Whence and Whither Intelligence, Command and Control? The Certainty of Uncertainty

Anthony G. Oettinger

Abstract

The continuing availability of ever smaller, faster, cheaper, better tools for information processing gives us the illusion that throwing these tools at perennial problems of intelligence, command and control can solve these problems once and for all. In reality, the new tools keep on triggering readjustments in numerous interlinked balancing acts, like those between operational security and operational effectiveness or between the desire to reduce the complexity of tasks and the desire to increase adaptability to changing tasks. The central theme is how best to enable military commanders — or civilian executives — to identify and to adjust these balances for effectiveness against opponents with similar problems. The endless frontier of complexity accounts for our simultaneous sensations of both progress and *déjà vu*.

Program on Information Resources Policy

Harvard University

Center for Information Policy Research

Cambridge, Massachusetts

September 1997

PROGRAM ON INFORMATION RESOURCES POLICY

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A publication of the Program on Information Resources Policy.

Whence and Whither Intelligence, Command and Control?
The Certainty of Uncertainty

Anthony G. Oettinger

February 1990, P-90-1

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

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Printing 5 4

Acknowledgments

Two presentations drew on drafts of this paper:

- May 24, 1989: Whence and Whither C^3I?, MITRE Institute, Bedford, MA.

- June 28, 1989: Whence and Whither Intelligence, Command and Control: The Certainty of Uncertainty., Joint Directors of Laboratories/Institute of Electrical and Electronics Engineers 1989 Symposium on Command and Control Research, National Defense University, Washington, DC. The text of this presentation appears as "Whence and Whither Intelligence, Command and Control: The Certainty of Uncertainty" in Johnson, Stuart E. and Alexander H. Levis (Eds.), *Proceedings of the 1989 Symposium on Command and Control Research*, McLean, VA: Science Applications International Corporation, SAIC-89/1565, 1989, pp. 5-21.

I am indebted to John F. McLaughlin for his collaboration on our seminar at the John F. Kennedy School of Government and to all those, listed in Section IX, who led the seminar discussions; to Dave McManis, Tom Coakley and Frank Snyder for their sharing of ideas; to Jack Jacobs, Bob Everett and Charlie Zraket who unlocked for the Kennedy School seminar such treasures as, among others, the editorial collaboration of Margaret Jennings and the production assistance of Bobbie Statkus; to Richard E. Hayes, Jerry Holland, John McLaughlin, Dave McManis, John Rothrock, Frank Snyder and Norm Wood for their critiques.

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Anthony G. Oettinger

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"I have no belief in panaceas and almost none in sudden ruin. I believe with Montesqieu that if the chance of a battle — I may add, the passage of a law — has ruined a state, there was a general cause at work that made the state ready to perish by a single battle or law. Hence I am not much interested one way or the other in the nostrums now so strenuously urged."

Oliver Wendell Holmes[1]

Permit me to share a puzzlement with you. My puzzlement stems from observing over and over again, as I expect you have observed over and over again, that there seems to be progress in intelligence, command and control while, at the same time, some problems seem never to go away. In plain French, "plus ça change, plus c'est la même chose".

Permit me further to sample contemporary manifestations of this age-old and messy coexistence of the new and the old. I hope that once we have discerned what seems to go forward and teased it apart from what seems to stay put, this knowledge can help us to gain an edge over adversaries who probably are in the same soup.

I. What is New Under the Sun

Some events make you believe that something is new under the sun, that there is such a thing as progress.

Like the other illustrations that I use in this talk, the anecdotes I am about to retell to suggest why we believe in progress come from a graduate seminar on intelligence, command and control that my associate John McLaughlin and have run each spring since 1980 at Harvard's John F. Kennedy School of Government.[2]

Jerry O. Tuttle, now Director, Space Command and Control, U.S. Navy (Op 94), was Director, Command, Control and Communications (J6) in the Organization of the Joint Chiefs of Staff when he led the seminar discussion in the spring of 1988. "If you look back to a time in history when I was in the Mediterranean", Jerry said — stressing the progress — "I was far removed, but I heard ad nauseam about Grenada [October 1983] and the interoperability issues. If you took a snapshot of that day, we've come a long way in interoperability".

In the same positive vein, Tuttle then went on to describe the situation he saw, in the spring of 1988, in what he called "that cul-de-sac at the base of the cradle of civilization, the Persian Gulf".

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[1] Holmes, Oliver Wendell. Collected Legal Papers. New York: Harcourt, Brace and Company, 1921, p. 295. [From Law and the Court, speech at a dinner of the Harvard Law School Association of New York on February 15, 1913; reprinted from Speeches (1913) Little, Brown & Co.]

[2] See Section IX for a listing of the presentations from 1980 to 1988.

> "You have U.S. Navy ships escorting reflagged tankers from another country. You have French, Belgian, Netherlands, British ships in a link with AWACS from the United States and Saudi Arabia. You have the joint task force commander in the North Arabian Sea, and his boss halfway around the world, 7,000 miles away in Tampa, Florida, at McDill Air Force Base. His Navy component is in Hawaii and they have secure communications to all, including all the Gulf Coast state embassies — certainly their Navy units do, and in most cases their Air Force — in an area that nine months ago that was basically a desert C^3 area. It's what we like to call a C^3 infrastructure — a real success story".[3]

I challenged him to explain why these upbeat "assertions sound so radically different from what the class had read from the record" by way of horror stories. I asked him to "underscore what is radically different here".[4] So, Tuttle went on:

> "In the Middle East ... [w]e had a paucity of satellite communications and we had to go to using what we call DAMA (demand assignment multiple access) to get greater efficiency from our satellites, freeing up two channels of the UHF satellites. It led us to interfacing an SHF satellite with a UHF satellite, which we had never tried before. ... You have a lot of activity, in a small hostile area, but we have created a system in which we can go either way around the world, east or west, by multiple satellite hops and be able to see in near-real time the force disposition in the Persian Gulf. The on-scene commander, the CINC in Florida, and the National Command Authorities in Washington can all share the same real-time picture".[5]

So, the judicious and timely fielding of the fruits of new science and technology is conducive to the perception of progress, so much so that perfection seems both necessary and just around the corner.

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[3] Tuttle, Jerry. "Tailoring C^3I Systems to Military Users", Seminar on Command, Control, Communications, and Intelligence, I-89-1, Spring 1988. Cambridge, MA: Harvard University Program on Information Resources Policy, pp. 92-93.

[4] Ibid, p. 93.

[5] Ibid, p. 93.

II. Essential Humanity, Distracting Divinity

Indeed, from what other folks say, I infer that those folks aspire to solve all intelligence, command and control problems by just the judicious and timely fielding of the fruits of new science and technology.

A 1987 report of a Defense Science Board Task Force on Command and Control Systems Management repeats, with approval, the following words written a decade earlier by another Defense Science Board Task Force:

> "The ideal command and control system *supporting a commander* is such that the commander knows what goes on, that he receives what is intended for him and that what he transmits is delivered to the intended addressee, so that the command decisions are made *with confidence* and are based on information that is *complete, true and up-to-date*".[6] [Emphasis added].

When I see such ideals expressed, it implies to me either cynical salesmanship mixed in some proportion with naive fervor or else a sincere belief in human perfectability. But Defense Science Board Task Forces are honorable men (with only an occasional woman). They are also scientists. Therefore they are, arguably, incapable of either cynical salesmanship or naivete.

Without digging into all that any deeper, I think I have to read the Defense Science Board statement as reflecting a belief that modern science and technology truly have made it reasonable not only to expect to make decisions "with confidence" but also to aspire to having information that is "complete, true and up-to-date" in systems "supporting a commander". Indeed, I hear and see such ideals commonly expressed by technical people and even occasionally by operational people.

Jerry Tuttle, on the other hand, although he is a self-described "born optimist"[7] when it comes to doing battle with the bureaucracies, is a consummate realist on matters of substance in the here and the now.

In the spring of 1988, even as he spoke of coming a long way and of a success story, and months before the Aegis cruiser *Vincennes* shot down an Iranian airliner in that cul-de-sac of a Persian Gulf, Tuttle oberved drily that, better as things were in the Gulf, some old-time problems were still around:

> "apart from the humanitarian aspects, you don't want to put an expensive Tomahawk, which is in limited supply — or Harpoon on a Texaco tanker, or on one of your own units when you're shooting at the enemy".[8]

Another Tuttle observation is the following:

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[6] Defense Science Board Task Force. Command and Control Systems Management. Office of the Under Secretary of Defense for Acquisition, Washington, DC: 1987. Cited in Snyder, Frank M., Command and Control: Readings and Commentary. Cambridge, MA: Harvard University Program on Information Resources Policy, P-89-1, April 1989, p. 11.

