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**Seminar on Command, Control,
Communications, and Intelligence**

**The National Defense University's
Command and Control Program
Gregory D. Foster**

Guest Presentations, Spring 1987

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The National Defense University's Command and Control Program

Gregory D. Foster

Dr. Foster, a former Army officer, is a Senior Fellow with the Institute for National Strategic Studies, National Defense University. Until recently, he was the first director of the university's Command and Control Research Program, a capacity in which he sought, through a variety of research, publishing, and educational initiatives, to focus the attention of the national security community on a reconceptualization of command and control. Dr. Foster previously served as Director of Research and Manager of Washington Operations for the Foreign Policy Research Institute, and before that as Director of the Center for Security and Policy Studies, Science Applications, Inc. He is co-author, with Adam Yarmolinsky, of Paradoxes of Power: The Military Establishment in the Eighties; his most recent book, The Strategic Dimension of Military Manpower, co-edited with Alan Ned Sabrosky and William J. Taylor, Jr., was published in 1987.

Oettinger: I'd like to say a brief word before turning it over to our guest. You have his biography and are aware that he is currently a Senior Fellow at the Institute for National Strategic Studies at NDU (National Defense University). He may want to say some things from that vantage point, but what we'd like to hear about is his slightly early incarnation as the first director of NDU's Command and Control Research Program, which is where we got to know him. We invited him to start off because we hoped that he might share with us some of his views on the command and control concept, not in some abstract or very philosophic sense, though that may have a place in it, but in a practical way: Why would the National Defense University create such a center, or why would it then fold it into something else not so long after creating it? These are some of the thoughts that he might share with us, but, of course, be free to go into any number of other directions about things that interest you.

Foster: I am very pleased to join you today. I can take this discussion in any of a number of directions. I have provided each of you a handout of vignettes that go beyond just my experience as the

director of the Command and Control Research Program at the National Defense University. However, if you want discussion of that experience, of how that program came into being, and of what my goals and objectives were in that program, I am perfectly willing to concentrate on that. The last sheet that you have in your handout (appendix A) is the charter for the Command and Control Research Program. What I thought might be useful, since I didn't know how practical or theoretical you were prepared to get in this seminar, was to give you one person's perspective of "the state of C³" theory and research (figure 1), and then to branch off to give you my conception of where I think we should be focusing our efforts and where command and control should properly fit in the context of broader concerns of strategy and culture. If you have a preference, speak now or forever hold your peace. If you would rather start by talking about some more practical, bureaucratic, and political questions, I'm perfectly willing to do that.

Student: My only question is, why do you divorce "C³" from "I"? In recent times there has been a lot of effort to join the disparate functions,

- **Communications (rather than C³).**
- **Technology (rather than essence).**
- **Military (rather than civil-military).**
- **War fighting (rather than conflict management).**
- **Tactical conventional and strategic nuclear (rather than the entire conflict spectrum).**
- **Uniservice vs. Joint? National vs. Alliance?**

Figure 1. The State of C³

and here it seems that there's been a deliberate breakoff in intelligence functions.

Foster: That reflects my bias. I don't think that my point of view necessarily reflects the prevailing view in the larger national security community. My focus in directing the Command and Control Research Program and in continuing my own command and control-related studies and investigations is that we should be focusing our emphasis on the first two "Cs" of C³I. I view communications and intelligence, although vital functions to be performed, as essentially residuals — instrumentalities that should support command, or what has come to be called command and control. Bureaucratically, there still is a heavy focus within the national security community on integrating those functions. In fact, you may have entertained other speakers who would oppose my point of view. Is there something behind your question? Do you have a sense that there is a move afoot to divorce the two?

Student: No, as a matter of fact, I thought that the trend was more to get it back together. There was a time when it was only C² and then C³ came along, and it seemed the evolution was one of always adding on as opposed to this recent divorce.

Foster: In fact, that was one of the points that I wanted to address. A little piece appeared in *Army* magazine about a year ago, a tongue-in-cheek piece, but nonetheless very cogent. As the author sees it, we have gone from what in traditional terms was command, to the point where we now have reached a pinnacle of what he calls C²⁷E — the E

standing for etc.* This underscores one of my points: In the course of trying to integrate and adapt all the different functions that support the exercise of authority, we have tended, regrettably, to lose sight of the underlying principles behind *command*, and that's where we should be focusing our efforts.

Oettinger: Let me stake out, for the sake of argument, a personal predilection not to be regarded as the management's, and then perhaps permit you to answer. I'll stake it out, partly to give you a foil to attack. My view, like John's, slices the salami somewhere between you and that C²⁷E. We would agree with you that "communications" is purely instrumental, and somehow doesn't belong in there, because it's a tool. Command and control are functions. They're independent of time, etc., etc., and there are lots of instrumentalities. Let's not confuse instrumentalities with necessary functions.

We're inclined to have intelligence in there because the notion of exercising command and control in a vacuum doesn't make terribly much sense. The environment and your knowledge of the environment, which is what to me "intelligence" means, is distinct from any technical process. It strikes me as kind of intrinsic, and so I tend to think of intelligence and command and control as the bundle. I would simply put that on the table as you go through this.

Foster: It's a legitimate argument, and there is nothing sufficiently compelling about my bias to negate that. I think it's an equally legitimate point of view. But we typically don't question why we

*Greg Todd, "C₁ Catharsis," *Army*, February 1986, p. 14.

need intelligence; we simply accept it as a necessity. My perspective is that the reason we need intelligence is because our "system," however defined, cannot respond quickly and effectively enough to the uncertainty inherent in the environment. If you have a system that, in a cybernetic sense, can respond to a turbulent environment effectively and quickly, your need for intelligence is diminished appreciably. But, when you have a system — a political system or a particular type of organization — that, for whatever reasons, cannot respond quickly and effectively enough to environmental turbulence, then you have a far greater dependence on intelligence. Intelligence provides a mechanism for coping with uncertainty and accommodating the systemic constraints that keep you from dealing with the situation better.

Student: I would also submit another reason for the bundling of intelligence with command and control is that intelligence needs to know what the commander needs to know in order to be effective with the plethora of information that's collected by the modern technology that intelligence handles. It's almost overwhelming. Unless you can focus and handle the essentials that the commander needs to know, a lot of intelligence effort, I think, is wasted. So, you need to direct a feedback loop with command to know what's going on.

Foster: I agree. In fact, that is a variation on a broader theme that I have attempted to deal with here: the relationship between researchers and practitioners, or policymakers. You see this sort of phenomenon in the relationship between the intelligence community and the policymaking community, for example. There is an expectation on the part of the intelligence community that policymakers will naturally be able to formulate the right types of questions, requirements, or needs to allow intelligence managers to devote their efforts to particular types of collection. On the other hand, there is legitimate cause for concern that policymakers actually are not equipped to do so.

When I was a consultant several years back, I worked on a study for the intelligence community staff. We did an input/output analysis in which we attempted to assess the productivity of the various elements of the intelligence community, relative to established intelligence requirements. We quickly learned that day-to-day intelligence collection and analysis deals with the real world, with real-time things. Annual intelligence requirements — once upon a time called Key Intelligence Questions; they're called something else now — lag well be-

hind the dynamics of the real-world intelligence process. In fact, they have very little impact on actual collection and analysis. That is a long-winded reinforcement of your point. I agree that there is a critical need for intelligence-command feedback. The difficulty is creating an environment in which such feedback works effectively because, typically, at the risk of over-generalizing, policymakers don't know how to ask the right questions.

Student: It's not so much the questions. I agree with you wholeheartedly. They have a hard time generating the questions, but if they share their objectives in a particular situation with either the tactical or the strategic intelligence people, sometimes they can help, because they are more familiar with the collection systems available.

Foster: I agree. Playing on this particular theme, there has been under way for some time now a study out of Fort Leavenworth. I'm not sure if it's the Army Research Institute's field unit at Fort Leavenworth, or a part of the Army's Command and General Staff College itself, but they did an initial survey of division and corps commanders to try to ascertain their information needs in a typical scenario — I presume the normal Central European one. As I understand it, there is a follow-on effort looking at the army-group level to ascertain commanders' information needs. Methodologically, I'm not sure whether they've taken the best approach — it has been pretty much a survey effort — but the intent I think is good: to sit down with real-world commanders, past and present, and get a sense of what they think their information needs are and to mold that into something useful.

I think what I'll do, in the interest of time, is to trip through this, just so you get the general sense of what my thinking was. Then, to the extent that you want me to elaborate on particular points, I'll be glad to. My basic intent was to give you a sense of where I think command and control theory and research are going, and to suggest where we should be focusing our efforts. Then I'll try to nest my concept of command, or command and control, in a broader context.

Basically, as I see it, C³ has tended to emphasize communications far more than the first two "Cs" in C³. The focus of the community, as you no doubt well know, tends to be on technological fixes to command-related problems rather than what I would call the *essence* of command. The focus, almost without exception, is on military concerns, with more than a little neglect of the civil-military connection. Over lunch we got into talking about the

Federal Emergency Management Agency, for example, and the crucial role it plays in the larger scheme of emergency management. I think there is something of a disconnect there. That doesn't suggest that there aren't technological issues afoot that are designed to equip the civil side of emergency management with the right technologies, but it does suggest that the very nature of the proper relationships that do and should exist between the civil and the military side of our command structure leaves something to be desired.

