all those things.

We make sure that people are using the same languages. There's nothing more important than starting with the data elements. What do we mean when we say "tank?" Tank means a lot of things. If it's looked at by a radar, it's something that's got some track modulation on the radar signal. If it's looked at by infrared it's something that's got a hotspot or a hot thing sticking out the front end of it. If it's looked at by the man who's in it, it's the difference between an M60-A1 and an A-3. And so on. When you tell a computer "tank," you've got to know which one of those is saying tank. It makes a lot of difference. It may or may not be a tank, it may be a field artillery piece or something else. It's a function of the kind of sensor reporting. Here (figure 20) is one of the Army missiles for which it's obvious you've got to have very tight command and control standards.

The world of high frequency, as a matter of survivability, is coming back (figure 21). The services almost stopped their high frequency radio programs in the past — they thought they were going over to satellites. We have seen that that is not the way to go. There are now active programs that are being coordinated so they will all interoperate with each other and can be used together, and I can promise you that this is a very important area. The real-time sounders let us watch the ionosphere and know exactly where it is; those have made a dramatic improvement in performance. High frequency radio: for example, in the 18th Airborne Corps at Fort Bragg, they used to get only about half their calls through the first time on HF radio. Using ionospheric sounders we get 98 percent call completion satisfaction, first time.

Fiber optics (figure 22) is a tremendous improvement area. It has a lot of advantages, not the least of which is mobility. You don't tend to think of plain fiber