[7] Tuttle, p. 101.

[8] Ibid, p. 99.

"All good sailors make a report and stay four hours ahead of Position of Intended Movement. We found out why there was a four-hour delay in position reports. The reporting system was set up in 1982. When they started this reporting system they pumped these reports out dutifully. They file these reports every four hours. It goes into this Honeywell, and it just resides there. But in 1982 the report was created for a machine — slant, slant, so many spaces; slant, slant, so many spaces. You had to spell out "Secret" or "Confidential" every time, etc. We became slaves to a system that no one used. But they had so many error rejections that they had 15 people on CINCLANTFLT staff who did nothing but make corrections. They had so many rejections at first that they only picked up the ones it rejected every four hours. The procedures became chiseled in concrete. It became one of the Ten Commandments, and they only picked the reports up every four hours.

I challenged the database and found Texaco tankers going by Omaha, Nebraska, and these tracks had been in the system since 1982. That same database was being drawn upon in the National Military Command Center by very intelligent 0-4 or 0-5 level Air Force, Army, or Navy officers. Every morning at seven o'clock and every evening at seven, these officers would get a page printout of all ship locators and put it up on top of the terminal. Why? Because that's what was in the turnover logs. Who looked at it? No one. But Admiral Crowe has to know right away where his ships are".[9]

So, in 1988, a decade after the Defense Science Board first expressed the ideal quoted on page , the millenium had not come. Jerry Tuttle could cite "a real success story" (page 2). But he could also worry about landing a Tomahawk on friendlies and report a database with "Texaco tankers going by Omaha, Nebraska" (page 4).

Again in 1988, Jim Locher, a staffer of the Senate Armed Services Committee — and just recently nominated by Secretary Cheney to be the Assistant Secretary of Defense for Special Operations Forces and Low Intensity Conflict, cited this list (Table 1)[10] as among the motivations for passage of the Goldwater Nichols Defense Reorganization Act of 1986. The list reached well into the decade between the first Defense Science Board report and the second, and we could add to it the Stark and Vincennes incidents.

Can we expect the millenium to come in another decade, namely by the year 2000? 10 years after that? I think not.

Tuttle's anecdotes and Locher's list amply illustrate not only that the millenium has not come but why it cannot come. People at every level do not, as the Defense Science Board Task Force statement implies, stand apart from their command and control systems. Commanders at many levels are a part, an integral part, of command and control systems.

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[9] Ibid, p. 104.

[10] Locher, James R., III. "Special Operations and Low Intensity Conflict: A Congressional Perspective", Seminar on Command, Control, Communications and Intelligence, I-89-1, Spring 1988. Cambridge, MA: Harvard University Program on Information Resources Policy.

Grant, even if only for the moment, a belief that I share, namely the belief that scientific knowledge will continue to widen and deepen. Grant that, therefore, new technology will continue to increase the variety of means at our disposal. Still, since fallible and resolutely imperfect people are part of command and control systems, one would have to believe in human perfectability as well, in order to take seriously the Defense Science Board's expressed ideals. I shall not take you further down that theological track.

- Iranian rescue mission
- Bombing of Marine barracks in Beirut
- Grenada
- Inadequate support for *Achille Lauro* and other counter-terrorism efforts
- DoD resistance to Special Operations Forces airlift initiatives
- *Mayaguez*
- Vietnam

Source: Locher, p. 43.

Table 1.

Evidence of Deficiencies Instrumental in Motivating Passage of Goldwater-Nichols Defense Reorganization Act of 1986

I think it more fruitful to accept fallibility, to accept that data bases will forever place Texaco tankers in Omaha, Nebraska. This leads, I think, to asking better questions.

I think that being decisive is quite consistent with doubts about the rightness of any specific decision: a commander is better served by healthy doubts that stimulate his monitoring the consequences of key decisions than by macho but misplaced confidence in decisions. I think it self-evidently absurd to believe that information can ever be complete, true and up-to-date anywhere other than in a stone cold dead universe. Nothing in science and technology can make a day so clear that you can see forever through von Clausewitz' fog of war.[11]

Thus, as I see it, the Defense Science Board's expressed ideal is false because it is unattainable not just in practice but even in principle. It is misleading in that it diverts attention from practical principles. It is dangerous because this diversion produces systems that are less effective than they otherwise might be. The best, as always, is the enemy of the good.

What I believe to be attainable is modest but, I think, sufficient: an edge over the other guy. All we need to beat the competition in trade, all we need to deter a war or all we need to win

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[11] von Clausewitz, Karl, On War. Washington: Infantry Journal Press, 1950, pp. 51-55.

a battle is command decisions that are made *with greater confidence than the other guy's* and that are based on information that is *more detailed (not "more complete": completeness is an impossible dream), more realistic, and more up-to-date* than the other guy's.[12]

Like us, the other guy is merely human, not divine. As the wise-ass but nonetheless profound saying goes, the reason why armies ever win wars is that they fight other armies. Aspiring to divine perfection distracts us from focusing on the real job, namely protecting ourselves from other human beings. And aspiring to an ultimate and static perfection distracts us from facing up to the dynamic and therefore perishable nature of whatever edge we may have over the other guy or of the other guy's edge over us: nothing in science and technology has put an end to the ageless actions and reactions of measures and countermeasures.

More likely to be fruitful, I think, than mooning over unattainable ideals is asking ourselves what we might do to increase the odds that the edge will be ours in a dynamic world of new science and technology, a dynamic world of ever shifting organizations.

That implies, I think, emphasis on knowing as much as possible about where the other guy has struck his balances, and being better than the other guy at identifying and adjusting one's own critical balances.[13]

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[12] For kindred views on this expressed in greater depth see: Rechtin, Eberhardt. "The Technology of Command", Naval War College Review, March-April 1984, pp. 5-25.

[13] "Balances" seems better than "tradeoffs", with its static, once-and-for-all connotations. "Juggling" would do, but connotes a more injudicious or playful an aura than is intended. "Tensions" has the same dynamic connotations as "balances", but I prefer to think of performing balancing acts than of resolving tensions.

III. The Observer Observed: Why Believe Any of This?

Before I turn to looking at balances, I should like to tackle a couple of procedural questions: How and why did we get to where the balances are today? Why should you believe me over the Defense Science Board?

This last question leads to another: How best to navigate the chaos and the controversy of rapid change? With charts, of course. Whose charts? The adversary's? Another military service's? A competing contractor's? Of course not. With charts made by competent and impartial observers of the changing information world. And where, pray tell, be there such competent and impartial observers of the changing information world? Of course at the Harvard Program on Information Resources Policy, yours truly, Anthony G. Oettinger, chairman, at your service.

In all seriousness, my colleagues at the Program and I set out, over 15 years ago, to create a climate that would favor research, both competent and impartial, on controversial matters of importance to stakeholders. Ideally, the findings of this research could be trusted by any stakeholder or by any bystander and could therefore aspire to being useful to any stakeholder or bystander.

Competence alone is no great problem. There are, fortunately, still lots of very competent people in the world. But competent people tend to be partial to what they are competent in. Why not? That's why they bothered to get good at whatever they are doing wherever and however they are doing it.

Impartiality alone is no great problem either. Just as all roads get you there if you don't care where you're going, so it's easy to be impartial when you don't know anything. With all the incompetence around us, impartiality is no big deal.

But combining competence <u>and</u> impartiality is a problem. So much of a problem that it is but rarely even tackled. It is not enough to hang out a shingle that proclaims, Snoopy like, that "The competent impartial adviser is in!". The only stakeholders who fail to look behind such a shingle are in the market merely for file stuffers. Even stakeholders who care about no more than covering their asses will look for something more substantial than shills' shingles to cover them with. And stakeholders truly concerned about the competence and the impartiality of the advice they buy ask many questions. Among the first of these questions is "who owns you?".

My associates and I have tailored what still seems to be a unique process for addressing "who owns you?" and other questions that stakeholders who want competent and impartial advice ask about their advisers. We are eager to share our recipe with anyone interested.

The process has many components, each responsive to some question about impartiality or about competence. Since bills have to be paid, answering "nobody" to "who owns you?" only invites raised eyebrows as in the presence of fools or knaves. Thus "nobody" is an impractical or a deceitful answer to "Who owns you?". "Some" as an answer to "Who owns you?" is the very

IV. Recent Evolution of our Concepts of Intelligence, Command and Control.

Let us now turn to how we got here from there?

The perfectionist flavor of the Defense Science Board's perception of command and control is quite understandable in the context both of history and of the eyes of that specific group of beholders.

