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

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Coming of Age in C^3I

Michael J. Zak

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Oettinger: Mike Zak is the first alumnus, if you will, of this seminar to come back. It says a number of things about us, I suppose the most obvious being we're all aging. As you can see from his bio, he has, quite aside then from the sentimental value of his coming back, a combination of experiences that make this particularly valuable. We've advertised from time to time that the seminar is about command, control, communications, and intelligence in business and government. Mike, who came to us fairly fresh from a stint as an officer, has military experience, some work at the business school here, and some real-world experience as well. So, we're looking to him in a sense to make good a little bit of our promise about the subject that we deal with from both a business and a military or government point of view with whatever he can share with us by way of comparisons, contrasts, common threads, differences, and so on. That's long-winded enough unless you have something to add, John.

One last question before I shut up and turn it over to you is: How interruptable are you?

Zak: Very.

Oettinger: It's our normal drill that the speaker is interruptable with questions, arguments, and so on.

Zak: Thank you very much for having me as a guest today. It's quite a treat to be here. In thinking about what I could talk about I found this invitation to be something of a boon. Sharing a few thoughts with John prior to coming in here, he urged me to think about synthesis and how I might be able to synthesize some of my experiences and observations. I find that that is a luxury that I too infrequently allow myself. The incentive was there and I was able to stop for a few minutes over the last several weeks and think about some of the things I've seen and done. I hope that we can successfully discuss them today.

If I was to offer a label for what it is I'd like to talk about today, with all apologies to Margaret Mead, I would say it is called, "Coming of Age in C^3I." I'd like to follow the format that goes something like this: In thinking through some of the things that I've seen and done in what we call C^3I, I saw that I had participated or lived through four professional eras. What I would like to do, for each one of those eras, is to outline for you some of the major experiences that I had in those eras, and derive from them some lessons, or rules of thumb. I am very sensitive to some of Tony's predilections, and I will not suggest that my "rules of thumb" are answers, but rather useful generalizations that I

found could carry me along, at least until I got half way through the next era and found that they were wrong.

In talking about some of the major experiences I've had in my professional eras, I must admit that the ones that I seem to think of the soonest and with the most depth were the fiascoes that I had been involved in, much more so than the successes. I think that that is just a natural extension of a tendency to learn from mistakes, and to ponder them much more than successes.

Oettinger: If I might make the first interruption, what you've just said about eras, and adaptation, and so on, brings to mind that in two or three weeks we have George Lodge coming to speak and the reading for that session comes from a book that he and Ezra Vogel have just published which deals with the role of ideology in adapting to changing circumstances.* I was struck on reading it about how abstract everything that Lodge was saying seemed to me. As I was listening to Mike, the beginning words, it seemed to me this is a concrete instance of what Lodge is trying so academically and abstractly to talk about. It may be very useful to treat what Mike is saying in a couple of layers, and one of them is to keep it in mind then as a concrete instance against which to judge the merits of what you'll be reading of Lodge's before he comes here.

Zak: Before I jump into some remarks about eras, I thought it would be useful to stop and talk about a definition. From what I know about the backgrounds of the students here, I think that some of you have been more "inside" the world that we loosely label as C^3I than perhaps others. C^3I is something that I could talk about for hours without ever defining what it is, and I'm about to do that. As a summary point to my thoughts about each one of these professional eras, I will also try to capture what C^3I was to me at that time.

The first professional era through which I passed was as a young, company-grade officer in the Marines. In that capacity I did most of my work in tactical telecommunications systems. I was fortunate in that the entire time I was there I straddled the interface between tactical command and control systems and strategic command and control systems. I found that in a small organization like the Marine Corps, where we did not have much opportunity for specialists, we tended often to straddle interfaces of one sort or another simply because we were resource constrained. Where my colleagues in the Army and the Air Force would tell me that they were tactical intel people, or strategic communications people, and that's all they did and "ne'er the twain shall meet," I found consistently that I was riding that interface, and I found that to be quite enlightening.

The major experiences I had during that period were some very far-flung and rather involved joint-combined exercises, mostly in the Western Pacific or the Far East, stretching north to Korea and south down into Australia with all kinds of stops in between. I also managed to do a lot of work in combined arms exercises at the Marine Corps Firing Range at 29 Palms, California. Then finally I spent a lot of time in and around the National Security Agency. I want to pass along some of the lessons that I've derived from being on the tactical-strategic interface in any series of joint and combined exercises.