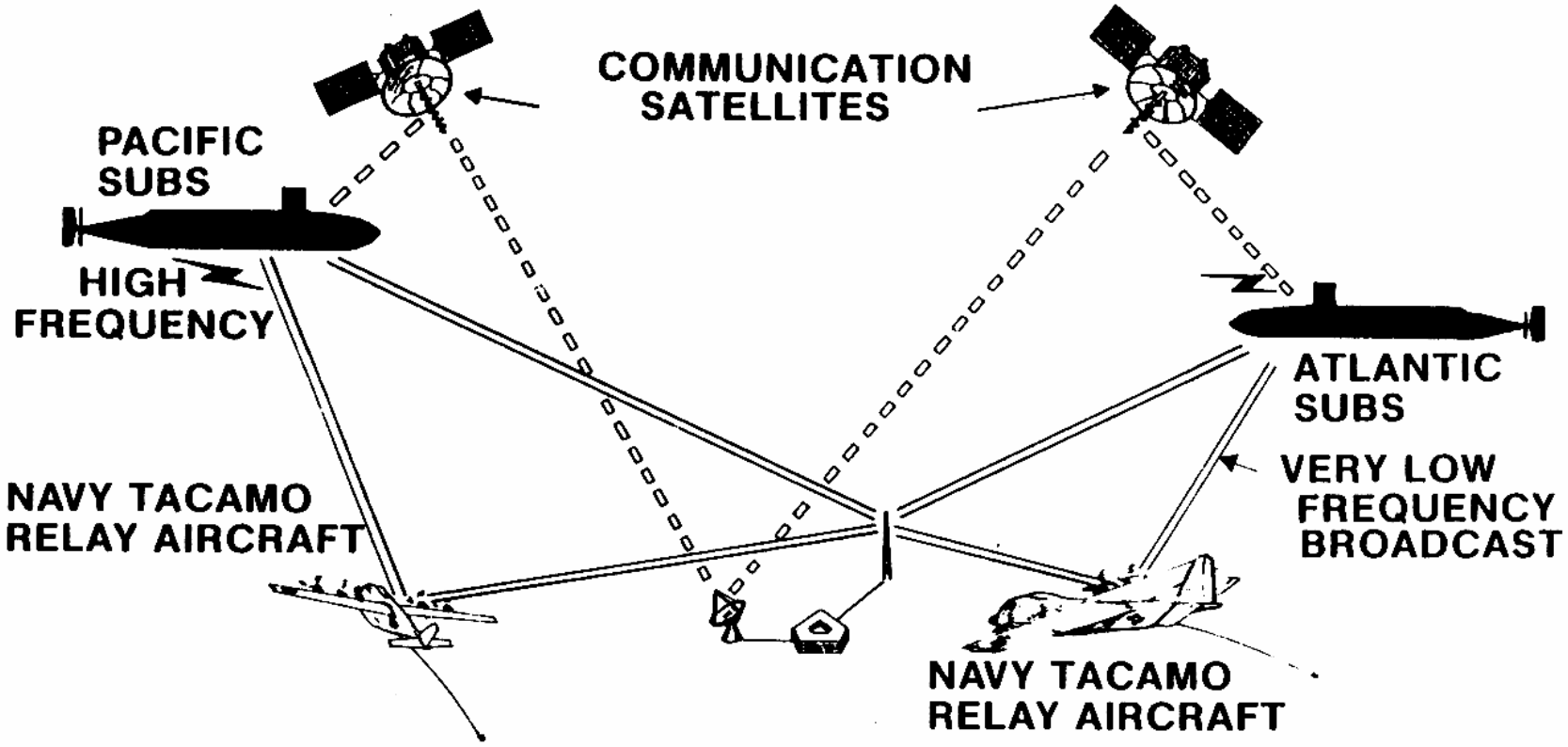

Figure 17. Connectivity to Missile Submarines

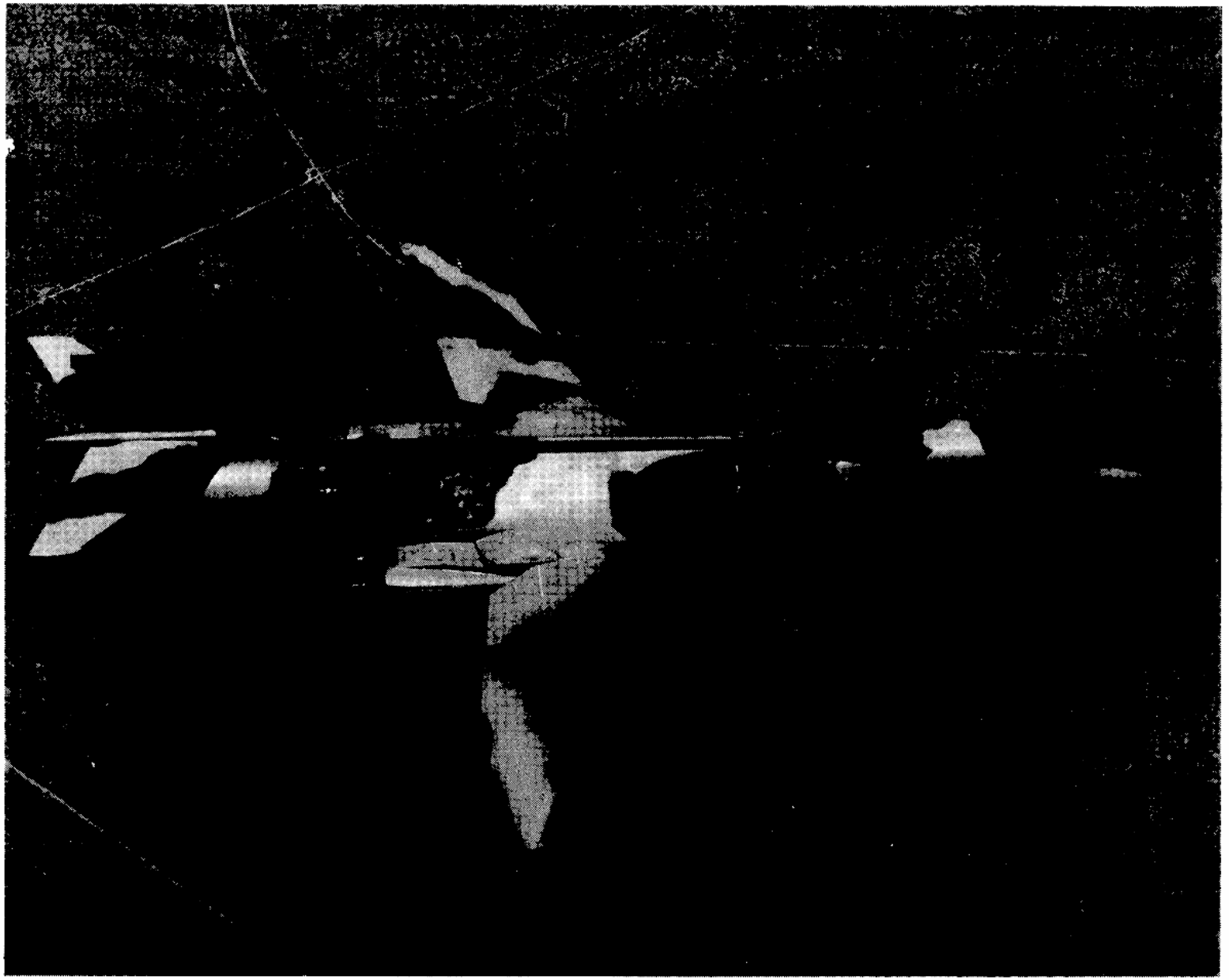