Student: Very often the civilian people probably have better communications than do the military. You look at our PPBS (Planning, Programming, and Budgeting System) program and how long it takes to get something implemented, but at the same time the interface is really what the key and the essence are. It's not so much what the systems are but the fact that they will interface with one another.

Foster: Are you talking about under normal routine conditions, or are you talking about in an emergency?

Student: Under normal routine conditions.

Foster: I think the situation differs materially in preparing for emergency or crisis situations, where there remains a great deal to be desired.

McLaughlin: Let me clarify. You're saying in an emergency situation the military is better equipped? I guess I would argue that civilian agencies have PPBS, too. I would not draw a huge distinction about the speed of bringing new systems online between most civilian agencies and most military agencies. Maybe you would like to disagree with that.

Foster: No, I was just trying to clarify the fundamental point.

Student: I'd be interested in knowing what your point of view is on civil agency procurement. Is it as arduous or as difficult as military PPBS is, if not more so?

Foster: Yes, my impression is, very definitely so.

Let me just touch on these last few points quickly so that we can move ahead. My perspective is that the C³ community's focus, in addition to being principally military in nature, has also been on war fighting rather than on the broader rubric of conflict management — that is, the entire spectrum of situations with which our national security establishment has to deal. I think we place quite a bit of emphasis on C³ at the tactical conventional and strategic nuclear levels, but there's a big gap in between. There are other levels of conflict that I don't think have been adequately accommodated.

Finally, there also are major unresolved questions concerning single-service versus joint- or multi-service activities and U.S. versus alliance C³. There is recognition throughout the community that (a) there are needs that have not yet been met, and (b) there are important things we have yet to do. We still have a long way to go, so that's why I merely wrote those off as question marks.

Specifically, with regard to research on the subject (figure 2), for the most part the research part of the community has tended to be either too basic or too applied. There's a part of the C³ research community that does good, basic research, and I guess there you have to ask the question, "Can you even do basic research in an applied context such as command and control?" That's kind of a moot issue that I won't attempt to wrestle with here. Then, at the other extreme, you have other research activities that are so applied that, in essence, they lose sight of some of the underlying conceptual issues that need to be addressed.

- Too basic or too applied (method over substance or substance without method).
- Undisciplinary fragmentation.
- Predominance of mathematicians, physicists, and "wireheads."

Figure 2. The State of C³ Research

Oettinger: Can you say a word about the universe for which that is true? You said you were there, and then let some contracts. Are you talking about academics? Are you talking about civilian or academic, including the NDU and the war colleges? Are you talking about the services? The contracts? What's the universe?

Foster: Well, the universe I was talking about encompassed virtually all of those. Let me point out that the program I headed at the National Defense University was part of an interservice group called the Basic Research Group, which came under an entity called the Joint Directors of Laboratories. My regular interaction tended to be with organizations that claimed they were doing basic research. It was not with those other laboratories, developmental organizations, systems commands and even academic institutions that are doing research related to C³, but in a very applied sense. So my broad sweeping statement was meant to apply to the entire universe, if you will. I guess what's implicit in this perspective is a point I will make later: that we need to forge more of a convergence between basic and applied research, because there are underlying conceptual issues that need to be grappled with more effectively by the practitioner community that tends to focus its efforts on applied research. At the same time, there is a continuing need, although this flies in the face perhaps of the traditionalist conception of research, to make that research more relevant to the practitioner community. How you do that is a neat trick.

I think there are in this field, as in other fields, a lot of barriers that continue to exist between different disciplines. For the most part, we have far more mathematicians, physicists, and what I have pejoratively labeled as "wireheads" doing C³-related research. Although there are some parts of the human resources or behavioral sciences community doing command and control-related research, it's pretty limited. And never the twain shall meet. Typically, the two parties don't talk to each other.

In a large sense, this reflects bureaucratic organizational patterns and missions, because there are developmental laboratories, such as the Army's Communications-Electronics Command, Rome Air Development Center, and the Naval Ocean Systems Center, that tend to be populated by mathematicians and physicists. On the other hand, you have the human resources labs — the Army Research Institute, the Air Force Human Resources Laboratory, the Navy Personnel Research and Development Center. These are labs that, in more modest fashion,

deal with some aspects of command and control. Again, though, the two communities hardly talk to one another. Perhaps the rare exception is where they are collocated, as in the case of the Naval Ocean Systems Center and the Navy Personnel Research and Development Center. They have some dialogue because they are located just down the road from each other. But, for the most part, this tends to be all too rare. This is problematical and needs to be rectified.

Student: I suspect that's very true in other areas as well.

Foster: It certainly is.

Student: Automotive tank technology, for example, has not taken into consideration the needs of troops and that sort of thing. There's much more of that going on now. I see that in a lot of systems where the human factor is critical, especially when it comes to a human accepting high technology types of systems. Some of that research is being done after the fact, after the systems have been put in the field.

Foster: That is correct. It's not endemic to the command and control arena. I didn't even mean to suggest that. It's pandemic, it manifests itself in a variety of fashions. There also continues to be a great deal of definitional ambiguity (figure 3). I offer the statement by Plato as an underlying justification of why it's important to grapple with these definitional issues. We all know that, if we allowed ourselves to, we could get bogged down interminably in definitional arguments and never get anything done. Be that as it may, if we are to achieve some kind of unity of perspective on what command and control is and where it properly fits into the larger scheme of things, we need to wrestle with these questions. The short article I have provided you (appendix A) really makes the case in spades. There is, again, this continuing argument of whether command and control is a function, a process, a system, or all three. I think most of us intuitively would be inclined to say it's some combination. Yet, there is no total agreement throughout the community that this is the case. That's something that really needs to be resolved. There is a tendency to fall back on the Joint Chiefs of Staff definition as being perhaps the best available. Because it says many things yet doesn't say other things, we ought to give it a re-look.

I've labeled my next chart (figure 4) "A Conceptual Potpourri." All this is designed to do is reinforce the argument further by pointing out to you that there are a number of popular, basic, concep-

- **Plato: “How can a man understand the name of anything, when he does not know the nature of it?”**
- **One C or many (C, C², C³, C³I, ... C²⁷ E)?**
- **Function, process, and/or system?**
- **The ol’ JCS fallback:
Command and Control: “The exercise of authority and direction by a properly designated commander over assigned forces in the accomplishment of the mission.”**

Figure 3. Definitional Ambiguity

- **Boyd’s O-O-D-A Loop (Observation-Orient-Decision-Action).**
- **The S-H-O-R Model (Sense-Hypothesize-Options-Response).**
- **The Lawson Model (Sense-Process-Compare-Decide-Act).**
- **The Mors Model (Sense-Assess-Generate-Select-Plan-Direct).**
- **Choose Another (see Appendix A).**

Figure 4. A Conceptual Potpourri

tual models of how the C^2 or the C^3 , or the C^3I process works. All of these models have a certain following, yet none is sufficiently different or compelling that it commands any kind of consensus throughout the community. That's significant if what you want to achieve, ultimately, is some degree of commonality and consensus.

Oettinger: Isn't the commonality there in a sense? My difficulty has been trying to figure out what the differences are. They all strike me as restatements of certain obvious central facts, and I usually get bogged down in trying to understand the points of differentiation. I was wondering whether there is not among them a certain amount of hair splitting. There is a consensus among them in a rough-and-ready sort of way and I wonder if the hairs are worth splitting.

Foster: There is indeed a degree of commonality. I guess the question this raises, though, is, if these underlying commonalities do in fact exist, then why do we continue to have competing models? Is it just because someone wants to attach his name to his own model and maybe make a distinction at the margin that is not significant? Or is there enough of a difference of opinion as to exactly what these functions or activities are that there is a need for these competing models? I don't know the answer. But it would seem to me that if, intuitively, we recognize there are underlying commonalities, then the community ought to be able to get together and accept a common model. Maybe that's asking too much. Maybe that in itself is splitting hairs and is not a worthwhile activity. I don't know.

Then I offer for your consideration a sample of an even more elaborate scheme which in essence draws on these same elements. This is a model formulated

by a group of students at the Naval Postgraduate School; if you're interested I can provide you the citation. The point here, though, is that community-wide, there are some differences of perspective as to exactly what is incorporated in this process that we ought to come to grips with more forcefully and more directly.

I will not elaborate on the next couple of charts. I merely wanted to point out that, at least within that part of the community that attempts to focus on the basic research side of command and control, there is a great deal of attraction for technique. We see this in other fields of endeavor as well (figure 5). There have been attempts to use Markovian analysis, catastrophe theory, and fuzzy sets as a basis for trying to come to grips with underlying relationships and processes. I mention this because I think, unfortunately, there is too much attraction for technique and method.

Oettinger: I find this fascinating because, thank God, I wasn't aware that these things existed out there in the command and control context. Historically, every Markovian analysis failed to do very much in the design of computers and in inventory control problems, and so forth and so on. So, the last refuge of the survivors became command and control. Then the fuzzy sets got invented on a rainy day in connection with information storage and retrieval problems, and it didn't do a hell of a lot there. Now it's alive and well in this niche. Petri nets; I remember Grace Hopper popularizing that in the computer area and it never did anything there.