The first thing I learned is: As an officer who was specifically charged with making things work, you know you're in trouble when the senior communications guy is a recent graduate of a middle- or senior-level school. The thing that gave us the most trouble and led us down the most primrose paths, is when we had to deal with either intermediate or senior officers who were fresh out of school because they had begun to believe doctrine. What we knew, as operators, was that doctrine rarely worked. From an organizational effectiveness standpoint, the thing that most often worked was relationships. Senior officers would tend to point to doctrine as a means of deriving force integration or coordination. What I understood was that, if I hadn't been to the local Defense Communications Agency switch several months before we got into an area of operations, then when we would be lashing up systems they would not play. By the way, the easiest way to tell whether a senior communications officer or a system planner has been to a school recently is the clarity of his systems diagrams. The tip-off is whether or not there are lightning bolts between the boxes on the chart. If there are lightning bolts, he's real trouble! I have met and worked with far too many senior officers who relegate technical command and control problems to lightning bolts. Their solution for pulling a fire support coordination center together with a senior headquarters is to put a box around each with a little flag and draw a lightning bolt between the two, and let the operators figure it out. That usually meant that

*Lodge, George C. and Ezra F. Vogel, *Ideology and National Competitiveness: An Analysis of Nine Countries*, Boston: Harvard Business School Press, 1987.

they didn't have the foggiest idea of what those two centers of command were supposed to do, and that we'd figure it out on the fly. Fortunately in these circumstances I'm describing, we were not being shot at. I suppose if we were, I might not be here recounting some of these stories.

The second thing I learned is that technology-based "stuff" often doesn't work when things are going wrong. I found in my command and control systems operations experience that technology is extremely frail. I think that that appreciation has served me long and well since observing it then. Shortly after leaving the Marine Corps and coming up here to Boston, I watched our own national problems at Desert One in Iran, and although I argued very strongly at the time that the failure of that operation was not related to technology, I think one has to understand the role that technology played in the failure. I suggest that one of the things decision makers seem to forget very quickly is how frail technology is.

Oettinger: It strikes me that, unqualified, that statement is about as absurd as the more usual statements about technology solving all of our problems, which one hears a great deal. Let me suggest a qualification and see if you buy it or not. It's very true that at certain stages of development, certain kinds of technology are frail. The fact remains that we're better off having thermostats controlling the heat in our houses even though every once in awhile the damn thing craps out. By and large, the automatic navigation systems on aircraft probably do better than the pilot who might be tired or smoking marijuana, and certainly they do on railroads. If you could focus in on what aspects of technology you're referring to, that might be more helpful, because I'm inclined not to buy the statement as universal. It flies in the face of a great deal of stuff where the technology is orders of magnitude more reliable than the people. None of us would be sitting around here if it weren't so; we rely on elevators, airplanes, any number of things.

Zak: I would never suggest for a second that any of these lessons are universal truths, but merely derivations based on empirical data. I think, though, based on my observations, the important considerations are more environmental than they are technological or stage of technology. I think that one of the things that we least kept in mind is how truly hostile the environment can get. I think far too often, in the calm of our thermostatically controlled playing rooms, we forget that dust storms come out of nowhere, and vibration for six hours straight is not a good thing. We forget all those things for one reason or another. I think that was a major oversight in the systems I worked in, in their failure to operate.

I will say one thing. I have spent a lot of time in the strategic community. Having straddled the fence I got to jump back and forth, and I do think that a lot of our strategic systems are quite reliable. The reason they tend to be reliable, at least at this stage, was that they tended to be in environmentally controlled rooms. It was the old raised-floor computer room that we've all seen so many times. This was funny — in strategic systems a lot of the maintenance was done by contractors who would come out from the vendor. The volumes of information could vary significantly and under loading you would tax the system, but you would not have it subjected to six hours of vibration.

I just point to environment as something that we tend to forget very quickly.

Oettinger: Here you're being very literal in terms of environment.

Zak: Absolutely. I'm talking about temperature, and humidity. Real basic stuff that tends to get left behind. I think the "so what" of all this, because ultimately the "so what" is pretty important, is that the more experienced I got, the simpler I tried to make things, which was often in direct opposition to the freshly trained senior communications planner, who wanted to take me all the way back to the other extreme and make things complicated: He'd say, "We're going to be able to talk in real time to the Air Force, and the Navy, and the Army, and we're going to have 17 channels to each one." I would sit there and say, "But, Colonel, if we have one good circuit to each one of those three places, I'll be a hero. I guarantee it."

Student: When you talk about these senior officers coming out of the schools, are these people who have grown up in the communications and electronics business and gone on to schools, or, as is often the case, do they take someone from some other career field, send them to a school and say, "Now you are a communicator."

Zak: Now that was real dangerous. Those we quickly isolated and tried to send off somewhere to be in charge of generators.

Student: Because in the Air Force, often times they'll take a pilot who is too old to fly now and he goes to Comm school and he is the commander, and that's pure hell.

Zak: I think the answer to your question is "all of the above." Remember, my position was as a junior officer. I did not have the benefit of a lot of experience or seniority, so my perceptions admittedly were limited. But, what I saw was, independent of who the guy was, if he was fresh back from a school he tended to have been brainwashed, and who he was before he went to the school affected how long it took him to get back to reality. As you point out, the guy who was one specialty and went to Communication Officers school took longer to bring back to reality than the guy who'd been a communications officer, went to school, and came back. But they nonetheless were all dangerous. The good ones would somehow figure out a way to lay low long enough so that they got back "into the groove."