Figure 18. Strategic Air Command B-1 Bomber

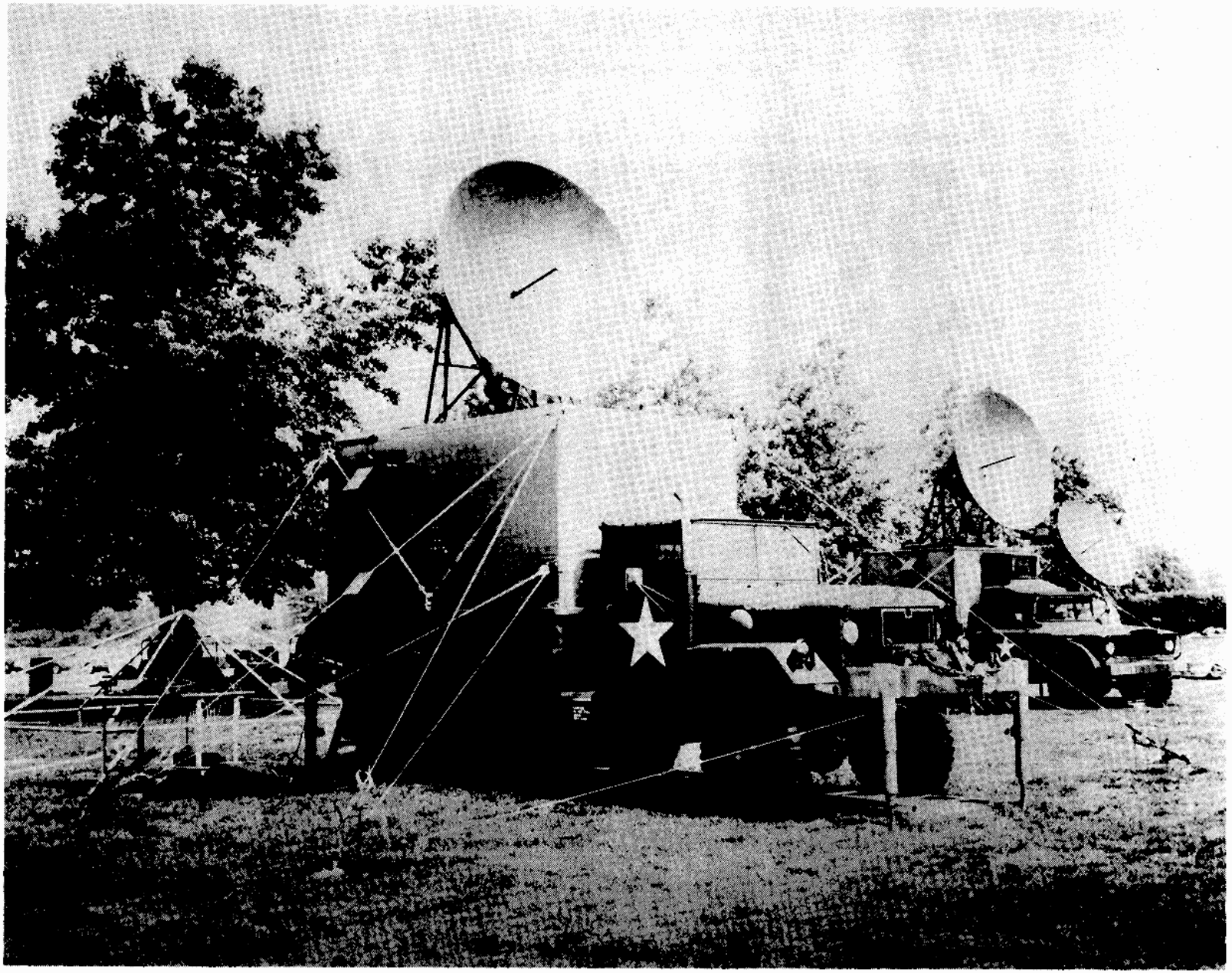

Figure 19. Army Ground Mobile Terminals (TSC-86 and -85, MSC-59)