At the 1988 seminar, Ruth Davis, who "had the fortune to stay involved"[14] throughout the 30-year history of contemporary command and control while holding numerous high level jobs, reports the following perceptions of the concept of "control" at its inception within a technological sub-dialect in the 1950s:

> "The original concept of control systems would fit what we would call tactical today. They were geographically localized, dedicated, or had very discrete bounded functional requirements. Control meant actual control of forces; it did not imply control of sensors, intelligence, or assets that were not under your immediate control.
>
> In the case of the Navy, for example, it meant control of carrier aircraft. It meant control of the air control facilities on board ships, along with control of shipboard radar. In the case of SAGE, it meant control by the Air Force of the air defense systems that were along the East Coast and Canadian perimeters".[15]

Davis' perception of control lends itself to illusions of perfectability. It is purely technical and, in technical terms, it is a relatively simple "open-loop" concept, challenging for the information-handling technology of the 1950s, but well within the state of the art today. This perception of control differs from "closed-loop" technical concepts; it differs from military notions of operational control; and it differs from a myriad other variants readily heard in conversations on the subject and seen in printed expositions.[16]

Great diversity of perceptions prevails even today. This diversity accounts for at least some of the perennial difficulty (Table 1) we have in coming to grips with problems of intelligence,

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14 Davis, Ruth, "Putting C^3I Development in a Strategic and Operational Context", Seminar on Command, Control, Communications, and Intelligence, I-89-1, Spring 1988. Cambridge, MA: Harvard University Program on Information Resources Policy, p. 161.

15 Ibid, pp. 162-163.

16 For deeper insights into diverse perceptions of command and control (including the Joint Chiefs' Unified Action Armed Forces (UNAAF) "This operational control is defined as those functions of command involving the composition of subordinate forces, the assignment of tasks, the designation of objectives and the authoritative direction necessary to accomplish the mission.") see Cushman, John H. Command and Control of Theater Forces: Adequacy. Washington, DC: AFCEA International Press, 1985. See also: Cushman, John H. Command and Control of Theater Forces: The Korea Command and Other Cases. Cambridge, MA: Harvard Program on Information Resources Policy, P-86-2, 1986. Snyder, Frank M. Command and Control: Readings and Commentary. Cambridge, MA: Harvard Program on Information Resources Policy, P-89-1, 1989. van Creveld, Martin. Technology and War: From 2000 B.C. to the Present. New York: The Free Press, 1989. _____. Command in War. Cambridge: Harvard Univ. Press, 1985. See also: Reorganization of the Department of Defense, Hearings before the Investigations Subcommittee of the Committee on Armed Services, House of Representatives, Ninety-Ninth Congress, Second Session, 1986. Washington, DC: U.S. Government Printing Office, 1987. For an account of attempts to negotiate common understandings of contemporary intelligence, command and control concepts, see: Defense Communications Agency, Joint Directors of Laboratories and National Security Industrial Association. Command, Control and Communications Technology Assessment: Conference Report 31 Jan - 1 Feb, 1989.

essence of partiality. Only being owned by everybody means being owned by nobody. Aspiring to that is getting as close to Olympian detachment as is practical in the fallible mortal world.

We have therefore deliberately sought our research money both in small doses and from the widest variety of sources that we can convince to contribute. We aim for competing industries and for competitors within industries. Where relevant, we go for the military as well as the civilian. We like both public and private contributors, both domestic and world-wide contributors, both small and large contributors, and so on.

The appended list (Section VIII, page 29) gives a snapshot of where the money came from in January of 1990. The most astute of concerned stakeholders also ask us if there is any money that is <u>not</u> on that list and the answer to that is "no!".

Besides impartiality, small amounts of money flowing from many sources also help toward another quality that we prize: resistance of our research activities to the money droughts that take place when this or that source dries up from the ins and outs of fashions and of incumbencies. Our contributing stakeholders themselves have come to value this statistical stability. We can stay with them through their droughts, and we can provide a trusted communal memory that they would otherwise lack. History does not repeat itself, but history sure helps ask questions that one might otherwise never think of asking.

And, since the money comes in annual contributions, it keeps up pressure on us to stay relevant to the collective of the stakeholders.

command and control. This great diversity also provides ready excuses for many difficulties that are really rooted elsewhere, as in inter-service rivalries, for example.

In any case, perceptions were not static, either. By the 1960s Davis observes that:

"Technology allowed a much greater aggregation of information in computers and a greater sophistication in the manner in which computers could handle and display information. This gave meaning to the phrase 'command and control,' or C^2, which was 'invented' at a conference at which we were trying to describe decision making by military commanders. It did not seem to be a very significant decision at the time, but the phrase has been long lasting and has become a part of both military and technological terminology".[17]

The technological, open-loop flavor remained in how Davis perceived the mid to late 1960s concept of command and control, with communications added by then. What had changed was the scale of operations along with the scale of budgetary concerns and all the related turf considerations:

"I'm differentiating control from command. In the early days we were not able to be as precise as we are now. The differences between C^2 and C probably centered on the ownership, size, and processing of computer databases, along with the ability to make decisions requiring the aggregation of a large set of incongruous data or information. From a military point of view, C^3 implied automated decision-making capabilities at theater command levels, and at the unified or specified command levels....

...C^3 was identified with the first Worldwide Military Command and Control System, called WWMCCS."

And here is the kicker. Davis adds:

"WWMCCS not only became an infrastructure for decision making at the operational level; it also became a programmatic and budget structure at the program and budget levels in Washington. It begat the mechanism to control [Ed. note: Note the pun into the financial, accounting and bureaucratic dialects] the spread, standardization, and resources associated with command and control and communications (C^3) across the world".[18]

We are now punning, using the same word "control" for vaguely related concepts in the dialects of the technical, programmatic, budgeting, operational, doctrinal and other subcultures all working the problem of intelligence, command and control. When all this "blue" jargon gets combined with English translations of "red" concepts like the Soviet notions of "troop control" and "correlation of forces", the fog gets still thicker.

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[17] Davis, p. 162.
[18] Davis, p. 163.

Looking through a seasoned budget warrior's telescope, Davis reports that the combination of intelligence, "I", with command, control and communications only made matters worse:

> "In the late 1960s there was a strong and successful attempt by defense policy makers to aggregate functions still further by creating C^3I — command, control, communications and intelligence. I fought that concept for about four years. My rationale was that having such an organizational aggregation would do nothing to improve the intelligence available to operational commanders either from their indigenous sensors or from central intelligence agencies. One would not, for example, be able to process both intelligence information and C^3 data in the same computers or in the same rooms because of security problems. The principal result of a C^3I function would be an aggregation of budget and management control in Washington that would dilute both the funds for C^3 and the funds for I.
>
> Nevertheless in 1971 the C^3I office in OSD [Office of the Secretary of Defense] was formed. In spite of valiant efforts over the years, my assessment is that "C^3" and "I" never really got married. They have just been forced to stand together at the altar for 18 years".[19]

Note how this accepts the "green door" as given, the J2-J3 wall as given. Anyhow, while C^3 and I were getting stiff standing at the altar, evolution continued. Here is Davis' perception of the 1980s:

> "In the 1980s we are witnessing a new dimension in C^3I. C^3I has really come to connote decision making in an abstract and programmatic sense, in contrast to its start as an operational or a tactical function. Today, we see the phrase 'battle management/C^3' popping up in both a tactical and a strategic sense. It exemplifies the Strategic Defense Initiative and the associated control of military operations in space. Battle management/C^3 is the phraseology describing control of and by the Strategic Defence System of space assets for strategic defense. Battle management/C^3 brings us full circle to where C^3 again implies primarily the management of forces and not just the management of programs and budgets".[20]
>
> How can one talk reasonably competently and impartially in this Tower of Babel?

I perceive military or civilian management functions and the effectiveness with which these functions are carried out with less regard for budgetary and turf overlays, at least for openers, than even Davis' latter-day perception of C^3I as "decision making in an abstract ... sense".[21] That is why this talk has "intelligence, command and control" in the title, not C^3I.

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[19] Davis, pp. 163-164.

[20] Davis, p. 164.

[21] The following account is adapted from U.S. Congress, House of Representatives, Ninety-Ninth Congress, Second Session. Hearings before the Investigations Subcommittee of the Committee on Armed Services: Reorganization of the Department of Defense. February-March 1986. Testimonies of John H. Cushman and Anthony G. Oettinger, pp. 544-582.

What makes up an organizational brain? An organizational brain is organized people using organized tools.[24]

Throughout much of the last forty years — as Ruth Davis' observations (pp. 9-11) corroborate — the technical tools of communications and of intelligence — phones, radios, computers, crypto gear, national technical means of verification and the like — have often been equated with command and control systems. The tool part of the organizational brain has been confused with the whole of the organizational brain. As a result, command failures have been mistakenly ascribed to failures of the tools. So we keep trying to fix the tools. And that doesn't work as well as is promised, for example by the Defense Science Board.