The final lesson that I learned — and as I thought about this, it really struck me as being dangerous although I didn't appreciate it at the time — is that when you have an operational command and control problem, a record traffic point is key. Let me explain. For us, in a tactical operation, if you could successfully deliver an entry point to the Defense Communications System to that field commander, you were a hero. To me, he often seemed less concerned with what was going on either around him or below him than he was with what was going on above him. I thought for awhile about how dangerous that could be.

I could think of two anecdotes. One, I was on a major operation in Australia that was spread out all over the country. We had a very complete and comprehensive solution to the command and control problem six weeks before we went in-country. It fell flat on its face. Nothing ever worked, but we did have (for those of you to whom this makes a difference) a full-duplex, high-frequency, low-speed, radio-teletype link that we had very, very comprehensively planned, to get into the DCS. That thing stayed up 24 hours a day, and we could deliver record traffic, up to a fairly high level of classification, to our field commander. We all came out heroes. The entire time planes were in the wrong place, people were in the wrong place, gear was out at sea, troops were roaming around lost, and we came out heroes because we could deliver this.

The other experience I had was out on the same major operation — it was just before the Marine Corps birthday, which, for those of you who don't know, is November 10th — we were going back to Japan and we would arrive there in time for the Marine Corps birthday party. Because of some pretty good planning on this record traffic entry point, we were able to provide a very, very good voice link so that the senior Marine commander on this exercise could talk back to the senior guy in Japan and plan the birthday party. He walked away from that conversation, and he looked at us and he told us that we were the greatest thing since sliced bread. At the same time, as I pointed out earlier, we had planes in the wrong places, we had people in the wrong places, we had ships that were running into each other. It was just an absolute mess. But, for one reason or another that just seemed not to matter as long as we provided a means to communicate with higher headquarters.

Student: I imagine you're going to move out of this area, but before you do I'd like to say that I've been exposed from the Navy side of the house to the exercises you're talking about. Maybe not on the grand scale of the Australian stuff, but I've been to all of those places, and I'd like to submit that as recently as 1983 in terms of HF communication, versus satellite communications, the situation is now diametrically reversed. We find a lot more reliability in terms of our satellite comms than we ever do with HF terminations.

Zak: Sure, my experience was before the satellite days. This was back when you actually had to put "top spin" on circuits. I'm in that business now and I fully concur that with SATCOMs, if you're into the bird, you're home free. But that was not the case at the time I'm describing.

Oettinger: I think once again, we're talking of a benign environment.

Zak: Yes, admittedly.

Student: The only other point I wanted to mention was that we have gone recently to a lot more preplanning in terms of the exercises, doing a lot of the things in planning conferences where time would be available to us. I was on the *Vancouver* as the principal planning officer for communications and for the service assault. We would do most of it in conferences before we even got to the area. So we eliminated a lot of what you needed and essentially we would have a couple of VHF circuits up for that portion of it and the air combined arms would use line-of-sight. We found that by preplanning these things, mostly in the future and, of course, with contingencies as they're required, we didn't have to worry too much. Of course, as I said, the SATCOM took care of itself.

Zak: I couldn't agree more. I was always pleasantly surprised at how much you can do without much communication. With just a few select circuits between agencies and a little bit of forethought, you could almost do anything. I don't mean to dwell on this high-level school thing, but it never ceased to amaze me how one of the biggest problems we would have in planning is that we would be working with folks who wanted all the doctrinal circuits to be in. You can go to the appendices of any of the forces' doctrinal comm pubs — ours was FMFM 10-1*, I know each service has its own — and go to some of the appendices and you could see literally hundreds of circuits that might be in: TAC Air A, TAC Air B, TAC Air F, Ad Log 14, that's the net that you request bandaids on. These guys would come out and try to have us put all this stuff up, and what our position would always be is, "Listen, we'd rather take the same gear and have quadruple redundancy on these four or five select circuits and guarantee that those will always be there." Generally we came out heroes as long as we weren't overridden by a more senior planning authority.

I think those planning conferences are great, but you don't have those in combat. You can't all converge on Camp Walker in Taegu, South Korea, for a three-day planning conference to see which part of the doctrine you're going to follow and which part you're not, and that's scary.

Student: I think the point about that, though, is if you're going to be doing something such as a landing exercise or for a real thing, you're going to do a rehearsal and hopefully in that rehearsal in that time afforded you're going to be able to do that planning. I guess it's a function not only of your readiness but of your training.