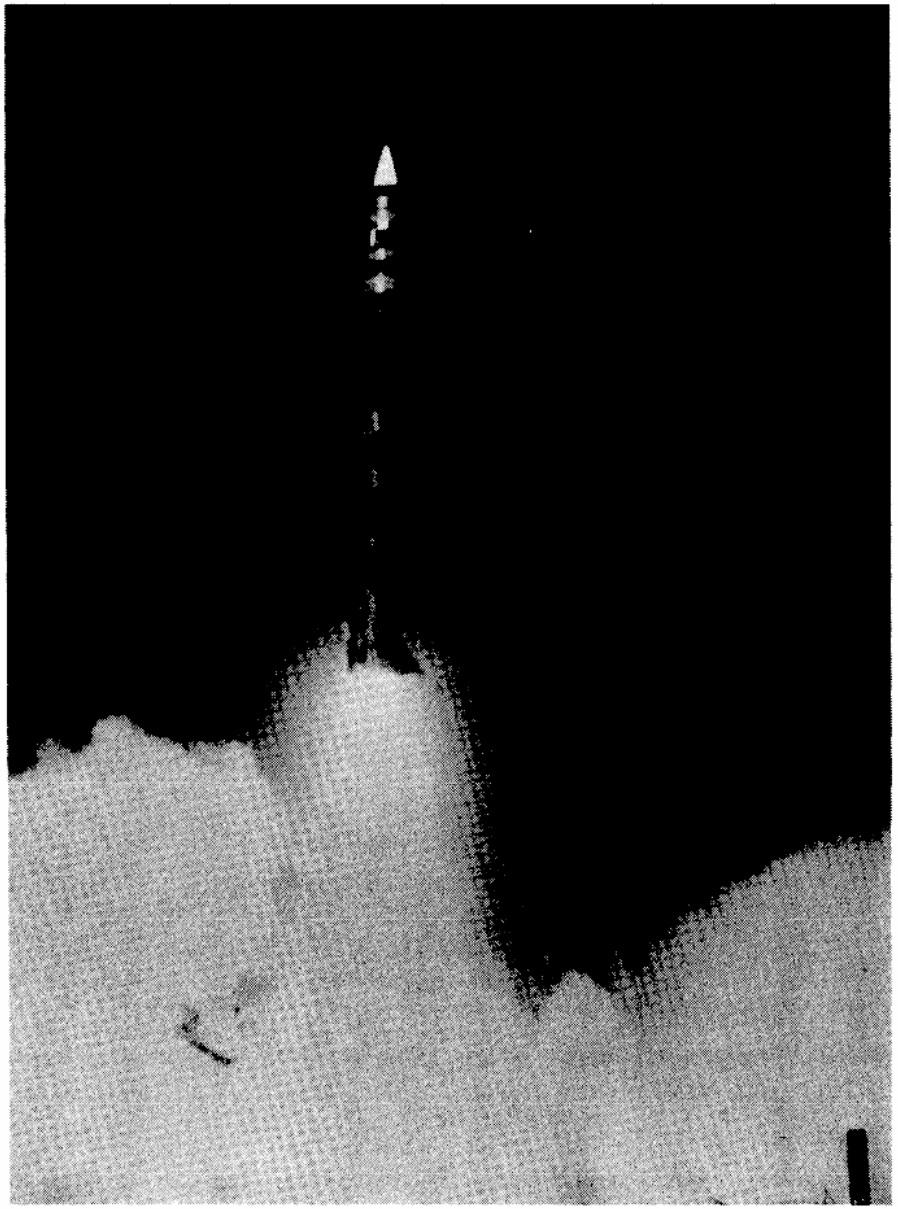

Figure 20. Pershing Missile

ARMY OBJECTIVE HF RADIO	NAVY HIGH FREQUENCY IMPROVEMENT PROGRAM	AIR FORCE MODERN MODULAR RADIO
COMPACT (MANPACK & VEHICLE)	AIRCRAFT TRANSCEIVER/ GROUND STATION	AIRCRAFT TRANSCEIVER/ GROUND STATION
ANTI-JAM (A/J) FREQUENCY HOP (FH) OPTION	A/J FH OPTION	A/J FH OPTION
ROBUST MODULATION/ERROR CORRECTION CODING	ROBUST MODULATION/ERROR CORRECTION CODING	ROBUST MODULATION/ERROR CORRECTION CODING
EXTENSION TO VHF OPTION (NUCLEAR ENVIRONMENT)	EXTENSION TO VHF OPTION	EXTENSION TO VHF OPTION
STEERABLE NULL ANTENNAS		
	STRATEGIC MODULES PLANNED	STRATEGIC MODULES PLANNED
		SELECTIVE CALLING/ADDRESSING