Foster: Petri nets are very popular at MIT (Massachusetts Institute of Technology). In fact, on the next chart (figure 6) note that one of the ongoing

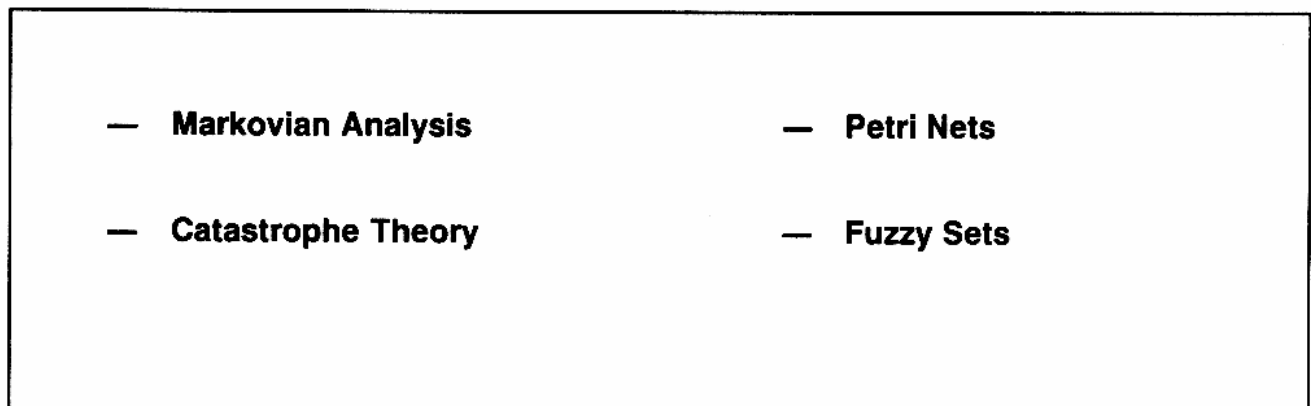


Figure 5. The Allure of Method

efforts to come to grips with a command and control theory — one of the most notable, in fact — is under the direction of Alex Levis of MIT. There have been a number of student research reports using Petri nets as the methodological tool for looking at command and control problems. That is one of the major efforts now under way, funded largely by the Office of Naval Research. I merely wanted to bring that to your attention so that, if you are interested in pursuing some of the more esoteric dimensions of command and control, that is a place where you might plug in to find out what's going on.

Oettinger: Over my dead body!

Foster: In addition, I've used acronyms here rather than complete names. MORS is the Military Operations Research Society, an organization that has been in existence for a number of years. It provides an outlet for ongoing operations research and related activities in the military. Part of MORS has attempted to come up with a conceptual framework for command and control. A group convened in 1984 produced, in January 1985, this document, titled "Command and Control Evaluation Workshop." The report attempts to grapple with some of the definitional problems and offers a conceptual framework that might serve as a basis for unifying thought and action throughout the command and control part of the national security community.

Earlier, I mentioned the Basic Research Group (BRG) of the Joint Directors of Laboratories. In addition to the Command and Control Research Program of the National Defense University, the member organizations of the BRG are the Army's Communications-Electronics Command; Rome Air Development Center, the Air Force representative in the group; the Naval Ocean Systems Center; the Defense Communications Agency; and the Naval Postgraduate School, which has a joint C³ course under the direction of Dr. Mike Sovereign. Sovereign and his people conduct annual command and control experiments — typically involving naval

tactical problems. Thus, although the focus is rather microcosmic, this is the only testbed-like facility that now exists for dealing with command and control hypotheses and formulations.

The last element I mentioned here is followed by four pages of description for you to digest as you see fit (appendix B). HEAT — the Headquarters Effectiveness Assessment Tool — is one of the most useful activities that has been ongoing for some time and continues. Developed by Defense Systems, Incorporated, of McLean, Virginia, HEAT has been used in a number of contexts to evaluate the effectiveness of headquarters groups — commanders and staffs. Although purists who view command and control as a larger system would say that HEAT deals with only one aspect of the problem, I think it has done a better and more effective job of dealing with some of the root command and control issues, formulating and testing hypotheses, and so forth, than anything else currently available. I view it as being so useful because, while it employs a structured, systematic approach that those with a scientific bent can accept, it also is understandable and meaningful enough to practitioners that it does not lose its value. In contrast, these other efforts I have mentioned are largely divorced from the practitioner community and, thus, have had very little impact.

Student: Is this very different from the Army's ongoing ORSA program: Operations Research and Systems Analysis?

Foster: Yes, this is totally different. The Army has an ORSA career specialty. The individuals involved go to school to get degrees in operations research or operations analysis, and then they serve a utilization tour in any of a variety of capacities to employ the skills they have acquired. That is a career path, if you will.

Student: What I was asking is, what do they do? I know in some cases, they go to organizations that perform functions such as this.

— Alex Levis/MIT

— BRG/JDL

— MORS
(Military Operations Research Society)

— Heat (DSI)
(see Appendix B)

Figure 6. Ongoing Efforts of Note

Foster: I think maybe what you have in mind is the Army's organizational effectiveness program, which is different from ORSA as a set of skills or a discipline. Some years back the Army created an organizational effectiveness program. OE and OD, Organizational Effectiveness and Organizational Development, were big items at the time, and the Army created organizational effectiveness staff officers who served in virtually all Army units, I guess down even to company level. Now, however, that program, because of funding constraints, turnover among advocates, and a variety of other things, has become more or less moribund. It no longer is quite the going concern it once was.

What that program sought to do, not in any truly structured or experimental fashion, was to provide a focal point for dealing with organizational effectiveness-related questions. There are many variables that the literature would suggest contribute to organizational effectiveness. These staff officers and organizations tried to deal with that in a real-world sense.

HEAT is a totally separate and distinct program, funded for the most part by the Defense Communications Agency and the Naval Postgraduate School. A look at some of the organizations where HEAT has been applied — the SHAPE (Supreme Headquarters, Allied Powers, Europe) Technical Center, Second Fleet Exercises, Naval War College war games, and the Army's Operational Test and Evaluation Agency — indicates that it has been employed in completely different contexts than the organizational effectiveness program.

Oettinger: If I hear you correctly, after hearing your concerns about measuring peacetime bureaucratic or program management behavior, and the connection to war fighting or conflict management, this seems remote. Or am I misinterpreting it?

Foster: No, in point of fact HEAT typically has been used with a wartime scenario, like a command post exercise. The message traffic and the general type and amount of information flow are dealt with in the context of a real wartime situation. That's how it typically has been used.

Going beyond that to this chart (figure 7) I think what we need to do is to ensure, first, that research and theory are tied together more closely in the command and control area and, second, that those two things in turn are related to the experimental component. I like to use a quote from R. D. Laing, who said, "We do not need theories so much as the experience that is the source of the theory. Even facts become fictions without adequate ways of

seeing the facts." Ultimately, what we must attempt to do is to relate experience and research to some theoretical framework that has applicability to practitioners — praxis thus being the marriage of theory and practice.

In a more refined sense, the next chart (figure 8) reflects my conceptual framework of where we ought to be going. If what we hope to do, ultimately, is to come to grips more assiduously with the conceptual foundations that underlie command and control, and then to package our findings in a form that practitioners are more likely to take advantage of, I think we will have served a valuable function by providing ourselves a mechanism for exercising better control over our civil-military systems. That will become clearer when I show you later how I see command philosophy fitting within the large framework of culture, strategy, and doctrine.

It is important to draw the links between experience and culture and between culture and control, because culture is fundamental to my conception of the problems we have in the command and control arena. The question we really need to ask in the first place is why we want to perform research on command and control. There obviously are three basic reasons why one undertakes research: first because you enjoy doing research and it is intrinsically satisfying; second, because you want to enhance your understanding and the understanding of others; or third, because you actually want to have an effect on policies, programs, and operations. I think here of a point that Roger Fisher of Harvard once made in dealing with international relations theory. Although he acknowledged that the two essential purposes of theory are to improve understanding and to be useful to those who have decisions to make, he went a step further and suggested that the best way to improve understanding is to try to create theory that would be useful to somebody who has a decision to make. The point is that you can go off and do research that is intrinsically satisfying and that will put you in good stead with your research contemporaries, but what we really need is research that will produce theoretical underpinnings that will affect policies, programs, and actual operations.