Zak: I think one of the things that this points out is that there's a big difference between a peacetime military and a wartime military. One of my favorite stories is how Douglas MacArthur used to mimeograph his amphibious operations plans in the South Pacific during the war. There are great stories of speedboats driving around the night before, like a paper boy, throwing out the OP plan that they had just ripped off the mimeograph machine. They did this so much — they did landing after landing after landing — that the various commanders would pick up the plan and they'd thumb through it and they'd say, "Okay, I see this variant. It's perfectly clear. Let's go." As opposed to the way a peacetime military works, where you tend not to move incrementally from one operation to the next. You have your winter exercise, and then you come back and you wash down and you retool and then you have your jungle exercise. Then by the time you roll around to the next winter exercise, the guys that were there last year rotated back so nobody knows anything anymore. Then you start all over again. I think it just points to that distinction. An ongoing organism would react very differently to some of these challenges than one that is constantly restarting and readdressing challenges.

The question at this point is for someone who is in this professional situation, what was C^3I to me? To me at this point I think to some measure it was that the system is the solution. Again, with all apologies to the Bell System in this case, I had a view that with a little bit of deft thinking and decision making in the area of systems and system technology we could pull off operations with higher degrees of certainty. I was not aware of, or conscious of, any of the organizational meanderings at the time.

One anecdote that I can relate to — I can remember sitting under a palm tree in Australia, out in the swamps in northern Queensland, with a high-frequency radio setup trying to copy radio teletype between us and a ship. Previously, the Navy had moved to negative-sense keying, and we (the Marines) were still on positive-sense keying which meant that whenever we sent a zero it came out a one on the other end. When we sent a one it came out a zero on the other end. I was sitting under this tree with my comm chief and a keyboard, and we were typing the test pattern you send when you're trying to install radio teletype. We would type one thing and the guy on the ship would come up and say it came out as something else. We'd scratch our heads and I said, "What do you think it is? Is it the keyboard?" We stripped it down and played around with it some more and we put it back together, and of course, it's getting darker and darker, and people were getting more and more concerned about why we can't talk to this ship.

I think I would have looked at that problem at the time and said, "Geez, the only problem here is technical. All we need to do is reverse a couple of wires and we're up sending zeros when they want zeros, and ones when they want ones." I had no real appreciation for the procurement process, and how somewhere, at some time, some guy had decided that we would be positive-sense keying and that was the way it was going to be, and had not

*FMFM 10-1: *Fleet Marine Force Manual 10-1*, the Marine Corps doctrinal publication on communications.

gone through any thinking about who else was either positive- or negative-sense keying. My view of it was that the system was the solution and all we had to do is inject a few technical fixes and everything will be fine. Then, Tony got hold of me.

The second era through which I lived and worked was as a business unit manager, which entailed a number of different things. I was an engineering group manager for a while. I was a marketing manager for a while. I managed a couple of business lines in a company that provides communications systems to typically large companies in service industries: insurance companies, banks, airlines, health care. We would provide these massive systems that would allow you to insert your BayBanks money card into a teller, or allow you as an agent in an insurance agency to give somebody some tables that would tell him what his life insurance policy looked like. Those were the kinds of systems we built and installed.

In that capacity I had, I think, at least four major experiences that I could abstract. One was trying to kill a product in an industrial concern: working with a product line that had really no business future and trying to kill it. Many of you have read anecdotal pieces like *In Search of Excellence*, or much of the business literature on innovation. One of the things that they often point to is that killing a product is one of the most difficult things that you can do, and I heartily concur.

The second thing I was able to experience was going through a number of major corporate reorganizations in constant search of the right organization to execute strategy.

The third thing I did was try to get a new business started in a company that tends to be very uninterested in businesses that are away from its mainstream.

Finally, the last major experience that I could think of easily was that I was involved in running a turnaround on a product line. A turnaround is when a business or product line within a given company, or sometimes even the company, is unsuccessful. When you're not selling anything, nobody knows why. They know that they've invested a lot of money up until then, but nobody can figure out why there's no payoff. Let me just run through a few of the lessons that I learned there.

The first one is that the best form of market research is what I called "reconnaissance by fire, but make sure somebody else is doing the shooting." Let me explain what I mean by that. I was also trained as an infantry officer, and although it's part of my very distant past, we had a concept called reconnaissance by fire. Reconnaissance by fire, at least in the Marines, was used when you suspected there was enemy activity somewhere, but you didn't have the time, the people, or the inclination to find out. What you would do is get on the radio and call the guys back in one of the artillery batteries and just have them send a couple of shells out into that grid square. If anybody shot back, you knew there were bad guys out there. If nobody shot back, you could generally assume at about the 60 percent level that that was a safe place to be. That is called reconnaissance by fire, as opposed to reconnaissance with patrolling, or photography, or signals intelligence, or anything like that.

One of the perpetual debates in any company that's trying to get into new businesses is, "How do you do market research?" How do you lower the risk that the investment you're making will not pay off, or to be more succinct, how do you raise certainty that the payoff will be there? The oft-used device, and usually the culprit in the end when it hasn't worked, is that not enough market research has been done. "We didn't know enough about the market." "We hadn't gathered enough statistics." "We hadn't done the right surveys." "We hadn't retained the right consultants."