Figure 21. Objectives of High Frequency Programs

CAPABILITES:

4-5 KM
26 CHANNELS

ADVANTAGES:

1. 20:1 WEIGHT REDUCTION
2. 7:1 SIZE REDUCTION
3. EMP AND RFI IMMUNITY
4. INCREASED SYSTEM CAPABILITY
5. CABLE ASSEMBLIES COMMON TO LONG HAUL SYSTEM
6. GROWTH CAPABILITY
7. BANDWIDTH
8. LOW TRANSMISSION LOSS
9. COST
10. NO ELECTRICAL GROUND OR SHORT PROBLEMS

Figure 22. Fiber Optics for Command, Control and Communications Systems

optics as being mobile, but look at its weight reduction. The metal cables in the Air Force 407L Tactical Air Control System take about twelve C-130 aircraft loads to transport, one system. It would take about one load with fiber optics, and that's a lot cheaper than buying eleven more C-130s. So fiber optics means less trucks, less truck drivers, less mechanics taking care of the trucks, less cooks cooking for mechanics, and so on. You add that up, it's a magnificent improvement in both mobility and capability, a manpower saving, and a saving in cost as well. Huge bandwidth, relatively secure, a little bit harder to tap than conventional wire lines. It can be tapped, but it's not as simple; it takes a pretty sophisticated fellow to get into a fiber optic cable. It is a lot less vulnerable, it's TEMPEST-proof, EMP-proof, and it's got a lot of dramatically improved capabilities. And just as rapidly as possible we're putting in fiber optic systems. You know — two things are happening. We're getting almost unlimited computer memory, so that memory capacity is almost free, and we're getting very wide-bandwidth systems to carry things.

Millimeter wave radios (figure 23) have dramatic possibilities. A typical millimeter wave radio looks like a 35-millimeter camera, and is just about as easy to handle. It's got about a two-degree beamwidth, so you can point it in the direction you want to talk to and get to anything within about four kilometers without laying any cable in between. This (figure 24) is a small sample of thirty-two communities that I deal with in the NATO arena. Alliance warfare is not easy, especially when you want to work system problems. Since the creation of the directorate, one of the accomplishments of which I'm resonably proud is that we have become the one point of contact, of approval, for all the positions from U.S. representatives, all the military side of that combination of committees — about half of those thirty-two.

The others are the responsibility of Don Latham, Deputy Undersecretary of Defense for C^3I in USDR&E, to coordinate. And so for the first time the U.S. is speaking with one instead of many voices in the NATO arena, and it is making a great deal of difference.

The ships in the Indian Ocean, I think, are worth looking at (figure 25). They stand for crises — and if you just count the number of crises we've been involved in during the last couple of years (figure 26), I don't know where that curve tells you we're going, but the world is not a very happy place these days. The only good news on that is that, as I've been saying, our communications have worked extremely well in those crises... the Gulf of Sidra, we had top-notch communications for everybody involved in that, and so on. But it's a continuous demand.

These are some of the people who help us do that (figure 27) — the joint communications support element that belongs to the J3 and myself. They are some of the best communicators in the world, and they are ready to go anyplace, and support any of our commands that get into trouble and need additional, immediate support. They have airborne equipment and they have airborne command posts that can fly into a crisis area where there is no command post. My last slide (figure 28) you'll want to see, I think. This is what our CINCs say.

Oettinger. That's a remarkable change over the last two years.

Dickinson. Yes. It really is.

Oettinger. I think part of the answer is that, for top-level activity to take place, that particular state of consciousness has to be reached by some of the folks who are presumably served by C^3.

CHOICES:

- FREQUENCY BANDS PROPOSED 36-40 GHz (MCPR)
  54-58 GHz (MISR)
- RANGE 36-40 GHz > 54-58 GHz
- COVERTNESS 36-40 GHz < 54-58 GHz
- ANTENNA