The next question that obviously needs to be asked is why, then, we engage in theory making. Why is theory important to command and control? I think there are three reasons. In the first place, I would argue that we have witnessed in the modern era a convergence of strategy and tactics. By virtue

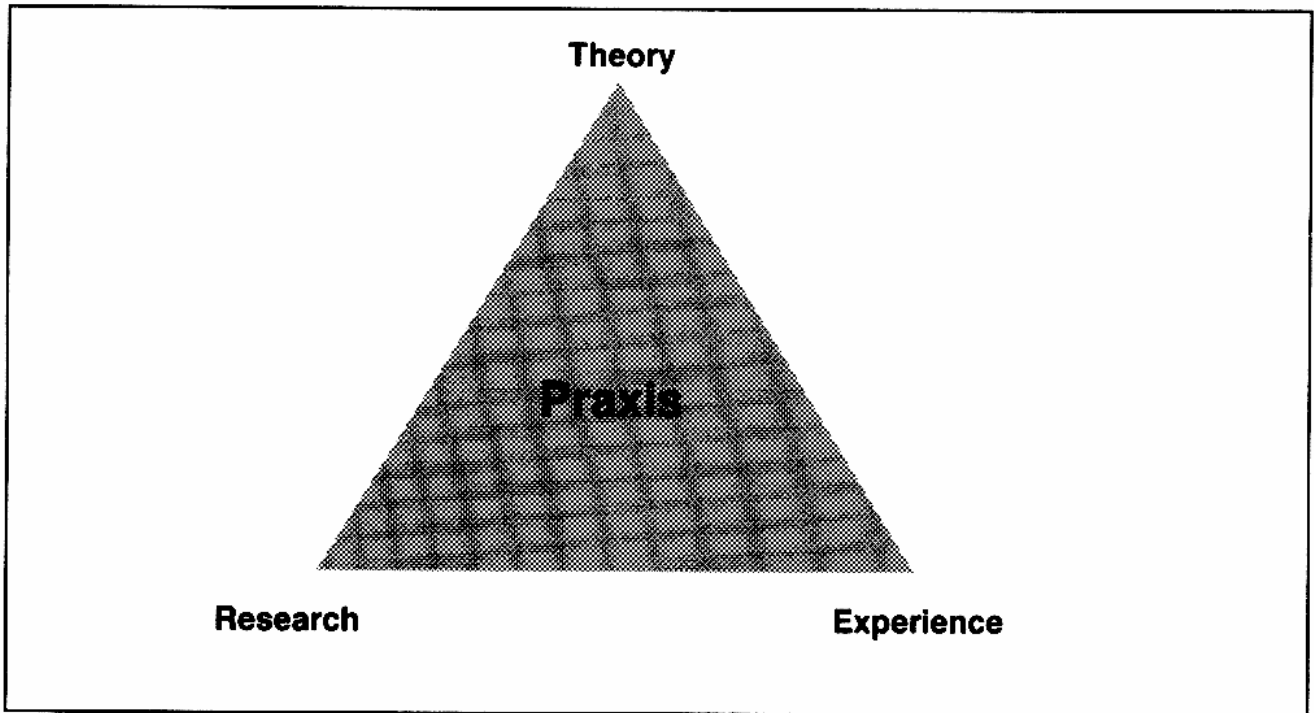


Figure 7. Linkages

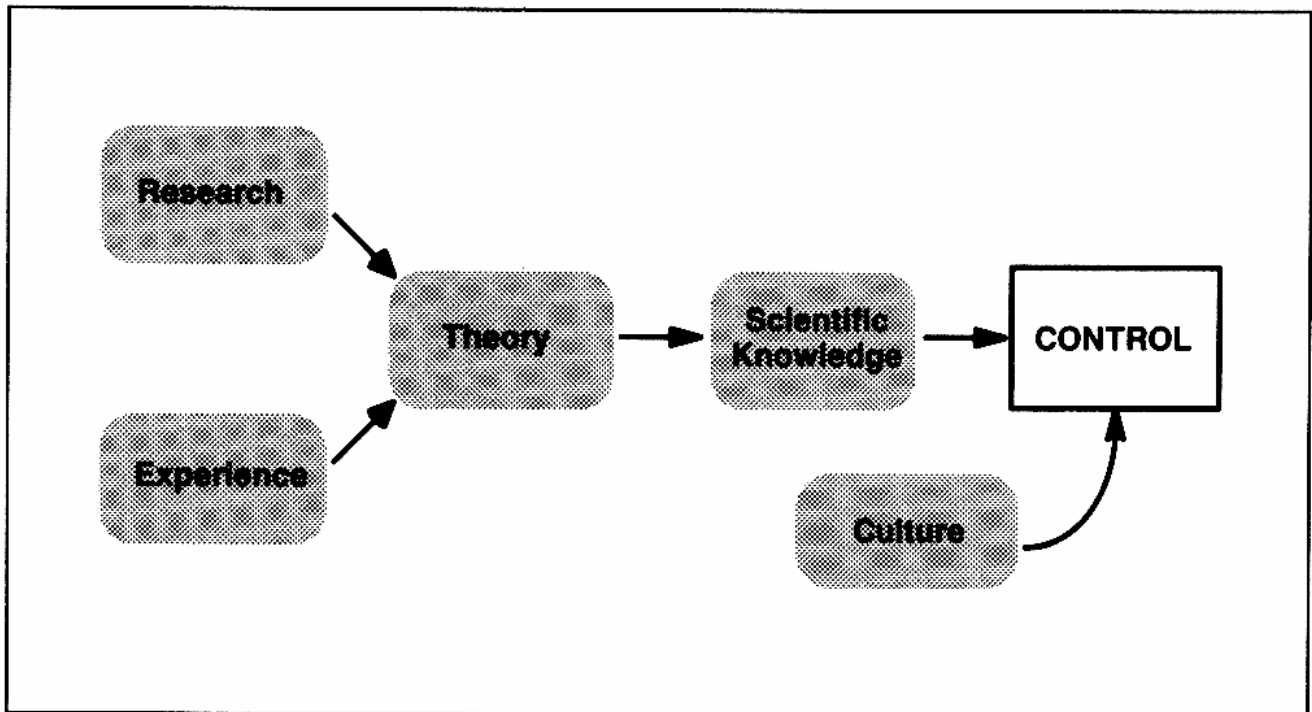


Figure 8. My Conceptual Framework

of significant improvements in telecommunications and transportation technologies, even the most remote tactical activity or action can have almost immediate strategic ramifications.

Similarly, I would suggest that we see before us today a complete reformulation of what war is. The traditional dichotomy between peace and war no longer is meaningful. We are engaged in forms of international interaction and conflict today that suggest to me that we really need to rethink what war is in the context of command and control. This affects how we view, at the grand level, the interrelationship between civil and military authorities and, at a more focused level, how commanders exercise command over forces in being.

Oettinger: Is the point complete? The second question will be what does it have to do with "why theory?" The first question is to ask you to sharpen your comments because at the most general level, they don't make sense to me. The convergence of strategy and tactics, as a new idea, is lacking. I go back to the anecdote "for want of a nail, the horse-shoe, etc., etc." It's clearly a parable about the connection between the most tactical of accidents and the most strategic of outcomes. The redefinition of war as carrying out essential diplomacy by other means is an aphorism that simply says that the civilian-military connection is not being made. In some sense, there's nothing new under the sun. I amuse myself by making fun of what you're saying here at that very abstract level. On the other hand, there are some things that have changed that make this more plain. I wonder if you could sharpen up where you see the boundary. What is it that makes this conceptually eternal? What's different now?

Foster: To reiterate a point I just made and then tie this back to some of my earlier premises about the state of C³ in general, I think we live today on kind of a global battlefield wrought, again, by marked advances in telecommunications and transportation technologies. We have witnessed a shrinkage of the globe such that those activities undertaken in what we traditionally have construed as peacetime actually are a form of waging conflict with real-world strategic significance. That is not to say that this is a new state of affairs. The important thing to acknowledge, though, is that our conception of command and control, and of how command should be exercised, continues to hew to a traditional conception of war, i.e., fighting battles and waging campaigns. We need to ask ourselves whether, in the modern era, the assumptions and

predispositions that would have been relevant in that traditional conception of war are still pertinent.

For example, consider the proper relationship between civil and military authorities. Although we continue to espouse civilian supremacy, we also tend to adhere to an idealistic notion of giving a mission-type order to a military commander — a la Eisenhower in Europe — and then letting him do his thing. This creates a tension and a paradox of sorts that demands our focused attention because, whether it's Grenada, Desert One, or whatever, we continue to wrestle with this relationship between civilian and military authorities. It may well be that we are in an era now where we have to accept and deal with the idea of having the Commander in Chief, a civilian decision maker, or the National Command Authorities (the President and the Secretary of Defense) directing traditionally military activities that, for a variety of strategic reasons, they are unwilling to turn over to military commanders.

McLaughlin: Let me just suggest that I don't see how problems today are any different than they were with Abraham Lincoln. All the same issues are there. Maybe it was different before the wide use of the telegraph. We certainly know that the process moves more slowly with naval commands, and we could discuss the issues and the theory or practice of naval versus land forces. But there is practically no issue of civil-military something-or-other presented by the new technology in the last 10 years that Abraham Lincoln didn't face in the Civil War.

Foster: I guess my position is that the potential that exists today for meddling as much in real time did not exist then. There were certain demarcations and limits that had to be established just because, even with the telegraph (to say nothing of different mind sets), they did not allow for such real-time intervention by civilian authorities. I would welcome your rejoinder to that, because you obviously have a good historical sense.