Throughout much of the last forty years, the brains of individual people have been confused with the whole of the organizational brain. Command failures have been mistakenly ascribed to failures of individual people. But we routinely keep rotating the people at intervals of a couple of years or so. So particular individuals cannot be responsible for what recurs over generations.

Over the last forty years, much money has been spent for better tools, some of them of amazing technical virtuosity. Over the last forty years innumerable individuals, many of them people of the greatest personal talent and dedication, have rotated through the billets of the military services, through the purple-suiter slots and through the intelligence community.

But, over the last forty years, events like those listed in Table 1 have persisted year in and year out. Many consider these events to reflect failures of command and control, whatever their outcomes or consequences.

A major common denominator over those four decades was the National Security Act of 1947, over three decades if you count from the passage of the 1958 Amendments to the Act.

The world at large has witnessed enormous changes in those three or four decades. Every major business with which I am familiar has made its brains over more than once during that time, so that it might cope more adequately with changes in the world around it. By literally making their brains over and by not just shuffling paper hats over the same old brains, these businesses have altered the balance of power among the limbs of their corporate bodies.

Passage of the Goldwater-Nichols Defense Reorganization Act of 1986 breached some of the walls of the services and tipped the balance of bureaucratic military power slightly away from the four services and toward the CINCs, namely the combatant commanders, and toward the Chairman and Vice Chairman of the Joint Chiefs of Staff.

That shift in balance was another reason, besides faster, smaller, cheaper, better information technology, why Jerry Tuttle could assert that "we've come a long way in interoperability" (page 1) since Grenada in October 1983. As he put it in 1988:

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[24] For some, that is a definition of technology. But, for most people, "technology" puts the accent on the tools. Both the Rambos and the touchie-feelie folk emphasize people. I wish to emphasize <u>both</u> people <u>and</u> tools.

I mean thereby to alert you to my usage, which differs from Davis' and, more than likely, differs also from your own, whatever your daily usage may be.

There is ample license for choosing one's own meaning: "'When I use a word,' Humpty Dumpty said, in rather a scornful tone, 'it means just what I choose it to mean — neither more nor less'".[22] But my motive is not frivolous: only by standing back and using neutral yet meaningful terms is it possible to do justice to the differing perceptions of the various stakeholders in an issue.

So, here is what *I* choose intelligence, command and control to mean.

Intelligence, command and control does for a company of bayonets, for a squadron of fighter planes or for an aircraft carrier task group what brains does for a dog's teeth or for a person's fists. Muscle is no good without the brains to apply it right. For organizations from two people on up to the largest alliances, intelligence, command and control systems are what flesh-and-blood nerves and brains are for individuals. That is why organization is a weapon of war as much as a knife or a nuke is.

One crucial difference between flesh-and-blood persons and organizations is that individuals can't do much about the brains they happen to grow up with. As Jack Jacobs put it in what I think is a classic paper that he wrote 25 years ago:

> "The human operator is the only link that cannot be changed by design, for his physical and mental capacities are largely formed long before he becomes the most vital part of a command and control system. It is a basic error to consider the command and control system as existing apart from the human element, for the human operator's capacities as an information system, in the end, will decide the success or failure of the system."[23]

In contrast to "the human operator's" nervous system, the intelligence, command and control systems of organizations are entirely man-made. Each of the individuals, such as the CINCs and the sergeants who are part of intelligence, command and control systems, comes in a more-or-less take-it-or-leave-it package. But which people are picked and how these people are organized is a matter of choice: organizations can and do procure and field their own brains as well as procure and field their own brawn. Organizations can fail because of a failure of either brain or brawn. Much attention traditionally focuses on military brawn. Not enough attention focuses on military brain, namely on intelligence, command and control as the nervous system of organizations, and neither as a piece of open-loop technology, nor as an organization chart, nor as a budget line-item.

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22 Lewis Carroll, Through the Looking-Glass, Chapter VI.

23 Jacobs, J. F. Design Approach for Command and Control. Bedford, MA: MITRE Corporation, SR-102, January 1964 (Adapted from lectures given December 16 through 19, 1963 at the University of California and the University of Washington), p. 1.

"That is one reason that the [Goldwater-Nichols] reorganization was done. It brought us into more unity. We do far more joint exercises and operations today.... C^3 systems, more than tanks, ships, and aircraft, have a greater pervasive application for jointness than any others and are, quite frankly, you might say the glue that draws all of the disparate elements together. I won't go into detail to see how initiatives have been taken to achieve equipment commonality and interoperability, but to point out that an ongoing success story, after a brief period of time — Grenada [October 1983] hasn't been that far past — is in that cul-de-sac at the base of the cradle of civilization, the Persian Gulf".[25]

Might Goldwater-Nichols have shifted the balance between services and CINCs too far? I put this to Bob Herres, who was in 1988 as he is now Vice Chairman of the Joint Chiefs. The Chairman, Admiral Crowe, has made General Herres responsible for the military's implementation of the Act. "Perhaps", I asked Herres — echoing an argument made against key provisions of the Goldwater-Nichols Act — "the CINCs ought to be worried about being combatant commanders ... and not get absorbed in ... budgets and procurement".[26]

Here is how Herres saw it as of the spring of 1988:

"I think it came out about right in that regard ... There were people talking about giving the CINCs their own budgets and all that kind of stuff, and that would have emasculated the military departments, creating the utmost in disaster. There's a reason to have military departments. ... The services have the vast logistics systems to manage. Somebody's got to do that, and the CINCs can't do it ... We needed to get the situation changed so that [the CINCs] can exert more influence over the services, and I think we've struck a good balance now. They don't have their own budgets. That distinction between the operational commands and the services still exists, but there is the opportunity to exert influence without controlling what the services do. What we've done is balance this out better. I think the result is pretty good. The CINCs still are the operational commanders, and that is their primary purpose".[27]

But folks thought they had it about right in 1947, and in 1949 and in 1958 and then again in 1986, all major milestones in the evolution of the National Security Act of 1947. And for all that, the dreary list of Table 1 goes on and on. Why?

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[25] Tuttle, p. 93.

[26] Herres, Robert T. "Strengthening the Chairman of the Joint Chiefs of Staff", Seminar on Command, Control, Communications, and Intelligence, I-89-1, Spring 1988. Cambridge, MA: Harvard University Program on Information Resources Policy, p. 76.

[27] Herres, pp. 76-77.

V. Balancing This Against That and the Other Thing

"Merciful, even magnificent it has been, that along with the role of science and engineering in providing nuclear and rocket propelled defenses of our freedom and humanism, it has been possible for this intelligence community and its sponsors at the top of our government, our chiefs of state, to apply equally new and effective science and technology to gathering and using knowledge which has so far substituted for the violence of our primary nuclear shield. ... for a length of time unsurpassed in recorded history, total war (whose horrors were already demonstrated in both nuclear and non-nuclear forms in the mid-century) has been deferred, and perhaps - just perhaps - even supplanted."

William O. Baker[28]

Why, indeed? This brings us to balances, as I promised on page 7.

In their introduction to the collection of essays Science of Command and Control: Coping with Uncertainty the editors, Stuart Johnson and Alexander Levis, accept that

> "The commander will never have a full complement of unambiguous information at his disposal. His decisions will always be made in the context of uncertainty. A good commander will learn to recognize this and act accordingly. Does this mean that there are no principles useful to guide a commander? Not at all."[29]

I believe in a principle, a cousin to Murphy's Law that anything that can go wrong will. My principle is that balances never stay balanced.

Why, over the centuries, do capable, honest, well-intentioned people assert again and again that "we've struck a good balance now" (Herres, page 14) while, again and again, the balance turns out to have been bad, if not at one critical juncture, then at another (Table 1)?

In my mind, I single out as paramount two distinct but occasionally mutually influential reasons.

One reason is that we keep on translating new knowledge from art or new knowledge from science, we keep translating this new knowledge into new technology, into new means. That's the part that looks progressive.

But whenever, armed with new means, we put our thumbs on one of Fate's many balances, we tip that balance one way or the other. This observation is at least as old as the story of the Garden of Eden or the myth of Prometheus. The strategic success that Bill Baker so eloquently extols has provided a shield of global nuclear peace over conflicts ranging from routine police matters through drug wars and terrorism to regional conflicts with non-nuclear means.

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[28] Baker, William O. Remarks at the SASA Awards Ceremony, in Colloquy. Annapolis, MD: Security Affairs Support Association, Volume 5 Number 2, June 1984 p. 6.