What I found, or what my own personal experience showed, was that, at least in a larger company, which I was in at the time, the best thing for us to do was conduct "reconnaissance by fire" by watching small startup companies around us. Watch what they were doing. Forget about the market; forget about customers; forget about statistics; forget about surveys. Watch the companies that were around us that did things that we more or less thought we could do as well. The minute we saw one that had been successful, as quickly as we could, we followed them. We brought all the corporate resources we could, which tended to be much more massive. We had resources in computer-aided design, and we had resources in semiconductor technology, and resources in computer programming, and tools that they tended not to have, because they were thinly capitalized and working out of somebody's garage, or out of a warehouse somewhere. The minute we saw one of them taking off, we would very quickly imitate them and follow them. That was my reconnaissance by fire. Only it was somebody else's ammo. What we would try to do is just tend to truck along in whatever business we were in, trying to stay profitable and healthy, and in order to ex-

pand in a new area, just wait until it looked like somebody else had been successful.

My own personal opinion at the time was that although more senior managers liked to beat me up about how much data I had gathered about the market, and how much sound market research had been done, I usually found it unproductive to worry too much about that.

Oettinger: That reminds me about a visit I once made to a man who was then the chairman of the board of the Macmillan Publishing Company. I was full of fire and flame about some kind of innovation, and so forth. He leaned back in his chair and he said to me, "Professor," and I knew by the tone that this was not complimentary, I can tell when people say, "Professor," in that tone of voice. He said, "You don't understand, I get rewarded not for being first but for being right." His strategy was exactly that. Never be first, always be behind. Go in second when it looks like it's promising.

Zak: As one of my colleagues recently offered to me, he said, "Mike, do you want to be a pioneer or a homesteader?" At this point anyway, in this incarnation, the circumstances were such that it was clearly smarter to be a homesteader than to be a pioneer.

The second thing I learned .....

Oettinger: We'll file under the heading of Advice About Intelligence. That's an intelligence story.

Zak: That's an intelligence story. Market research is business's way of gathering information about its environment. Ultimately so that it can exploit an opportunity.

Student: What in effect you're doing though is lowering your risk, purely and simply. You're not engaging in venture capital problems at that point by letting someone else do it. You're taking the safe way out. Not everyone can do that. You're only in a particular position when you can afford to do that.

Zak: There's no question that my perspective was very heavily conditioned by where I was at the time — which was in a larger company that had a very successful core business, and although it had trouble getting into new businesses, it was always interested in getting into new businesses. In working on new businesses, it took me a while to figure out the secret to defining a new business, and the secret is not to go out and do a lot of statistically significant market research. The secret is to keep your eyes and your ears open to a fairly limited number of sources of information. I think in any industry you tend to know who the players are, because you've worked with them; they've worked for you; they used to be with you and now they're off somewhere else. You pretty much know the pockets of energy that are being invested in doing things that you also could do if you wanted to. By very religiously being at the Newton-Marriott on Friday afternoons, which is one of the local watering holes out on Route 128, or any one of three or four other places, and making sure that you check in with all these people, you could keep your hands on what was going on in the market without having to do anything that was statistically significant.

McLaughlin: Do you sometimes feel that in your present role you are doing reconnaissance by fire for other people?

Zak: Absolutely. We'll talk about that in a little while.

Another thing that I learned is, don't sell systems unless, (a) you're IBM, or (b) the government is funding you. This gives pause to think about the economics of systems. Systems tend to be very, very expensive. They tend to go through very long and painful project management and shakedown periods. Justifying the economics of a system, a priori, tends to be very difficult because no single person really understands what the system does. Many of the system specifications I've seen, by the time I've seen them, have been through so many committees, and have been reviewed by so many different people, and are so general, that no single person understands what they are any more. When you get to that point, and the economic benefit of the system is unclear, there tend to be only two people who are in that position — either large IBM customers or the government. This is something, in fact, that I can talk about in a little while because I now participate in pieces of systems that are neither bought by the government nor sold by IBM. I can talk a little bit about how I feel about systems now.

Oettinger: Before you do, I think we should be a little bit more precise because I think you're using systems in a manner that has something to do with some implicit — and invisible to you — element of scale, or again timing or something, that isn't clear to me. Everything is a system, or a system of systems, and every system is a part of a larger one. I mean big flies, little flies, fleas, and so on. Unqualified, "systems" doesn't say anything to me because the problems occur up and down the hierarchy. You must have in mind some yardstick where you say, "relative to where I am, this is what I mean by a

system." Could you try to make that more explicit, otherwise I'm not sure I understand what you're saying.

Zak: In this particular case, I think the easiest way to get at a figure of merit is to use dollars. Depending on who you are and whom you're selling to, a system becomes a system at a certain purchase price. Up until then it's a product. That is relative. For instance, to a large financial institution the purchase of a few CPUs (central processing units) and some teleprocessing equipment associated with it might not be a system, but somebody's patch on a point problem. Whereas to someone else that might be the biggest investment they've ever made in teleprocessing, and indeed be a system.