McLaughlin: I think you made a different distinction there than I had in mind, but, again, we are talking partially about functions versus systems here. I'm not sure this is the best point until you get through and then I'd like to come back and say, "What's all this control business?" If I took the Pub 1* definition that you've used here for "command and control" and I removed "and control" from that definition, do I have anything different? I

*Joint Chiefs of Staff, *U.S. Department of Defense Dictionary of Military and Associated Terms*, JCS Pub 1. Washington, D.C.: Government Printing Office, 1979.

say that because, in a sense, until that is better defined, I'm not sure you can address this problem of how much it has changed over time. I would contend that the theoretical concept of what is command is sort of immemorial: decisionmaking, leadership, and whatever else we want to package there. What changed fairly dramatically in recent years is the time span of control. Sure, in the past you gave a commander more general orders, "Go invade the continent." If he screwed it up, and by the time you eventually concluded he screwed it up, you relieved him. Today, it may be that half an hour into the battle you know he has screwed it up to a "fare-thee-well" and you relieve him then. And that's called "micromanagement" by every person who wears a uniform. Conceptually, is it different? You've changed the time frame and, again, maybe I'm hanging too much on "control."

Foster: No, control I think is the essential question. Unfortunately, I will not add any clarity to what control is. I think we need to come to grips with that since, in a sense, there is a redundancy between command and control. The essence of

command, it might be suggested, is how one exercises control.

Let me skip ahead. Let's go to the chart that says, "Framing a Unified Theory of Command and Control" (figure 9), because I want to touch on that quickly. The important thing we need to do that we haven't done previously is to formulate a conception of command and control that has relevance and applicability across levels — the tactical level, the operational level, and the strategic level — across domains — multiservice, multinational, civil-military — and across contexts — looking not only at wartime but also at peacetime and crisis situations and the transition periods in between. Some of the most significant problems we have in our conception and exercise of command focus on these transitional periods, because we have many organizations and interagency bodies that are organized in peacetime inappropriately to carry out crisis or wartime activities. Many of the transitional activities that would have to be undertaken to enable them to function effectively are not in place. The Federal Emergency Management Agency is a perfect example of this.

- **Multidisciplinary**

- **Synthetic (fuse extant theory: Control, Cybernetic, Information, Network, Organization, etc.)**

- **Holistic:**
 - **Across levels (Tactical-Operational-Strategic)**
 - **Across domains (Multiservice; Multinational; Civil-Military)**
 - **Across contexts (Peacetime-Crisis-Wartime; Subconventional-Conventional-Nuclear)**

- **Integrative:**
 - **Theory-Practice**
 - **Science-Social Science**
 - **Basic-Applied Research**

Figure 9. Framing a Unified Theory of C²

I could spend any amount of time talking about the impediments to a unified theory of command and control (figure 10). They're all pretty self-explanatory, but the thing I would focus on most directly is the practitioner-researcher gulf. The bottom line is that we need a marriage of tools and approaches that will, on the one hand, allow researchers to deal with truly fundamental questions and offer new insights and, on the other hand, not intimidate practitioners. I am intrigued by the statement of the mathematician G. H. Hardy, who once said, "Here's to pure mathematics, may it never find an application." Regrettably, there are a lot of folks out there doing research on command and control right now who would embrace that statement unreservedly.

In searching for an ideal conception of command and control, we get to the real essence of the question (figure 11). There has been some recent attraction to the German concept of "Auftragstaktik," an integral component of German military philosophy, dating back to the World Wars. Simply stated, the term equates to "directive control." The best treatment of the subject now available is the Richard Simpkin book, *Race to the Swift*, published by Brassey's in 1985. The essence of Auftragstaktik, in the German conception, is that a commander makes known his *general* intention to his subordinates and then provides them maximum latitude to achieve that objective without imposing too restrictive a degree of control.

- | | |
|--------------------------------|-------------------------------------|
| — Cultural uniqueness? | — Disciplinary parochialism |
| — Historical discontinuity? | — The immediacy imperative? |
| — Methodological inadequacies? | — The practitioner-researcher gulf? |
| — Intellectual incapacity? | |

Figure 10. Impediments to a Unified Theory

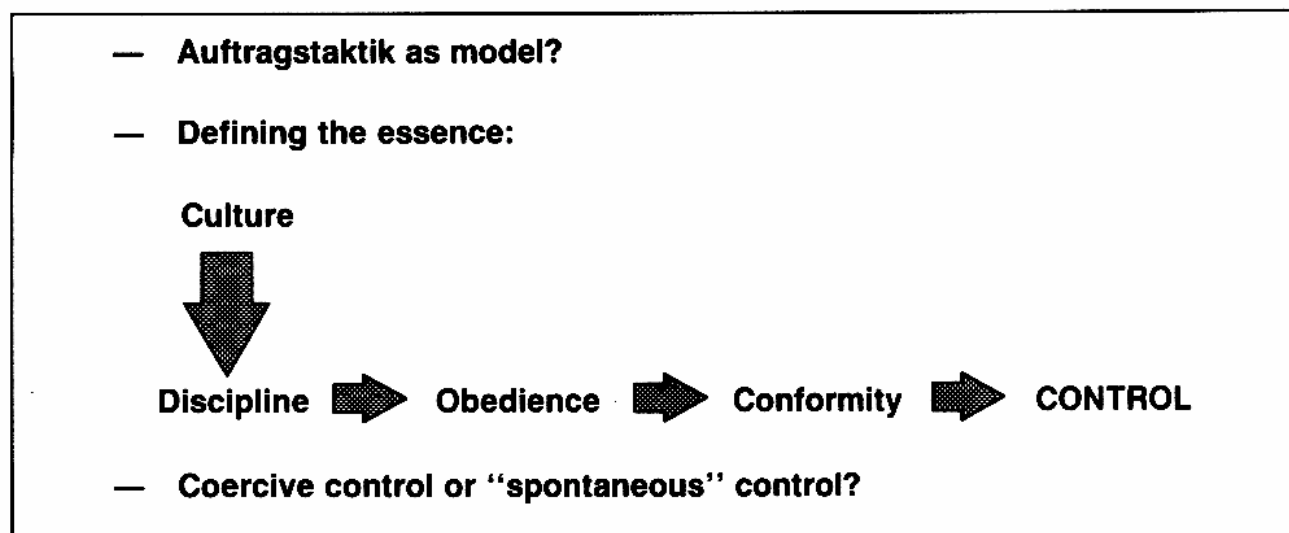


Figure 11. In Search of an Ideal

Oettinger: The illustration earlier of the instructions to Eisenhower was of that kind. Would that be an example of *Auftragstaktik*?

Foster: Yes, it definitely would.

Oettinger: Why is it a German conception?

Foster: It typically is cited as an ideal by those military reform critics who espouse a more maneuver-oriented approach to war fighting by the United States. The German conceptions of *Auftragstaktik*, “*Schwerpunkt*,” and the like have been presented as models of how blitzkrieg warfare provides an appropriate analog. This conception lay behind the successful Germans prosecution of blitzkrieg operations. Subordinate commanders were given maximum latitude, similar to the Eisenhower example. In a sense, this does equate to the ideal of a mission-type order: give the subordinate commander maximum latitude to carry out the mission, so long as it is in line with the spirit of the superior commander’s intention or objective.

Student: This doesn’t seem to be new, because it’s still what’s being taught in the military schools.

Foster: No, it is not new at all. My question, though, is whether, given the cultural differences that exist between ourselves and the Germans, it actually is a proper model for us. I don’t have an answer to that question.

Oettinger: It seems to me that although either the name may be different or it would be nameless, it’s not clear that cultural differences have anything to do with it. I can think of any number of instances indicating that: your own example of the Eisenhower orders, or a personal one from a somewhat different realm. We were sitting in 1963 in the Office of Manned Space Flight, and General Sam Phillips, who had just become commander or maybe Director of the Office of Manned Spaced Flight, sent me and a couple of other guys out to Houston where they were developing a thing which at that time was called the Real-Time Control Center. It later became Mission Control Center for the Apollo project and is still functioning. What was worrying the hell out of him was just this kind of broad order. The work specification for the contractor for the Mission Control Center was that the contractor, who in this case happened to be IBM, “shall supply the software for the mission control center.” That was it. The question was, how the hell would one keep track of this contractor? By the time the first man-on-the-moon flight — the Apollo

flight — took place, they had managed to get very thick documents specifying every bloody detail of the software. It probably delayed it by a significant measure. It’s not cultural. The antagonism is between the trust, or whatever it takes, to make that kind of delegation and the desire to micromanage. There may be any number of other variables. Why do you pose the question as a cultural one?

Foster: Let me jump ahead and use this (figure 11) as a basis for getting to my bottom line. If you think there is some utility to this cryptic model — with control being a reflection of the relationship of discipline to obedience to conformity — then the question is whether concepts and world views of other cultures (e.g., German, or Israeli, or Russian, or even Chinese — societies that typically tend to be more disciplined than ours) provide a suitable ideal for a culture such as ours. Give me a chance to draw the link between this and the following two charts, because I hope to put some meat on these conceptual bones.

The question that needs to be asked is whether what we should be shooting for in our society is a sort of “coercive control” — which I would suggest is what all the technologies we are pursuing provide us a mechanism for — or whether what we need and want is what I would call “spontaneous control” — which, because of the nature of our culture, must rely more on intellectual consensus and thus the need for a philosophy or theory of command.