[29] Johnson, Stuart E. and Alexander H. Levis, Eds. Science of Command and Control: Coping with Uncertainty. Washington, DC: AFCEA International Press, 1988. Introduction by Johnson and Levis, p. vii. See also _____. Science of Command and Control - Part II: Coping with Complexity. Washington, DC: AFCEA International Press, 1989.

their missions to bomb a target. Very shortly thereafter, within hours, they would put up a photo reconnaissance plane which would fly over that target to take a look at the target to see the damage. He would return, and they would process the film, and that night they'd take a look. 'No, you didn't hit that tank. You didn't hit that rail yard. You didn't do this. Go back and do this again'. That cycle would sometimes take days. We are required to accomplish that effort now in hours and minutes."[30]

- **The balance** between owning and controlling limited assets and sharing vast assets with little if any control over them.

  Frank Breth again:

  "The acronym TENCAP stands for tactical exploitation of national capabilities. As you know, there is lots of junk flying around in space. There are very important items that you read about. There's a terrific intelligence capability in space. It's nice to have the President receive the product, but it's also nice to have that forward-deployed Marine out there know what that system can do for you and get him those products".[31]

  And you worry about whose priorities prevail in the crunch.

- **The balance** between experience, focused competency and set ways that are best suited for stable tasks versus innovation, generic competency and adaptability best suited for ill-defined or undefined tasks.

  On that score, I give you the testimony of a civilian crisis manager, Dick Thornburgh, now Attorney General of the United States, but in 1988 reminiscing about crises he had been through as governor of Pennsylvania:

  "Perhaps the first among these lessons is to 'expect the unexpected' and be prepared to adjust accordingly. For us, if it wasn't Three Mile Island, it was three-mile long gas lines at a time of energy shortage. If it wasn't a water shortage, it was a flood. If it wasn't a transit strike, it was a subway crash. If it wasn't an underground mine fire, it was a prison hostage crisis. All of which happened while I was in office".[32]

  "Because we were so unfamiliar with the existing state bureaucracy and because there simply was no state bureau of nuclear crisis management as such, let alone a precedent to study, we did something at the outset which was to serve us very well. In lieu of the existing bureaucracy, I assembled what might be called an 'ad hocracy' — a team of close associates whose judgment and competence I would trust absolutely, and a support group

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[30] Breth, Frank J. "Getting in Front of C^4I^2 Problems", Seminar on Command, Control, Communications, and Intelligence, I-89-1, Spring 1988. Cambridge, MA: Harvard University Program on Information Resources Policy, p. 149.
[31] Ibid, p. 147.
[32] Thornburgh, Richard L. "Three Mile Island: A Case Study in C^3I for Crisis Management", Seminar on Command, Control, Communications, and Intelligence, I-89-1, Spring 1988. Cambridge, MA: Harvard University Program on Information Resources Policy, p. 27.

The second reason is that organizations keep changing and, in changing, upset all the balances in which they weigh or which they hold in their hands. This too, is ancient wisdom. Only the pace of change alters with time. So, even as we roll ever faster, we have to keep re-inventing the wheel.

What balances am I talking about? Here are some that occur to me. Doubtlessly you will find many others in your minds if you start thinking that way, as I hope you shall.

- **The balance**, sketched by Bob Herres (page 14), between the military departments and their roles in training, logistics, systems acquisition, research and development and resource management and the CINCs and their roles in planning for, exercising for, and carrying out military operations, using the resources provided by the military departments.

  If military departments did not exist, they would have to be invented. Like most "real worlds", the military world is too big to treat effectively as an undifferentiated whole. So, breaking the military world into specialties, the services and their components, is essential, even if the boundaries of the specialties — the services and their components — are arbitrary boundaries.

  But breaking up into specialties entails some way to orchestrate the specialties. So, if the CINCs did not exist, some other instrument would have to be invented. Tugging at the boundaries would occur no matter what the details of how the boundaries are drawn. There is no such thing as a last reorganization except just before an organization dies. Introducing new technology may change just the details of a living organization. But that's enough to upset whatever balance might have been struck previously: so it was with the stirrup, the longbow, the airplane, and the means for instantaneous world-wide communications.

- **The balance** between waiting to learn more and more about a situation and acting in time to do something about that situation.

  There is always something else that could be worth knowing, that could increase one's confidence. But it takes time and other resources to get to know it. As time passes, the time for significant action may go by. That is one reason why the idea of complete information is nonsense.

  By enabling some things to be done in fractions of a second that used to take hours or years technology gives the illusion that you can have your cake and eat it too. But the interplay of measures and countemeasures soon speeds everything up, so tradeoffs that once were measured in hours now get measured in seconds. This creates a need to reset the balance on a different time scale than before.

  As Frank Breth put it in 1988 when he was the Marine Corps' intelligence chief:

  "... real time means now. Near-real time means in a few seconds or minutes. For example, when carrier air ... and Air Force air ... were fighting in North Korea, they would be given

of relevant state specialists whose judgment and competence were about to be tested under pressures none of them had ever known before".[33]

From these experiences, Thornburgh distilled some practical advice:

"Upon taking office, any Governor should make sure not only that the state's existing emergency apparatus is adequate, but also that good men and women are in place to handle the administration's planned agenda, should the chief executive become occupied by an item that never was planned for at all".[34]

If you put "any CINC" in place of "any governor", that strikes me as sound military advice as well.

Consider a military angle as expressed by Bob Kingston, an experienced Special Forces officer who served as the first CINC of the U.S. Central Command:

"The Army has formed a separate branch for special forces. I was probably the only ... senior officer requested who said, 'Don't do it. It's a stupid thing to do.' ... People who are outstanding in Special Forces will retire as captains and maybe as lieutenant colonels. If they stayed in infantry, they'd be general officers, but there's no place to put them. They blocked themselves by trying to institutionalize special operations....SAS has NCOs staying as long as they are physically able to perform. The officers come in for two or three years and then go back to the regulars".[35]

Kingston's comment could be made about civilian specialties as well. It is one of the reasons why specialty shops that used to be staffs in large organizations more and more nowadays set themselves up as outside businesses. Some Beltway Bandits exemplify the point even for the military.

John Rothrock makes the same generic point with specific reference to the question of whom to consult regarding improvements in command and control:

"A now honored truism within the Command and Control community (the extent to which it is actually followed is another issue) is 'get the user's (i.e. the 'operator's' and or 'Commander's') requirements. ... Is it realistic and advisable to allow 'operators' and 'commanders' to define the operational relevance of the new technologies — especially given the extent to which those technologies' most effective applications might require substantial rethinking of employment practives or objectives".[36]

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[33] Ibid, p. 22.
[34] Ibid, p. 27.

[35] in Lockwood, Earl. "The Evolution of Special Operations Forces", Seminar on Command, Control, Communications, and Intelligence, I-89-1, Spring 1988. Cambridge, MA: Harvard University Program on Information Resources Policy, p. 112.
[36] Col. John Rothrock, USAF, Senior Fellow, Strategic Concepts Development Center, National Defense University. Syllabus for NDU Command and Control Course, personal communication, September 1989.

- **The balance** between putting everyone in the know for operational effectiveness and limiting who's in the know for operational security.

  Better crypto technology like STU-III secure telephones makes it easier than with plain old telephones to put all of *us* in the know while keeping all of *them* in the dark. But, if John Walker walks among us, he will tell *them* if he knows, so it's déjà vu all over again for the new tools.

- **The balance** between using intelligence to good effect and protecting sources and methods for use another day.

  Rae Huffstutler who, in 1988, had just moved from being director of the National Photographic Interpretation Center to being the CIA's Deputy Director of Administration, gives an intelligence view of that balance:

  "...they are very real balances that have to be struck — I mean compartmentation versus sort of dropping all compartments. You have a very difficult situation, particularly in Washington, where if you aren't careful about compartmentation, you're going to lose your source in a snap of the fingers. He's going to pop up, be quoted in the newspaper, and he's going to be dead. I've seen it happen, and it can happen within days of an article hitting the press".[37]

  The same balance, framed in different words by Bob Herres, the Vice Chairman of the Joint Chiefs of Staff at the turn of the 1990s, words which he spoke as Commander of the Air Force Communications Service at the turn of the 1980s:

  "...[I]t seems that we're in some sort of dilemma: on the one hand, we must maintain the security and integrity of our sensitive information, but on the other hand we must be able to respond quickly to rapidly changing situations, especially during times of crisis or war. And this means that we must process and distribute information rapidly."[38]

  Herres went on:

  "We cannot let security considerations throttle our operational responsiveness, but we also cannot jeopardize sources of intelligence information, war plans, actions, or sensitive information by having some unknown hole in our security which could be exploited by some individual or group, quite undetectably."