Oettinger: There's involved there the notion of the scale of both the supply and the purchaser. You're speaking from a supplier's point of view. That's maybe 10 times or 100 times the scale of what your normal piece of hardware is. Is that a rough way of looking at it?

Zak: That's fair.

Oettinger: Then I can buy it. It sort of makes sense with regard to any number of different levels.

Zak: Another thing that I learned is that markets usually move more slowly than the experts say. I try to think of how that lesson relates to command and control systems. The way it does is that in trying to get into new businesses, or build new businesses within larger companies, I often found that senior managers who ultimately were responsible for making the investment decisions associated with getting into those new businesses would tend to believe what they wanted to believe. Where that affected me was that, if I did not go in and paint an opportunity as being explosive growth, wildly profitable, low risk, in very short order, I would tend not to get funded. The guy who would go in and do that would get funded. I, of course, very quickly learned what I had to say, but nonetheless, it never ceased to surprise me how senior executive after senior executive would be burned because he believed what he wanted to believe as opposed to what he reasonably could expect to be true.

Recently, I was having lunch with a very well-known venture capitalist. That's one of the things you get to do all the time when you're in a small company. They always want to ask you this, or you want to ask them that, so you see these guys all the time. One of the things I remarked to him is that at this stage of my observation of growing businesses, I am much more excited by the thought of building a profitable $25 million business over a four- or five-year period than I am of building a $200 million business over the same period. The reason I'm excited by it is because I think it's possible, as opposed to the improbability of building a $500 million business in a five-year period. Certainly it has happened, and there are notable places where folks have gotten rich and happy and big and they've all gone off and fished in the Bahamas for the rest of their lives. But I think those examples are few and far between. Successful business is more a case of multiple tens of profitable $25 million businesses as opposed to one or two $100 million businesses.

Again, the important point being that senior managers generally will tend to believe what they want to believe as opposed to what any reasonable person could point to them as being close to reality.

Oettinger: The implication of what you say is a little self-delusion, a little flim-flam, here or there. Another observation might be that it's all done perfectly straightforwardly and that the error is less in sort of hyping yourself, and believing what you want to believe, than in believing reasonably what you believe from a supplier's point of view, forgetting that the person you're selling to is a consumer who has a different point of view, and may not value the same things you do. I agree, this is the notorious, "Yes, I've got this wonderful mousetrap." It's no self-delusion. It's all exactly as it seems. But to go back to your earlier point, the buyer doesn't see it as a free-standing thing. It's something that he does have to fit into a system on his scale and he's damned if he's going to disrupt whatever the hell it is in order to get a 10 percent advantage because of this piece. The problem is a radical difference in the perception of the marketplace by the buyer in the marketplace versus the perception of the seller. Is that a possibility?

Zak: I think probably, Tony, in the end, it's somewhere in the middle. My personal experience has been that very few people, very few of the persons I've been associated with, would consciously go out and misrepresent something. As with anything, any projection you're making, there are error bars. You can pick which end of the error bar you want to base your presentation on. What you do is you always pick the most optimistic one, and you're usually wrong. That was my observation.

The last two things I learned in this incarnation was something that I'm sure some of the military folks in the room would understand and that is that forgiveness is always easier to get than permission. In any large organization opportunities will walk by

you on a daily basis if you worry about procuring the permission that you might think is necessary in order to exploit them.

McLaughlin: Do you think that's what Ollie North is saying right now?

Zak: It may be.

Oettinger: It depends on whether he gets immunity or not.

Zak: There is no doubt in my mind that an organization would be paralyzed if the bulk of the folks in that organization didn't understand that forgiveness is easier to get than permission. When people stop understanding that, you're headed for stagnation, because of a sort of paranoia, and I've seen this. It's jumping ahead a little bit, but as a consultant I had the opportunity to work in some large organizations that did not understand that. It was understandable that they didn't understand it because someone who did that was very heavily penalized for having done that.

The important thing about understanding that forgiveness is easier to get than permission is that there is an understanding of that on both sides of the table. The smart organizations, and in this case I think I was part of one, had a senior management group that not only understood that as well, but actually endorsed or supported the proliferation of this idea. A lot of the things we did over one table or another would be with a wink of the eye, and perhaps Ollie North is in the same boat there, too. I know that the Congress has said, "Don't send anything to Nicaragua, but you know what we mean." Ollie says, "Yes, sir, I understand that I'm not to do that, but flexibility ....." And I think that in any commercial environment, in many commercial environments, you can do that without the repercussions that our friend Lt. Colonel North has to face, or the constituencies that ultimately you have to be held accountable to. I think that's a real important concept to support.

Oettinger: When you look at North, or the insider trading questions, some of it, of course, is blatant; accepting a suitcase full of money transcends a possible misunderstanding, but one can imagine the question of the propriety of joint venturing, collaborating, etc., etc., possibly being on the edge, and somebody saying forgiveness is better than permission. My guess is that we'll find some of that although so far the ones who have been indicted show a certain blatancy to accepting a briefcase full of money which suggests that that is beyond the pale.