I see command philosophy as being embedded within these concentric circles (figure 12): first, within our culture; second, within the nation’s strategy; third, within doctrine, the codification of strategy. Let me elaborate on what I mean by these terms. I am attracted to Edward Hall’s conception of culture as the hidden or implicit rules that guide our behavior, and over which man may have little control. Man is born into a world in which there are certain givens. The extent to which he can control or change these givens is, in many instances, limited. What we’re talking about are hidden rules that we may not even recognize, much less be able to express or verbalize.

My conception of strategy — a function of the culture in which we live — is that strategy in the modern era (this plays again on my theme of the convergence of strategy and tactics in a reformulation or redefinition of war) is essentially grand strategy — the coordinated direction of *all* the resources at the nation’s disposal, not just military resources. Whereas, traditionally, we have tended for both

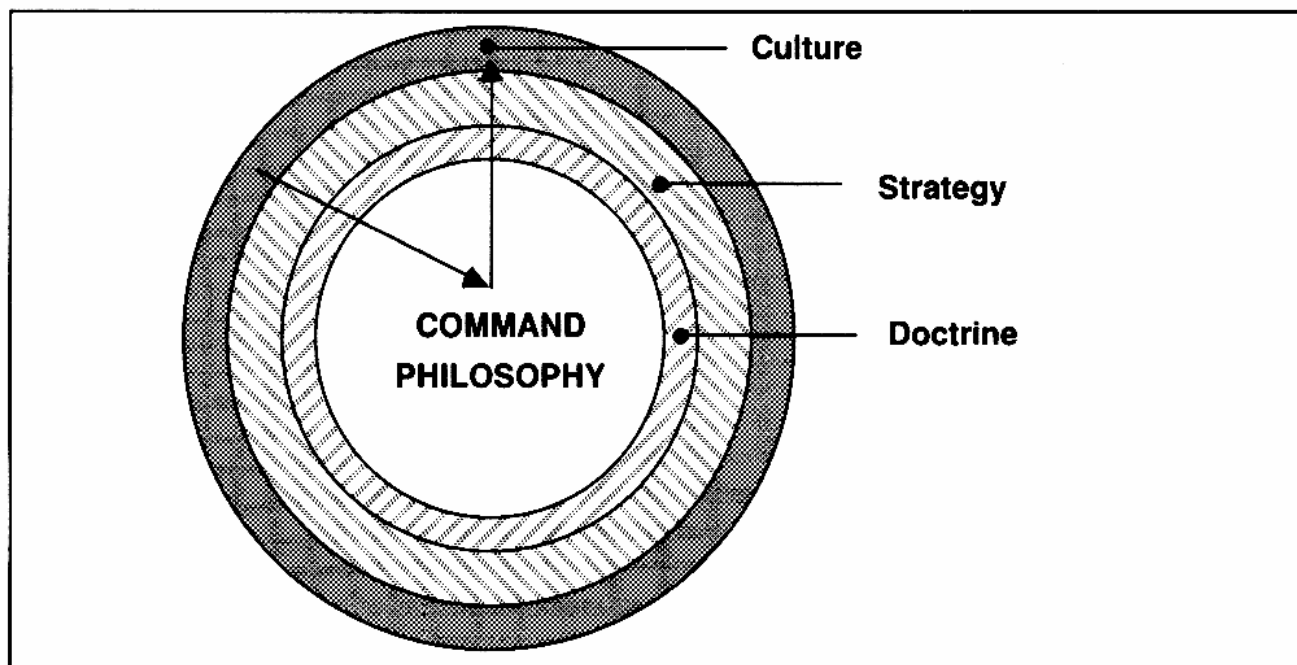


Figure 12. In Search of an Ideal

bureaucratic and intellectual reasons to deal with tradeoff decisions among military capabilities, we need now to think in a broader context of tradeoffs between military capabilities and other elements of national power.

Secondly, I would define strategy as a philosophy of global conduct: one's conception of how the world operates and how we should operate in that world. A philosophy of global conduct forces one to come to grips with questions that we tend to assume away: the nature of the threat, the nature of conflict, and even the nature of our relationship with the Soviet Union. For example, is the latter relationship zero-sum in nature or something else? These are questions for which we need a national consensus, but for which little consensus now exists.

Finally, I would suggest that strategy is an exercise in the management of perceptions. It is not the application of force, per se, but the utilization of power. Military force may be a mechanism for exercising power, but the two are not one and the same. Doctrine is an elaboration of strategy. The analogy I would draw is between doctrine and what Thomas Kuhn called a paradigm. A paradigm represents the consensual world view of the members of a community. It defines not only how they look at the world, but also the basic assumptions they embrace, the techniques they employ, and even the questions they ask. I think that is how doctrine operates.

Oettinger: This is Thomas S. Kuhn, *The Structure of Scientific Revolutions*,* in case you're interested.

Foster: The culture that I'm talking about manifests itself in four different forms, not all of which are congruent (figure 13). There is, first and most fundamentally, American national culture, which embodies certain attributes that obviously affect how we look at the world. We tend, for example, to be individualistic as a society. We are open and pluralistic. We are achievement-oriented and, thus, impatient. We are both moralistic and legalistic. Why is that important? Because a moralistic view of the world affects how we see international problems and their moral underpinnings. Our legalistic sense can have just as important an effect on how we view relationships with others — for instance, whether our relationships with the Soviet Union on arms control should be binding in a contractual sense. We also tend to be aphiosophical and ahistorical, image-conscious, media-oriented, and, for the most part, not inured to sacrifice or hardship.

Within the context of our national culture, there exists what some have called an American strategic culture that is not entirely congruent with the national culture but may share characteristics with

*Thomas S. Kuhn, *The Structure of Scientific Revolutions*, 2nd ed. Chicago: University of Chicago Press, 1970.

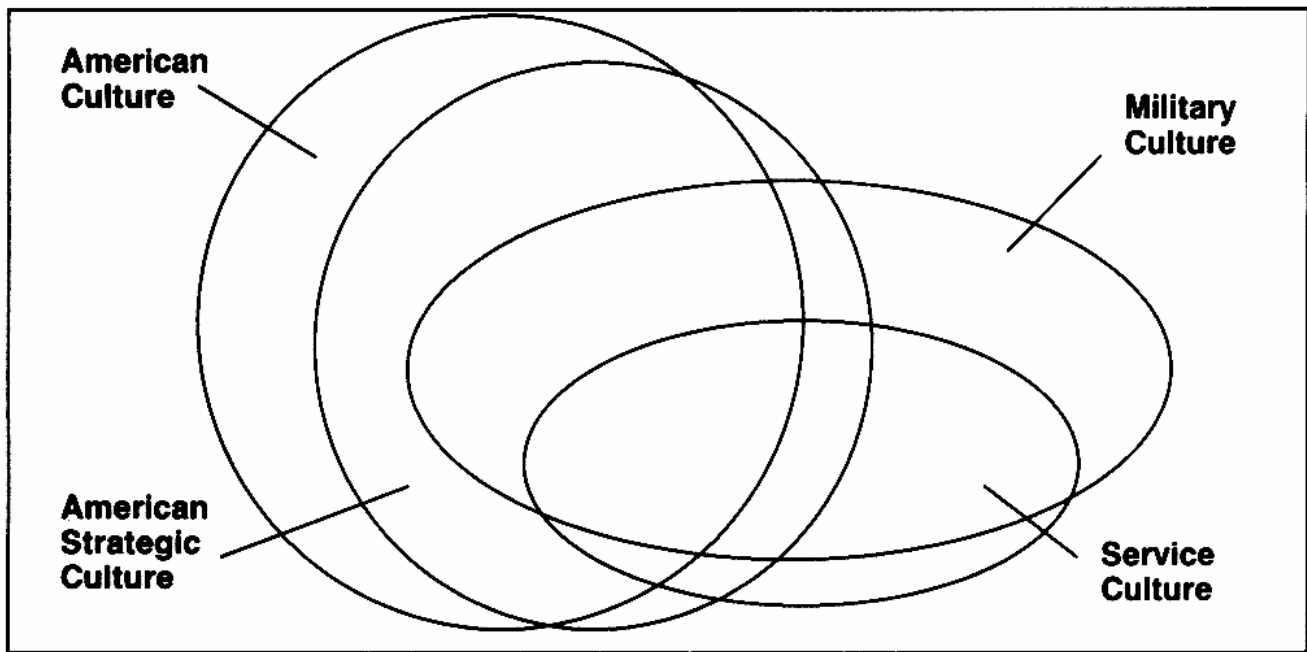


Figure 13. The Cultural Imperative

other societies. Our strategic culture focuses on such questions as the utility of force — Is it, to an advanced industrialized nation such as ours, a useful instrument of national power? — the utility of nuclear weapons — Are they useful instruments or not? — and the role of negotiations — Should they be conducted in consonance with, or in lieu of, other instruments of power?

Military culture, in turn, has somewhat a transcendent nature, in that there is a military ethos that tends to cut across societies and cultures: the warrior ideal, attitudes toward discipline, sacrifice, duty, efficiency, resistance to change, mission orientation, and the like.

There is yet another overlay on this: the unique service cultures within our military. At issue are questions of service distinctiveness, mission specialization, unique career progression patterns and incentive structures, and so forth.