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[37] Huffstutler, Rae. "Intelligence Sources and Their Applications", Seminar on Command, Control, Communications, and Intelligence, I-89-1, Spring 1988. Cambridge, MA: Harvard University Program on Information Resources Policy, pp. 7-8.

[38] Robert J. Herres, "Overview of Computer Security Requirements," text of a speech included as Appendix C in: J. Barton DeWolf and Paul A. Szulewski (ed.), Final Report of the 1979 Summer Study on Air Force Computer Security, the Charles Stark Draper Laboratories, Cambridge, MA, Report Number R-1326, October 1979, pp. 132-133. As cited in Jelen, George F. Information Security: An Elusive Goal. Cambridge, MA: Harvard University Program on Information Resources Policy, (P-85-8), 1985, p. I-2.

VI. Balancing Acts for Relative Advantage

"Eternal vigilance is the price of liberty."
Attributed to Thomas Jefferson

So, where are we?

At one extreme, we perceive with some certainty that there is progress where technology can be applied to improve our instruments, our means, along fairly well understood or at least widely enough agreed upon scales or criteria. Nowadays, for instance, faster, smaller, cheaper, better electro-optical tools for gathering, transmitting, manipulating, storing and displaying information keep coming on the scene. Since World War II the range of these tools has expanded from the tactical to the global. As Davis and Breth tell us, the time of operation has gone down from hours into minutes or seconds. If you like a scale of how far force can reach how fast, these changes can be read as progress.

At the other extreme, there is irreducible uncertainty and therefore unavoidable surprise and — best remembered — unpleasant surprise about random acts like the unpremeditated suicide mission of a single fanatic or nut, the incidents of airliners that attracted the attention of the Soviet Air Force in Kamtchatka or of the U.S. Navy in the Persian Gulf.

The landscape in-between these extremes, where most of the action is, is filled with innumerable balancing acts, like those illustrated in Section V, that we and they keep on playing out with some mixture of spontaneity and of action and reaction, of measure and countermeasure, of move and countermove. The essential ingredients of those balancing acts, again as illustrated in Section , are us, them, our tools — technical and organizational — along with our values and their values, our goals and their goals, the all-important but often implicit elements that calibrate the balances and determine the relative importance of the diverse balancing acts.

A listing of balancing acts, a listing far more extensive than the sample of Section V is only a beginning. A beginning, not of a journey toward unattainable perfection, but toward a realizable edge, however small, for our settings of our balances over their settings of their balances. Running down a mental check-list of balancing acts can spot some balance that's both grievously out of whack and within one's power to redress while there's time.

That such a listing can never be complete is not of itself cause for despair. The game — military superiority or economic competitiveness — is, after all, not played against God or Nature but only against other mortals. It is relative advantage that counts, not absolute confidence nor complete, true and up-to-date information.

Focusing on <u>relative</u> advantage is critical because, in absolute terms, the military and economic games are harder than the scientific and technological games.

Albert Einstein believed that God does not play dice with the Universe. Immutable or only statistically stable, the order of the natural universe has a beguiling stability that underlies the

Whether it's a civilian or a soldier sitting on them, the horns of this dilemma remain as sharp at the turn of the 1990s as they were at the turn of the 1980s or, for that matter, at the dawn of both business and warfare.

- **The balance** between arm's length distancing of intelligence from policy makers for integrity and closeness of intelligence to decision makers for effectiveness.

  The perennial tug-of-war between the Department of State and the Department of Defense at one end of the rope and the National Security Adviser and the National Security Council staff at the other end of the rope is one case in point.

  Suppose the departments do good work and forward a range of options to the boss. The image of the President of the United States or of the Chairman of the Mammoth Corporation wading through all the options all by their lonesome plays better on the screen that in a real 24-hour day. So what really happens, of course, is that the boss gets a staff to do it. That staff, like the National Security Council's staff, then competes with the departments or tries to override them. The Oliver North Iran/Contra situation is a good example of the extreme of going toward too much staff role. When that happens, you tend to downgrade staff. You then put the burden back on the departments, you start getting wishy-washy broad option kind of things, and you say, "Oh my God, I can't cope with it," and you build up staff again.

  If you look at the history of the relationship between the decisionmaker, whether it's the President of the United States, or Ma and Pa from the Ma and Pa store, you see this kind of back and forth. It's an area where there are no set answers because there is an inherent instability, and so you have the rope going back and forth.

- **The balance** between more broadly informed but more poorly focused command from higher up and more narrowly informed but better focused command from lower down.

- **The balance** between centralized (or hierarchical) and decentralized (or flat) command and control.

- **The balance** between fielding and exercising new command and control measures thereby inviting earlier countermeasures and keeping new measures under wraps thereby delaying the creation of countermeasures but inviting operational failure of the measures.

- **The balance** between fielding a new communications system and improving indoctrination that might reduce the need for communications in a combat situation.

- **The balance**, within the United States government, between powers exercised by the executive and legislative branches in military command and control.

successes of the natural arts and sciences within the past millenium or so with phenomena where the underlying order changes, if at all, on a scale from century to aeons.

By contrast, the man-made rules of organizations last only through a range from seconds to generations, depending on the size of the organization and on how deep the rule runs in the organization.

The natural arts and sciences have given us reliable understanding if not mastery of dynamic processes played out according to laws of Nature which stay put for practical lifetime purposes.

But, to the extent that the military, economic and social arts and would-be sciences have aped the natural sciences over the last few decades, their record has been a dismal failure. I think there is a good reason for that. Dynamic processes, like actions from policing against drugs through anti-terrorism through low-intensity conflicts through theater warfare to all-out nuclear war, that are played out according to the rapidly changing, for practical lifetime purposes, rules of mankind, are beyond our present mastery.

Keeping a checklist of balances is a practical way to get along. It might also be but need not be a step on the road toward identifying the relevant rules of mankind, ours and theirs, sorting out those that are easily changeable and rapidly changing from those that are hard to change and staying put and toward thinking about what that means toward reducing surprise or toward cutting losses or even gaining advantage when surprise occurs, as it inevitably will.

Henri Bergson, in one of my favorite aphorisms, urges us to "act as men of thought; think as men of action". I would add that even though you prepare against surprise, you must be prepared to be surprised nonetheless. The aim is to be less surprised than the other guy!

To this point, I have drawn my illustrations from the past and the present. There are also, it will not surprise you to hear, plenty of opportunities for future surprises.

VII. From Simplicity to Complexity and Back: The Eternal Round

First, even as you heard me rattling off my samples of balancing acts, it perhaps occurred to you that these samples are not independent of one another but interact in many ways, some of which lie on the suface but most of which are buried. How far might one usefully go in trying to tease out and make explicit such buried interactions? I have no idea, although I think it probably worthwhile to give it a go.

There are plenty of future threats to go around. Here is a sampler from early 1989 speeches of the incumbent Director of Central Intelligence, William Webster.

Webster sounds the nuclear proliferation note, with its intimation of far greater complexity in a multi-threat future than in the presence of but one erstwhile "evil empire":

> "...In 1989, as in the 1960s, there are still only five countries which possess declared (that is, acknowledge possessing) nuclear arsenals — the United States, the Soviet Union, China, Britain, and France.
>
> This is not altogether reassuring. ... Several countries either possess a nuclear device or can fabricate and assemble one on short notice, and I'm talking about in a matter of weeks".[39]

If you prefer thinking positively about threat reduction, this comes with its own complexity:

> "We must ... help the policymaker sort out how reform will affect Soviet military and economic capabilities and — even more difficult — how it may change Moscow's foreign policy.
>
> We must manage the information explosion that glasnost has produced which, although very welcome to us, challenges us to sort out what is important and what is not, what is real versus what Moscow wants us to hear. ..."[40]

As World War II drew to a close, Vannevar Bush, one of the leaders of the application of science and technology to the winning of that war, wrote a report to the President of the United States looking forward to the role of science in peace. He called it Science: The Endless Frontier.[41] Looking forward into the 1990s, a similar report might be titled Complexity: The Endless Frontier.

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[39] Remarks by William H. Webster, Director of Central Intelligence, before the Town Hall of California, Los Angeles, California, March 30, 1989. Washington DC: CIA Public Affairs Office, p. 3.

[40] Remarks of William H. Webster, Director of Central Intelligence, before the Palm Beach Round Table, West Palm Beach, Florida, March 20, 1989. Washington, DC: CIA Public Affairs Office, pp. 6-7.