Zak: My observation about this has been that it is somewhat analogous to the piece that came out of Peters and Waterman, *In Search of Excellence*. One of the proverbs they offered was the "ready, fire, aim" proverb. To me what I'm suggesting here about permission and forgiveness is more analogous to that. In other words, go out and do something. Don't worry that you don't know exactly what it is you're doing, or that if you were to present what you're trying to do, it wouldn't get approved because it probably wouldn't. Just go out and do it. If you succeed you're a hero, and if you don't, we understand, and had we not supported that we'd never get anywhere. Just don't do it too often.

The question here is, what was C^3I to me as a business unit manager in a company that provides communications systems? I think that it was much more oriented toward the intelligence side of things. In fact, at one point in one of my jobs I used to be known as the Zen marketeer, because I was such an advocate of being, if you'll pardon the Californiaism, in touch with my environment. In trying to get a large company into new businesses, the thing that paid off over and over again was being in touch with my environment where my environment tended to be the smaller companies that sprang up around me, and I was trying to process my observations of those companies such that I could then deploy my own resources profitably. I would say here it was more toward the "I" than it was toward the C^3.

Oettinger: One of your tools was the watering hole at the Marriott as distinct from the statistical systems. It's not only intelligence, but you seem to have a predilection for the more informal end rather than the more formal end of information systems.

Zak: Yes, I think each one of us is saddled with either being an inductive or a deductive reasoner, manager, thinker; I would guess I'm more inductive than deductive, and my sources of information would tend to be informal.

The analog, by the way, of the Marriott is Ricky's Hyatt House in Palo Alto. Depending on where you are, whether you're in the Silicon Valley or the Boston area, you know exactly where to go on Friday afternoon to gather information as described.

The third era was a period in which I was what I would call an observer/analyst. This was working with a management consulting firm where I tried to do two things. One is, I worked with vendors of communications systems who were trying to serve what we called information technology markets. I'll qualify "information technology" by saying that it

was our version of C^3I. We never really knew what it was, but it was a lot easier to say "IT" than it was to say, "We're doing something and we're not really sure what it is, but as soon as we figure it out we'll let you know."

The other thing I did as an observer/analyst / counselor would be the third part of that — I worked with users who were trying to deploy information technology. These tended to be large financial institutions or information services companies.

I had three broad sets of experiences. One is that I spent a great deal of time working in and around parts of the Bell breakup. I've been in the North Atlantic after the spring thaw on a ship, and as we would cruise along we would see chunks of ice broken up and a floating log or two and that's what it was like working in and around the Bell breakup. Companies were trying to navigate through this breakup without really knowing if it was an iceberg, or a log, or how much was below the water and how much was above. It was an extremely ambiguous and stressful time for the companies that were involved.

I think, parenthetically, that at the time, one of the things that those of us who were involved least appreciated, which is now getting a fair amount of coverage and attention, is the emotional stress that this breakup was causing for the participants. At the time there were other things on people's minds and I don't think any of us really appreciated that.

The second major experience was that I had the privilege of doing something that my consulting firm did not often do. I worked with a couple of very small companies. Small companies tend not to employ consultants or use consulting services. But for any number of reasons, which from my standpoint were fortuitous, I had the opportunity to work with a couple of high-flying small companies who were dealing with organizational problems, or market strategy problems, "what do we do next" kinds of problems.

Then the last thing I did was a lot of internal work at the firm where I worked. It had to do with the search for a formula for the application of information technology for large users of information technology. Here we did not specify that it had to be a company in financial services, or an insurance company, or anything you would typically associate with making large expenditures on information systems. We were much more general and we asked ourselves how a company in any given industry can make investments in information technology in order to somehow seize competitive advantage. We worked very, very, hard on developing and, as rigorously as we could, testing some of the models, however conceptual they may have been, for the application of this information technology.

Here are some of the lessons that I learned. The first one I learned is that a lot of the stuff which seems well thought out and sound actually happens by accident, and the real glory ought to go to those who responded to the opportunity. Let me give you a couple of examples, at least one of which is very close to home. As some of you may know, the original business plan that Lotus submitted to its venture capitalists projected first-year sales of $3 million. The first year of sales at Lotus was $53 million. There was an error by at least an order of magnitude.

There is a great deal of credit, ostensibly, at Lotus given to the fellow or the fellows who developed the product. I would submit that the real credit ought to go to the guys who added capacity, brought in people from the outside to run the business, procured plant property and equipment, kept the lid on the quality control, because it is those guys who, having stumbled into this business purely by accident — and I would submit the $3 million in the original business plan versus the $53 million as the only piece of evidence that needs to be submitted that it was by accident — the real heroes are the guys whose names you don't know. The names that you do know out of Lotus, in some ways, I would submit, were more observers than anything else.