All of these overlapping, yet not entirely congruent, cultural influences affect how we view command. The question is whether we can derive a conception of how command should be exercised that cuts across cultures, or whether we have to recognize cultural peculiarities. This takes me back to my simple schematic (figure 11). If, in fact, control ultimately results from conformity, and obedience, and discipline, our culture may not lend itself to ideal conceptions such as *Auftragstaktik*. Thus, I think there is utility for our having a unified conception of command and control, adhered to by most of

the community, that more closely coincides with what I have called spontaneous control.

We have become dependent on communications technologies that, if disrupted by the “fog of war,” will force us to rely on other forms of (spontaneous) control. Although I may have gotten a little too abstract and esoteric in this discussion, I think we need to start thinking about command and control in such terms.

McLaughlin: Somehow I think I missed a link in terms of what is spontaneous control.

Foster: Spontaneous control is tied to the idea of a paradigm, or doctrine. It’s the sort of control that results from having an *a priori* consensus within the community of commanders or decisionmakers of what is being dealt with, how situations are to be handled, what the proper nature of authority is, and so forth. We are a long way from achieving that.

Student: Is that like following a standard operating procedure automatically?

Foster: No.

Oettinger: Why is that different from what we might describe as somebody’s definition of doctrine?

McLaughlin: “Take the high ground and hold it.”

Oettinger: Could you try to again to clarify. You’ve just listed a couple of things which you thought were essential to a common idea of what to

do under which circumstances as being essential to spontaneous control. As I was hearing that list, it conjured up in this gentleman's mind standard operating procedure, and it conjured up in my mind, doctrine. I am puzzled as to why you find a need for a different set of conceptual baggage with which to deal with spontaneous control than by either doctrine or standard operating procedure?

Foster: Doctrine is a key element in spontaneous control. My conception results from the belief that we don't really have a *unifying* doctrine now. Yes, we have single-service doctrines for dealing with particular things, but we have very little joint doctrine and virtually no doctrine that unites the entire national security community. To the extent that there is widespread agreement on doctrine, and to the extent that doctrine does not become dogma but instead is adaptable enough to cope with changing circumstances, it provides a valuable tool for inculcating the values and perspectives that are needed to ensure unity of thought and action.

Oettinger: That view puts a greater weight on problems, let's say of service culture, than on fundamental questions of differences among national cultures, which is where I heard you put emphasis on a little bit earlier. Maybe I didn't hear you correctly.

Foster: No, what I meant to do was to pose a question for which I obviously have come full circle to proposing an answer. My question is, if reform critics advocate *Auftragstaktik* as an ideal, would such an approach actually work within our culture, which has certain distinctive characteristics that make us less disciplined as a society than, say, German, Israeli, or Russian society? I would like to think that it can, but I'm not so sure. If there is some validity to the set of characteristics I have posited as defining American culture, then one must ask oneself whether such characteristics enable us to employ an approach similar to that which the Germans or the Israelis would employ. That is where the issue takes on a national, cultural dimension.

Actually, we have an overlay of four different kinds of culture. In some cases, the characteristics of these various cultures may be in conflict with one another. This is especially true if you agree with the idea that there is a kind of transcendent military culture that cuts across societies and provides a common military perspective on such matters as sacrifice, discipline, duty, and the like. These transcendent military values may or may not coincide with the characteristics of American culture or even

of American strategic culture. This creates inherent tensions, of course.

McLaughlin: The thing I find fascinating about this is that normally so much of this discussion goes on without any reference to the whole other world of bureaucratic organizational behavior, i.e., outside of the national security community. An awful lot of the things that you talk about, you can talk about in another world in terms of decentralization, profit centers, and incentives. We may not be talking life or death, but again in the business realm we're talking about a world, at least in competitive industries, where you are at war every day. It seems to me that central to so much of this is the issue of time and of performance, if you will. I guess just about every admiral or every general who was ever considered a failure thought he wasn't given enough time. I guess there are some exceptions to that.

There's a sense in the uniformed military that if you let a guy go and he really loses a campaign on his own, well, it's okay to exercise a higher authority and take him out, but he's got to lose first. You've got to give him a fair chance to really lose, no matter how many lives it costs in men, or how many tanks, or planes, or ships. Anything short of that is micromanaging. If I take a corporation where you may have a guy out there running a profit center, there's a much wider range and a very different conception of how much you let a guy lose, or not win before you relieve him of duty. I'm not sure that we're talking black and white cases here. I think the importance is that you have gradations in between and the fact that maybe how long you let somebody go on losing or not winning has changed. We are in an era where it is possible to monitor progress more closely, to get feedback more quickly, and this is very distressing in the military culture. A counterpart analogy might be in collegiate athletics. You have to give the guy three or four years as a coach. If it's less than that, he hasn't had time to recruit a full team. I think the conception today in the military is you really have to let a guy lose a war, or at least lose a major campaign, before the higher authorities relieve him.

I think that some of these are modern conceptions, many stemming from the First World War, when operations outran the communications of the commander. But in a sense that is the way Napoleon fought a war, which was exactly the reverse of how Wellington fought.

Wellington felt very comfortable intervening. He never gave these broad delegations. He continually skipped echelons as he rode around the battlefield.

He understood that tactical crises at La Haye Sainte or Hougomount were critical to the strategic outcome, and by modern terms he micromanaged them. Napoleon gave broad mission-type orders and lost the Empire.

Now we seem to have a fetish about giving people broad mission statements and then the length of the campaign determines whether or not we micromanage.

Foster: The reason it is important to focus on this particular question, and the reason I want to relate it back to a point I glossed over earlier — the perishability of experience — is that an important consideration is whether, in a nonwar situation (call it peacetime or whatever), we are inculcating the sorts of values and the degree of initiative and responsibility in commanders that they would need in a crisis or wartime situation. To relate to your earlier example, Tony, about a simple contract to do all of the software for NASA's Mission Control Center, today we see contracts that contain voluminous details and specifications. This is merely a manifestation of a larger, more pervasive trend in the way we do business, particularly within our military establishment. The question becomes, if you do not instill the sense of initiative, responsibility, and authority in commanders in peacetime that you will expect from them in wartime, are you doing both them and the nation a disservice? The consequences of waiting until a commander loses a battle or a war, or until he gets several thousand people killed, are such that we shouldn't want to wait until that time to deal with the situation.

Business is different, as is coaching or managing a sports team, because you're engaged on a daily basis in your operational mission. But in this age of deterrence, we must concern ourselves with whether we are nurturing the right types of folks to command in war. That is a traditional problem that has existed before every previous war, and it will continue to exist. Unfortunately, there are no school solutions to the problem.

Since I might have done you a disservice in getting too esoteric in this discussion, I would be happy to talk about the creation of the Command and Control Research Program at the National Defense University and what it was intended to do, if that would be useful.

Oettinger: I think if, in the remaining 15 minutes or so, you were to turn to that and perhaps link it in terms of your previous remarks, it would be useful. Presumably somebody who was creating the program had in mind certain deficiencies and some gap

that needed to be filled, and it might or might not have anything to do with these perceptions of either altering this piece of culture or fiddling with that piece of technology or whatever.

Foster: The common links here are myself and the charter you have before you (appendix A). Although I came along after the decision was made to create the Command and Control Research Program at the National Defense University, the charter is my formulation. Moreover, the activities I undertook when I got this program off the ground tended to reinforce the sort of conceptual orientation I have provided today.

The Command and Control Research Program grew out of a report prepared by a study group under the aegis of the Defense Science Board. The study group was headed by Dr. Bob Hermann, who now works with United Technologies and was a former Assistant Secretary of Defense for C³I under the Carter Administration. The report was issued in 1982. In essence, it was an investigation of the performance of the laboratories conducting C³-related work. One of the major recommendations was that there be created a focal point for command and control theory, research, and education that could look at command and control in a truly joint context. Each of the service laboratories I mentioned earlier does its own service-related command and control work, which tends to be oriented on tactical military C³.

There are two educational institutions with programs of studies in joint C³. One is the Armed Forces Staff College (AFSC). Typically the folks who go through the AFSC C³ course are officers at the rank of captain or major. The focus tends to be on in-place systems, such as the Worldwide Military Command and Control System, and on various command and control activities and functions — for example, how NORAD (the North American Aerospace Defense Command) or the U.S. Space Command or the National Military Command Center operates. The course tends to focus on the mechanics of how these and other activities operate.

The program at the Naval Postgraduate School (NPGS), which also tends to get captain and major types, is a regular graduate-level program principally for "wireheads." In other words, the course is quite technical. There is very much an operations research orientation because of the people who constitute the faculty there. Neither AFSC nor NPGS really comes to grips with questions related to the philosophy of command, what command and control really is, particularly at the national and theater

levels. There is no course of studies for more senior officers that would prepare them to assume command. Yes, these senior officers do go through the regular sequence of schools within the military educational system, but those schools tend to be all things to all people. Bob Kreps [Air Force Fellow in the Program on Information Resources Policy] can give you a first-hand, blow-by-blow description of how things looked at the Air University at Maxwell Air Force Base. But there tend to be so many things crammed into the curricula of the intermediate and senior service schools that there really is no focal point on the educational side for command and control studies.

On the research side, there is no focal point for addressing command and control at the national and theater levels of joint and combined operations in peacetime, crisis, and wartime, involving both civil and military decision structures. When I came in, I took the scanty guidance that existed and attempted to fold all of these things together, so that the two principal foci of the program were (a) to conduct and sponsor basic and applied research that looked at command and control along the aforementioned lines, and (b) to develop a program of command and control studies for senior officers and civilians from throughout the national security establishment.