36-40 GHz DIRECTIONAL • LOW PROBABILITY OF INTERCEPT

54-58 GHz DIRECTIONAL • MAXIMIZE COVERTNESS OMNI • COVERT MIMI NET

- FREQUENCY TUNING

36-40 GHz/54-58 GHz - SELECTABLE/PLANNED • ADAPTIVE

54-58 GHz TUNING • MINIMIZE OVERSHOOT

SYSTEM "TAILORING" TO MATCH USER REQUIREMENT

Figure 23. Features of Army Millimeter Wave Radio Family

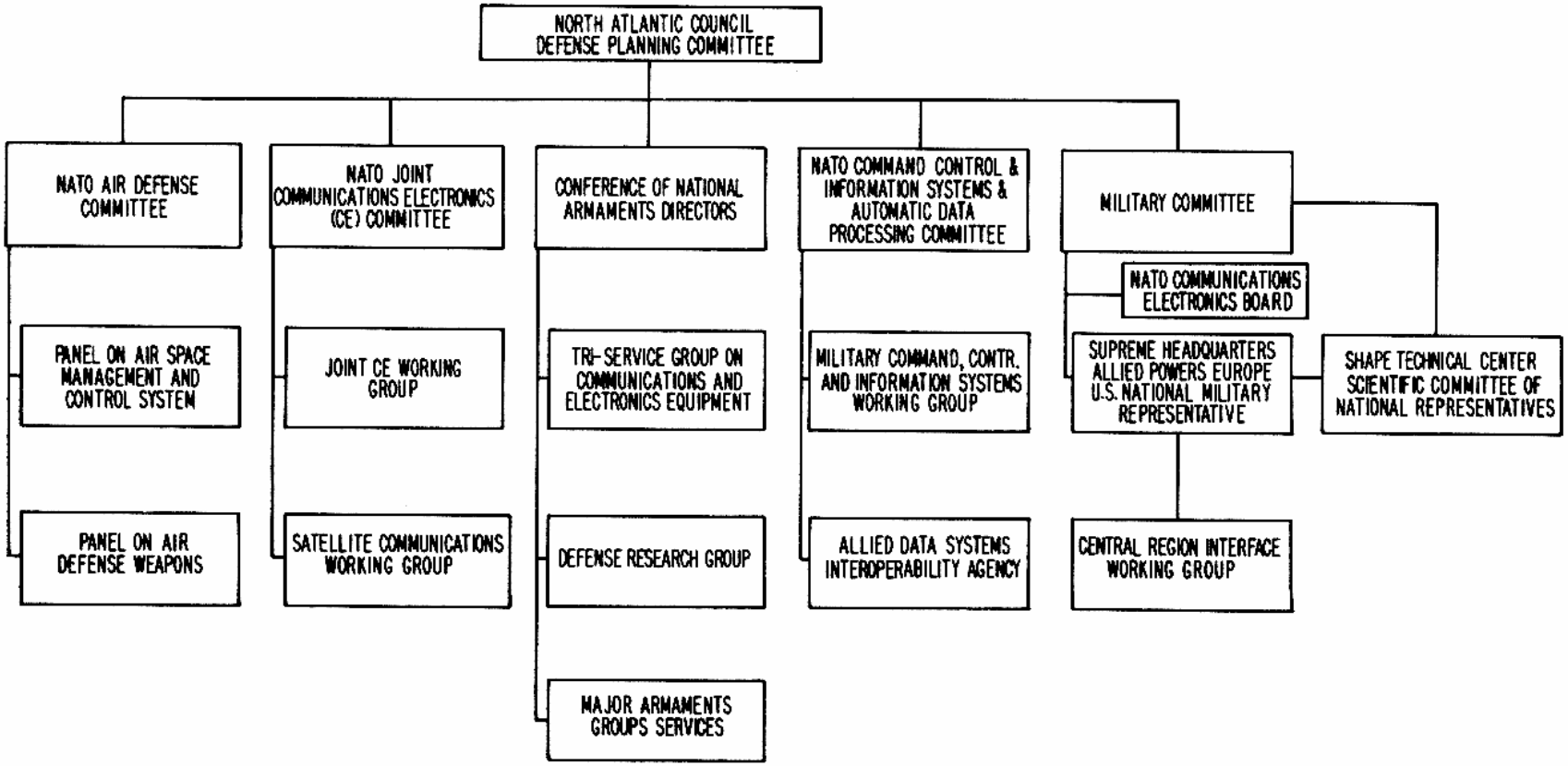

Figure 24. NATO Command, Control and Communications Committees

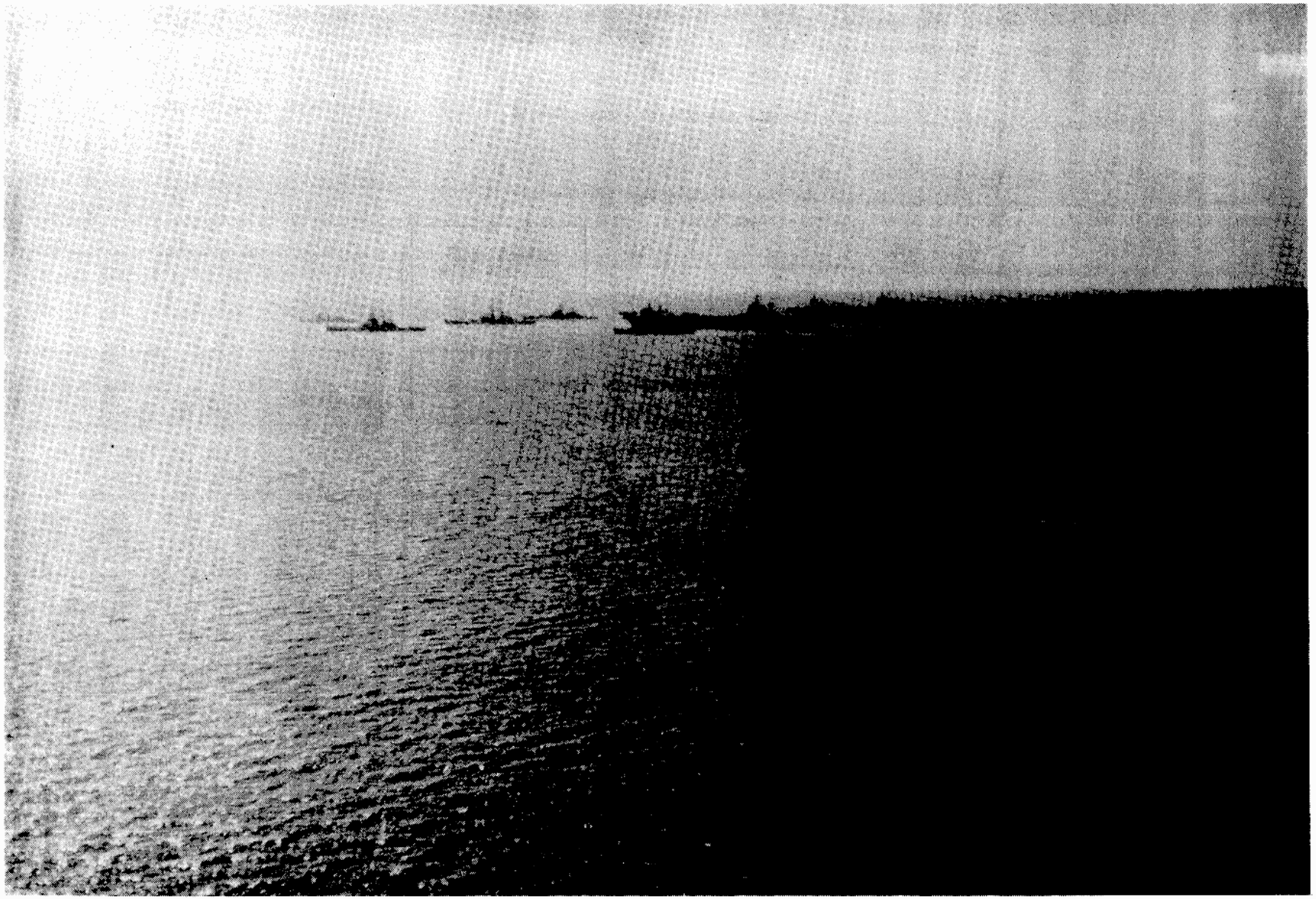