[41] First issued in 1945, the report is reproduced in the series: Cohen, I. Bernard (Ed.). Three Centuries of American Science. New York: Ayer, 1980.

formulation of requirements and in the research and design of a defense architecture that can be implemented incrementally and be fully tested to operate reliably. The analysis and measurement of system survivability, performance, and cost-effectiveness are critical to this process. Similar complexities exist for an adversary's system that would suppress or use countermeasures against a missile defense".[44]

Looking to "what may happen after the 1980s", Ruth Davis anticipates

"with equal certainty one of two divergent trends. We may on the one hand, aggregate functions even more. We may, for example, migrate to C^3IL — where "L" stands for logistics. Currently, for the first time DOD has projects underway to digitize all the information in the entire logistic cycle in order to achieve massive improvements. In addition to making specialized changes such as remote diagnostics, DOD is telling commanders that they can have automated and computerized electronic logistics systems at their fingertips. So C^3IL has definite attractions.

On the other hand, the divergent but equally possible trend is to disaggregate and return to C^2, C, I, and L. The force behind this trend is the disaggregation of military conflict as exemplified by special operations, localized tactical operations, and low intensity conflict (LIC), e.g., the LIC/SOF arena which negates much of the military need for aggregated information data banks.

A SEAL (member of a Navy Sea-Air-Land unit) will tell you, for example, that he doesn't want to know all the intelligence assets that he can task. He has specific localized functional tasks, and carries out C^2 or C or I, depending upon what his mission is. But he normally doesn't worry about the C^3IL or the strategic military or operational decision making. Prediction is difficult as to which trend will dominate, or whether both trends will occur as military conflict becomes more complex".[45]

Clearly, in a world of limitless growth in complexity, there will be more than enough balancing to go around as well. The following exchange with Rae Huffstutler gives a small sample from just within the small world of intelligence:

Huffstutler: "The military has an enormous role right now. Probably more than three-quarters of the people in the intelligence community are in the military components, maybe higher than that. So there's a tremendous capability out there right now. SIGINT is dominated by military collection. A lot of some of the more exotic collection is dominated by military collectors. No, they have a large role right now.

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[44] Zraket, C. A. "Uncertainties in Building a Strategic Defense", Science, Vol. 235. 27 March 1987, p. 1600.

[45] Davis, p. 164.

William Webster draws us a picture of one well of complexity he peers into:

> "We must provide intelligence analysis for U.S. - Soviet arms control talks ... [a]nd the amount of support required is tremendous. The INF treaty has required the United States to monitor about 120 facilities declared by the Soviets. And monitoring the START treaty, which is being negotiated in Geneva, could involve as many as 2,500 weapon locations spread throughout the Soviet Union.
>
> Monitoring agreements on strategic weapons, however, would be relatively simple compared to monitoring an agreement to reduce conventional forces. Our government might have to monitor an area encompassing about 10 million square kilometers — over 6 million square miles — and literally thousands of Warsaw Pact units and hundreds of thousands of tanks, armored vehicles, artillery pieces, and other kinds of equipment. The cost in money and manpower could be staggering — and yet this monitoring functions as an indispensable part of Congressional thinking as it approaches ratification of any such treaty".[42]

Offensive capabilities are not overlooked as a wellspring of complexity. Here is how Dan Quayle, now the Vice President of the United States, conceived an Afghanistan-like scenario when he was a senator:

> "...The mission planning to target these bridges and tunnels must be available within days, not weeks — something we cannot provide today."
>
> "...Mission planning ... requires collecting ultra-precise maps and photos along the route to each target and of the target itself; converting this information into digital computer commands for the missile for every second of its flight; and transferring all of this data from land sites to the launching ships." [43]

There is, in Quayle's statement, modesty about what can be done today, but confidence in tomorrow. The refrain "If we can put a man on the moon, why can't we ..." that grew familiar after the success of the Apollo program, illustrates that spirit and its blindness to our penchant for raising the ante on complexity.

MITRE Corporation's chief, Charlie Zraket, sees a clutter of complexities in the Strategic Defense Initiative:

> "Building a strategic defense against nuclear ballistic missiles involves complex and uncertain functional, spatial, and temporal relations. Such a defensive system would evolve and grow over decades. It is too complex, dynamic and interactive to be fully understood initially by design, analysis and experiments. Uncertainties exist in the

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[42] Remarks of William H. Webster, Director of Central Intelligence, before the Palm Beach Round Table, West Palm Beach, Florida, March 20, 1989. Washington, DC: CIA Public Affairs Office, pp. 6-7.

[43] Quayle, Dan. "Upgrading our Cruise Missiles: Imperative for the 1990s", Armed Forces Journal International, August 1987, pp. 76-80.

What I'm talking about basically is that this kind of collection, processing, and reporting function, instead of stopping in Washington with the finished product going out, has got to go directly out to the field, because of the timeliness issue. You can't have the delay: When you have forces that can move within hours, you've got to have information about those forces turned around and moved directly out to the field. It's that time pressure that's going to force the new architecture in the intelligence community which gets this data out to field commanders. That's the architecture that's going to be much more useful, I think, than the current one, to people who are dealing with low intensity combat, people who are dealing with conventional combat, and so on.

Oettinger: Let's stop there for a minute because I think in these last two minutes you've raised questions that could occupy us for the rest of this semester very easily. Students should keep them in mind also when Kingston, Tuttle, Lockwood, and Breth get here. Your answer that the military have a significant role right now to my mind is accurate up to a point, but the role is often as agents for some of these things that flow up to Washington and come back down again. And there is, in fact, it seems to me, a mammoth tension allied to the point that had already been made, that my, yes, we're doing this work, but it's for national things and then it comes back down to us, only after it's been through this, and we may not even get access to it because by that time it has been merged with some other things, etc., etc. As opposed to the question, hey, it's my assets and I want to use this stuff to do my local thing. Then you say, yeah man, but the information that you need for doing this thing right here may not be obtainable by assets under your control, it may be under somebody else's control, and if you get too damn localized then you will deprive yourself of 16 other things that you might've gotten, and while they come through Washington now, they've still got to come from someplace else, and how the hell do you organize that? It seems to me that you open up there the heart of the set of questions that are implied by your comment that things need to be reorganized. I think that part is quite true. The question is, how the hell do you it?

Huffstutler: Well, it's starting.

Oettinger: It reopens some of the most basic and almost insoluble disputes about structure and its relationship to performance.

Huffstutler: That is all true, and what's made these problem virtually intractable in the past is that the rare good has been the collector. The thing that's different is that today the rare good is the processor-analyst. We have an era coming where we're going to be able to collect more than we've

ever had in the past, and that's going to allow all kinds of people to be able to put in requirements and get them serviced. The choke point is going to come with the analytical effort — the readout, getting information out of it — and it's simply beyond Washington to be able to cope with all that. The right thing to happen is to have that pushed out into the field commands, if it is, say, a CINCPAC requirement. An example I like is a Navy requirement because I think it's clean and tidy. Forgive me if I oversimplify. Right now, every day, we look at Soviet ports for national indications and warning (I&W). One of the things that we're charged with doing is avoiding Pearl Harbor repeating itself and so we look at Soviet ports almost every day. What we're trying to answer, for example, at the National Photographic Interpretation Center is, are the Soviets generating forces to go to war? In order to answer that question we'll look at some ports, we'll look at some ground military bases, we'll look at air fields, we'll look at missile bases, we'll look at a wide variety of things, we'll circle through the force and we'll say, "Nope, everything is at standard readiness."

But the Navy has a different problem. Over and above having to report on indications and warning, the Navy is interested in finding out when ballistic missile submarines leave port. And the closer to the exact moment that they can get, the easier it's going to be for ASW forces to rendezvous with those forces and find them at sea. At the national level, we could tell them if war was imminent. But the Navy has a quite different and quite valid requirement to carry out its mission by rendezvousing with forces. They may want to look at this 10 times a day. I don't want to look at it 10 times a day. I could look at it three times a week and tell you whether they're going to war. You just don't pack a valise and go off to war. You have 12 million men in uniform. They don't sneak through the leaves without making any noise. It takes a while to pack the beans.

But the fact of the matter is, it is the advent of a large volume of intelligence that's beginning to flow like rivers, which means that those requirements which are now handled in Washington ought just to go directly to the Navy. At the national level you should continue to look at a broad sample of forces in order to make a determination of the general readiness of forces, but for what I'm now calling tactical targeting purposes, whether it's shooting at mobilized ICBMs in the field, or finding the ballistic missile submarines as they leave port, or keeping track of special units as they leave their casernes, that ought to go directly to the commander and be processed locally. That's a new architecture. That's a new program, and that's big money".[46]

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[46] Huffstutler, pp. 14ff.