We joined in common endeavor with the other organizations constituting the Basic Research Group (BRG) of the Joint Directors of Laboratories because the foci that we represented were missing. These organizations all focus on uniservice, tactical, military initiatives. Besides our substantive orientation, we have at the National Defense University a wargaming and simulation center. One of my long-term designs was to create there a testbed that could be employed for both experimental and quasi-experimental purposes, looking at various dimensions of command and control. We also could undertake, I believe, what would amount to field research on how student groups acting as commanders and staffs performed in different types of situations. The only experimentation that now goes on takes place at the Naval Postgraduate School. That involves captain- and major-level folks who deal, for the most part, with naval tactical problems. That leaves a big range of issues that are not addressed.

The types of things I set about doing when I created the program included establishing NDU as a legitimate actor in the command and control community. One mechanism for doing that was a series of publications, of which there were two types.

Two edited volumes were commissioned that attempted to deal with different dimensions of command and control. One volume, titled *Toward a Theory of Command and Control*, was kind of a living experiment in which I commissioned 10 different authors to address the same set of questions: What is command and control? What are its constituent elements? What is the state of the art in command and control theory and research? What work outside the military domain has been done that might be relevant? And where should we go from here? The idea was that if I could get 10 reputable individuals with expertise in the area and stature within the community, who could look independently at these questions, we could determine where natural divergence or convergence exists.

Another volume, titled *The Dimensions of Command and Control*, looks at command and control from different perspectives: the technological dimension, the behavioral dimension, the legal dimension, the historical dimension, the socio-political dimension, and so forth. The idea was to get individuals with expertise in each of these areas to look at command and control from their different perspectives, and thereby to see where we have areas of commonality and complementarity.

Then there was a series of occasional papers. The intent of the occasional papers was to elevate the level of discourse and expand the bounds of inquiry on command and control. So I commissioned papers which deal with such issues as command and control in a democratic society. One paper I commissioned was titled, "Toward an American Philosophy of Command and Control." Another looked at the Soviet philosophy of command and control. I commissioned General Paul Gorman, former Commander in Chief, U.S. Southern Command, to provide a theater commander's perspective on command and control.

On the educational side, I established a network with the other military educational institutions to try to see where NDU should be focusing its efforts in developing a course of instruction for senior officers and civilians. That is how the program came into being, and that is what the initial thrust was and continues to be. I would be glad to pursue this in more detail with any of you later.

Oettinger: There may be a few folks who might have some additional questions. We are at a breakpoint, and I thank you very much for spending the time with us.

Appendix A

— Charter —

Command & Control Research Program National Defense University

Mission Statement

The missions of the Command & Control Research Program are to:

- a. Provide a center of expertise on all aspects of command and control having substantive policy relevance at the national and theater levels.
- b. Contribute to, and extend, the body of knowledge on command and control concepts, theory, methods, and applications.
- c. Enhance the command and control education and training of senior military officers and civilians throughout the national security establishment.
- d. Facilitate dialogue on critical command and control issues throughout the entire national security community.

Functions and Responsibilities

The Command & Control Research Program will:

- a. Perform basic and applied research that contributes to the formulation and validation of a theory of command and control.
- b. Design, develop, and implement a program of command and control studies for senior military officers and civilians throughout the national security establishment.
- c. Respond to tasking from the Secretary of Defense, the Deputy Secretary of Defense,

and the Chairman of the Joint Chiefs of Staff, and to requests from Commanders-in-Chief of unified and specified commands, Service Chiefs, and other non-DoD departments/agencies constituting the national security establishment.

- d. Interact with and support other elements of the National Defense University in the conduct of studies, the provision of instruction, and the development of programs having command and control content.
- e. Coordinate activities with military laboratories and other military and civilian organizations charged with performing command and control research and analysis.
- f. Develop a repository of research materials on command and control and its associated functions (e.g., communications, intelligence).
- g. Establish and implement an Outreach Program with academic institutions, associations, industrial enterprises, professional journals, and research organizations, so as to stay abreast of developments in the field and to foster awareness of CCRP contributions.

Management

The management of the Command & Control Research Program will be the responsibility of a Director, nominated by the Director of the Institute for National Strategic Studies, and approved by the President, NDU.

Appendix B

File No. 129

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Title: Headquarters Effectiveness
Assessment Tool (HEAT)

Reference: Defense Systems, Inc.,
HEAT User's Manual (Draft)

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Classification: Unclassified

Abstract: HEAT was developed in 1982 to enable a team of observers to determine when a headquarters is performing effectively and when it is not. HEAT views a headquarters as an adaptive control system composed of six process steps: monitor, understand, develop alternative actions, predict consequences, direct, and inform. HEAT includes 141 measures of effectiveness or process quality from which users select and/or adapt a subset that

matches their questions. HEAT has been applied to historical combat, laboratory experiments, fleet exercises, and recent military operations.

Description: Headquarters exert control by preparing, issuing, and enforcing plans of action for subordinate forces. This definition leads the developers to two underlying principles for HEAT:

1. Headquarters effectiveness is properly measured by the achieved lives of issued plans, in relation to the schedules developed by the headquarters.
2. The quality of headquarters processes, which underlies and sustains headquarters effectiveness, is properly measured by the congruence between headquarters perception and ground truth.

The *HEAT User's Manual* provides a description of the measures, the 12 data collection sheets needed to collect data for all the measures, and a set of scoring sheets to translate the raw data into standardized absolute scores.

Example: Examples of HEAT measures and standards for each process step are shown below.

Step	Measure	Command Standard
Monitor	Percent of units where HQ data on unit location, status, plans of operations are outside desired window	Desired accuracy window
Understand	Average error in prediction of time at which system operability changes due to weather	Maximum acceptable error in prediction
Develop Alternative Actions	Were all hypothesized futures examined and alternative actions planned?	Maximum percentage of "no" answers
Predict Consequences	Percent of intended period predictions are: correct, in the contingency set, wrong	Relative value of prediction being in the contingency set
Direct	Average number of queries received per directive	Maximum acceptable number of queries
Inform	Average age of information at time transmitted	Maximum acceptable delay or age of information

Analysis:

Limitations

1. Labor-intensive for observers and analysts (e.g., one man-year required to assess performance in BFIT 2-85).
2. Data collection procedures are intrusive.
3. Requires the user to be psychometrically and operationally knowledgeable. The user must select measures, identify standards and ground truth, and determine data collection and observation schedules.
4. Psychometric properties of HEAT are unknown.
5. Lack of generalizability and comparability across applications due to differences in the selection of measures and standards.
6. Inappropriate for analyses at the platform level or below and for analysis of command war-fighting (vs. planning and directing).

Strengths

1. The only available, systematic C³ measurement tool.
2. Based on a conceptual model of C³ processes.
3. An evolving measurement tool. The authors are revising and adding measures with experience. In particular, measures of network effectiveness are being field-tested during BFIT exercises.
4. Numerous applications provide a rich body of literature.
5. Applicable to laboratory experiments and Fleet exercises that could provide data to feed back into C³ theory development and validation.

Past Applications:

1. Historical combat (WW II Sicily Invasion) — 1982.
2. Assessment of JTF-7 at BOLD EAGLE-84 — October 1983.
3. Experiments of centralized/decentralized headquarters — November 1983.
4. Assessment of new USA/OTEA headquarters — January 1984.
5. Assessment of the Grenada invasion — March 1984.
6. Application to a MAC exercise — September 1984.
7. Experiments of functional/geographic organization — October 1984.

8. Application to a SHAPE exercise — November 1984.

Future Applications:

1. Model development for a SHAPE Technical Centre — ongoing.
2. Application to 2nd Fleet BFIT exercises — 1985 and ongoing.
3. Application to Naval War College war games — 1985 and ongoing.
4. Application to 3rd Fleet battle group evaluation — ongoing.

References:

1. Defense Systems, Inc., *Theater Headquarters Effectiveness: Its Measurement and Relationship to Size, Structure, Functions, and Linkages. Volume I: Measures of Effectiveness and the Headquarters Effectiveness Assessment Tool*. December 15, 1982. (Revision March 31, 1983.)
2. Defense Systems, Inc., *Theater Headquarters Effectiveness: Its Measurement and Relationship to Size, Structure, Functions, and Linkages. Volume II: Design Considerations and Guidelines for Theater Headquarters Effectiveness*. December 15, 1982. (Revision March 31, 1983.)
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4. Defense Systems, Inc., *Headquarters Effectiveness Assessment Tool (HEAT) Course for the NPS/USREDCOM-Joint Task Force ADP Application Project*. July 7-8, 1983.
5. Defense Systems, Inc., *Headquarters Effectiveness Program Summary Task 002*. September 30, 1983.
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7. Defense Systems, Inc., *HEAT Executive Summary*. June 22, 1984.
8. Defense Systems, Inc., *HEAT User's Manual (Draft)*. July 26, 1984. (Revision in preparation.)
9. Defense Systems, Inc., *Elements of C³ Theory (Draft)*. January 30, 1985. (Revision in preparation.)