Figure 25. Ships in the Indian Ocean

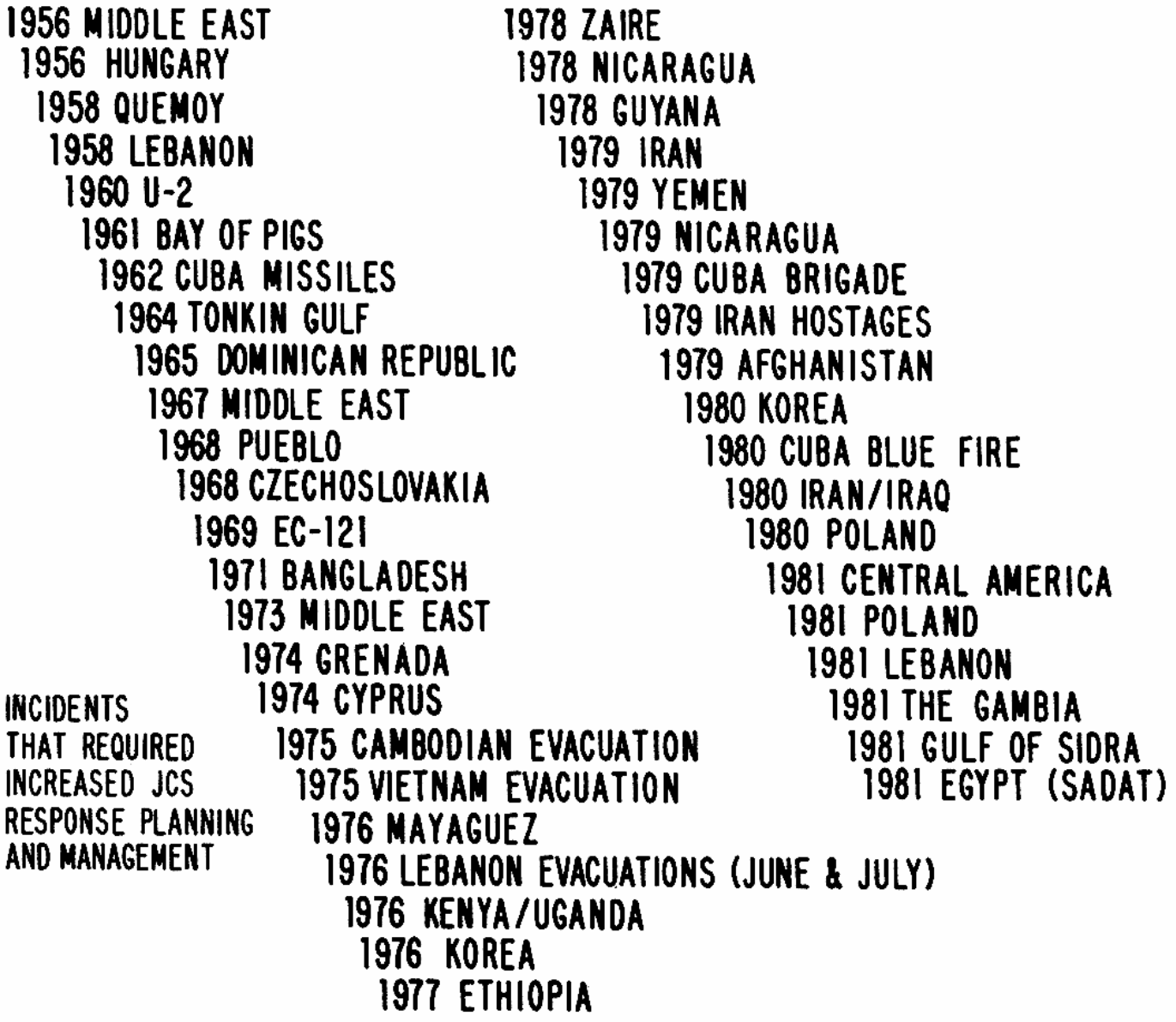

Figure 26. Notable US Crises

Figure 27. Joint Communications Support Element Communication Team

"IT IS APPARENT THAT IN MANY CASES THE BENEFIT GAINED FROM ADDITIONAL DOLLARS COMMITTED TOWARD C3 PROGRAMS IN THE BUDGET CAN FAR OUTWEIGH MONEY SPENT ON OTHER PROGRAMS."

"C3 SYSTEMS MUST BE MODERNIZED BECAUSE A WEAPON SYSTEM WITHOUT EFFECTIVE COMMUNICATIONS IS IMPOTENT."

"ONE OF MY HIGHEST PRIORITIES IS TO MAKE SIGNIFICANT IMPROVEMENTS IN OUR COMMAND AND CONTROL SYSTEMS."

"ONE OF MY MOST SERIOUS PROBLEMS IS THE VULNERABILITY OF THE DEFENSE COMMUNICATIONS SYSTEM."

"OUR ALLIES NEED MORE ANTITANK, AIR DEFENSE, AND COMMAND AND CONTROL SYSTEMS. THEY ALSO NEED A SECURE CAPABILITY SO THEY CAN LINK THEIR COMMAND AND CONTROL COMMUNICATIONS WITH OUR OWN"

Figure 28. Statements by Commanders-in-Chief on Priority of Command, Control and Communications