VIII. Program Affiliates

February 1990

PROGRAM ON INFORMATION RESOURCES POLICY

Harvard University **Center for Information Policy Research**

Affiliates

Action for Children's Television
American Newspaper Publishers Association
American Telephone & Telegraph Co.
Ameritech Publishing
Anderson, Benjamin, Read & Haney, Inc.
Apple Computer, Inc.
Arthur D. Little, Inc.
Auerbach Publishers Inc.
Bell Atlantic
Bell Canada
BellSouth Corporation
Boice Dunham Group Inc.
Bull, S.A. (France)
Centel Corporation
Chronicle Broadcasting Company
CMC Limited (India)
Communications Workers of America
Computer & Communications Industry Assoc.
Computer Intelligence
Data America Corp.
Dialog Information Services, Inc.
Digital Equipment Corp.
Dow Jones & Co., Inc.
France Telecom
Gannett Co., Inc.
Gartner Group, Inc.
GTE Corporation
Hitachi Research Institute (Japan)
Honeywell, Inc.
IBM Corp.
Information Gatekeepers, Inc.
Information Industry Association
International Data Corp.
International Resource Development, Inc.
Invoco AB Gunnar Bergvall (Sweden)
I.T. Direction Ltd. (UK)
Knowledge Industry Publications, Inc.
Lee Enterprises, Inc.
John and Mary R. Markle Foundation
MCI Telecommunications, Inc.
Mead Data Central
MITRE Corp.
National Telephone Cooperative Assoc.
The New York Times Co.
NEC Corp. (Japan)
Nippon Telegraph & Telephone Corp. (Japan)
Northern Telecom Ltd. (Canada)
Nova Systems Inc.
NYNEX
OTC Limited (Australia)
Pacific Telesis Group
Public Agenda Foundation
Research Institute of Telecommunications and Economics (Japan)
RESEAU (Italy)
Rhode Island Public Utilities Commission
Rizzoli Corriere della Sera (Italy)
Saint Phalle International Group
Salomon Brothers
Scaife Family Charitable Trusts
SEAT S.P.A. (Italy)
Southern New England Telecommunications Corp.
State of California Public Utilities Commission
State of Minnesota Funding
TEKNIBANK S.p.A. (Italy)
Telecom Australia
Telecommunications Research Action Center (TRAC)
Tele/Scope Networks, Inc.
Third Class Mail Association
Times Mirror Co.
United States Government:
- Department of Commerce
  - National Telecommunications and Information Administration
- Department of Defense
  - National Defense University
- Department of Health and Human Services
  - National Library of Medicine
- Department of State
  - Office of Communications
- Federal Communications Commission
- General Services Administration
- National Aeronautics and Space Administration
- National Security Agency
- U.S. General Accounting Office
- United States Postal Rate Commission

United Telecommunications, Inc.
US West
Wolters Kluwer

New architectures, whether Huffstutler's or someone else's, mean new organizations or the rearrangement of old organizations and, certainly, the rearrangement of people's heads. And that is where the mechanisms wherebt people cope with complexity come into play. The following illustrates John F. Jacobs' twenty-five-year-old conception of how that might work:

> "Hence, there is a second level of conceptual communication which may be called the level of embedding. The new concept now 'understood' by the receiver must be coordinated with other concepts he holds, to determine their effect on the new concept and the new concept's effect on them. During this process he must modify all of the concepts he holds, including the new one just acquired. When he has accomplished this, the concept is, in effect, embedded in his information system and becomes part of the command person. The concept can be given a symbol, and this symbol can be reliably used in subsequent communication (provided the symbol is made part of the command vocabulary.)"

> "One must take care that, in talking about either command and control organizations, or design organizations, he does not assume he can operate an indefinitely long chain of nodes. If we examine what happens in these chains as we try to control what goes on in the last node of the chain, we find that for one node to share a concept with another, all of the node's communicating capacity must first be directed to translating the concept for the second node until the second node achieves understanding. After that, some of the communicating capacity has to be spend in embedding this concept in the second node. And, after that, some capacity has to be used in maintaining the concept." [47]

While all that — or something else like it — is going on, there is, of course, plenty of scope for surprise and of fodder for the sensation of standing still while moving forward. How we cope with complexity's endless frontier is for another story.

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[47] Jacobs, J. F., op. cit., pp. 10, 18.

IX. Guest Speakers 1980-1988 (no 1983 session)[48]

1988

Intelligence Sources and Their Applications
Rae Huffstutler

Three Mile Island: A Case Study in C^3I for Crisis Management
Richard L. Thornburgh

Special Operations and Low Intensity Conflict: A Congressional Perspective
James R. Locher, III

Strengthening the Chairman of the Joint Chiefs of Staff
Robert T. Herres

The Special Operations Command: Structure and Responsibilities
Robert C. Kingston

Tailoring C^3I Systems to Military Users
Jerry Tuttle

The Evolution of Special Operations Forces
Earl Lockwood

Getting in Front of C^4I^2 Problems
Frank J. Breth

Putting C^3I Development in a Strategic and Operational Context
Ruth Davis

1987

The National Defense University's Command and Control Program
Greg Foster

Coming of Age in C^3I
Michael J. Zak

Teaching Intelligence
Robert L. DeGross

The Information Management Marketplace
Eugene B. Lotochinski

Ideology and National Competitiveness
George C. Lodge

C^3I: A National Security Council Perspective
Rodney B. McDaniel

Making Intelligence Better
Fred R. Demech, Jr.

Defense Reorganization: A View from the Senate
James R. Locher, III

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[48] Proceedings of the Seminar on Intelligence, Command and Control for each year other than 1983 are available from the Program on Information Resources Policy, Harvard University, Aiken 200, 33 Oxford Street, Cambridge MA 02138. Telephone: (617) 495-4114; Facsimile: (617)-495-3338

1984

U.S. - U.S.S.R. Information Competition
W. Scott Thompson

Decision Making, Crisis Management, Information and Technology
Richard S. Beal

Warning as a Peacekeeping Mechanism
David McManis

Television News and the National Interest
Leo Cherne

Cost-Effective Rearmament
James W. Stansberry

Strategic Defense: A Challenge for C^3I
Robert A.Rosenberg

C^3I and Crisis Management
Stuart Branch

With AT&T in Iran
Hubert L. Kertz with Anthony G. Oettinger

1983 - NO SEMINAR

1982

Strategic Connectivity
Richard H. Ellis

Planning for Defense-Wide Command and Control
Hillman Dickinson

A Tactical Commander's View of C^3I
Thomas H. McMullen

C^3 Priorities
Gerald P. Dinneen

Air Force C^3I Systems
Robert T. Marsh

Policy and National Command
Richard G. Stilwell

The View from the Hot Seat
Richard D. DeLauer

Foreign Affairs, Diplomacy and Intelligence
William G. Miller

Defense Reorganization: A View from the House
Archie D. Barrett

1986

C^3I Systems at the Joint Level
Clarence E. McKnight

Data Security in the Information Age
Robert Conley

Intelligence Techniques for the American Business Community
Lionel Olmer

The Role of the National Security Agency in Command, Control and Communications
Harold Daniels

The Quest for "Good" Intelligence
Mark Lowenthal

Data Base Publishing for Business Intelligence
Richard Levine

Information Technologies and Multinational Corporations
John Grimes

Technological Innovation and the Cost of Change
Bobby R. Inman

1985

Centralization of Authority in Defense Organizations
Samuel P. Huntington

The Role of Intelligence within C^3I
Lincoln D. Faurer

Structure and Mechanisms for Command and Control
Richard G. Stilwell

Politics and the Military - The Climate for Reform
Archibald D. Barrett

A Consultant's View
Richard D. DeLauer

A View from Inside OSD
Donald C. Latham

A CINC's View of Defense Organization
Robert T. Herres

Roles of the Joint Chiefs of Staff in Crisis Management
Robert P. Hilton

1981

Meeting Military Needs for Intelligence Systems
James M. Osborne

The Convergence of C^3I Techniques and Technology
William O. Baker

A Major Contractor's View of C^3I
Richard D. DeLauer

C^3I and the Commander: Responsibility and Accountability
John H. Cushman

Funding C^3I
Charles W. Snodgrass

The Uses of Intelligence
David C. Richardson

Congress and C^3I
Charles Rose

Issues in Intelligence
B.R. Inman

1980

C^3I and Telecommunications at the Policy Level
William Odom

Worldwide C3I and Telecommunications
Raymond Tate

The Influence of Policy Making on C^3I
Robert Rosenberg

C^3I and the National Military Command System
Lee Paschall

Oil Crisis Management
A.K. Wolgast

The Developing Perspective of Intelligence
William E. Colby

Managing Intelligence for Effective Use
B. R. Inman

Watchdogging Intelligence
Lionel Olmer