Student: They had already done their work.

Zak: They were done, and they were off working on the next thing and watched this take place rather than having induced this to take place. Some of this goes back to some of my earlier comments on market research. There are folks who would argue that an opportunity such as the one we just described, with very careful market research and a great deal of customer contact and any number of other things, could have been scoped and understood before the fact. I would argue that it never could happen.

Oettinger: I think there is good support for that. They were competing with earlier spreadsheets and the market research would not necessarily have revealed what the ingredients were that might make it take off. In retrospect a lot of that is crystal clear, but the notion that one could have thought that through prior to stumbling on it seems very remote.

Zak: This reminds me of an interesting experience I had as a consultant. One day I spent the afternoon with a very senior person at a very well-known

market research house. He was explaining to me how he had analytically derived the market for a consumer product whose name, unfortunately, I can't tell you because of confidentiality requirements, but this is a very well-known consumer product, and he tried to show me that he had analytically derived a definition for it before the fact. I walked out of this guy's office and I thought, "This guy actually believes that he did that. He is convinced that he could do that." Maybe he did. But I sure as hell couldn't do it, and I don't know of many people who really could have. I think that one of the lessons here is that, at least for senior corporate managers, it's often a good idea to have as many things going on as you possibly can at any given time, so that maybe you get lucky and hit it. And then as quickly as you can, kill some of the other ones which, I pointed out earlier, is one of the most difficult things to do, and get those resources deployed on to the thing that, for luck or accident, has made it.

The second thing I learned as an observer/analyst/counselor is that "integration" is a concept for consultants. Information technologies in the real world expand incrementally. Part of this ties back to my earlier comment about it, if you're going to sell systems make sure you're IBM or that you're selling to the U.S. government. One of the biggest buzzwords and themes that we've had to deal with in the last several years in the information systems world is "integration": increasing levels of integration; joining together parts of companies; standardizing databases. In practice what I've found is that, although there may be value to integration, it comes slowly and with great difficulty, and that by and large the thing that most users are interested in is making the right incremental decision so that they can keep moving in whatever direction it is they tend to be moving. As opposed to stopping, thinking through what the next leapfrog is going to be, defining it, funding it, doing it, taking an extra year and a half because the schedules were overly optimistic, and then by the time it gets done it's overly expensive, or underperforms, or has missed a major opportunity that presented itself in the intervening 18 months.

This also relates back to an earlier comment about the difference between having planning meetings before a major exercise versus incrementally deriving what the next movement is going to be. Just as integration is for consultants, planning meetings are for peacetime. Commanders, I think, are interested in war; are interested in taking the next twist on what they did successfully last time, and keeping moving toward the objective. Just as MacArthur was going back to Manila, bankers tend to want to get the next product out rather than redefine their businesses.

Oettinger: I love everything you say and tend to agree with it, and maybe it's a matter of temperament, but why is it that the views that you're expressing, and that I tend to agree with, are, in a way, such a minority? I tend to believe that some of the most disastrous propaganda and self-delusion in recent years along those lines was the Bell Systems attitude towards its systems. The notion that systems design, top-down planning, etc., etc., was the right way to do it. That flew in the face of their own practice, which over a century was, in fact, the very skillful cobbling together of cats and dogs, and so on, and never missing a beat. The practice was an enormously successful one that belied the preaching. I never could quite figure out whether that this was sort of naked propaganda or self-delusion or what. But assuredly a lot of the world believed, or acted, or talked at least, their way. I don't know whether you have any hypothesis as to why that attitude or at least the rhetoric is so widespread. Do you have any opinion on that?

Zak: I think that there may be some analogy between the Bell System, operating in a regulated environment, and a peacetime military. I think organizations behave as a function of the threat in which they operate. The more threatened or the more dangerous the environment they're operating in is, empirically anyway, the more incremental they tend to be, because they are always reacting. The threat is always there and they've always got to do something, as opposed to the threat not being there and not necessarily not having to do anything. One possibility is that "The System Is the Solution," and the espousal of that thought by the Bell System, was nothing more than a reflection that the people who were in positions to define that strategy did not feel threatened in any way by competitors or regulators.

McLaughlin: My phrasing of what you're describing is that businesses in competitive industries are at war every day. I think that the same thing relates to some of the other points you were making. You commented about the human cost, or personal cost of all this chaos in looking at the Bell breakup. *Communications Week* this week had a front-page article about the psychologist's report at AT&T about how traumatic all this was. In the last

paragraph or two it talked about his recommendations for AT&T's management finding stability. We've heard people from the telephone industry, every six months, from a variety of companies saying, "Well, we just did our last reorganization. We really need stability. We can't fool around with it anymore. We've got to be in a fixed mode now for awhile." Of course, they'll never have it.

Oettinger: The way to avoid seasickness while out on a life raft is to get onto dry land. We ought to let you move on.

Student: One more question about this expanding incrementally, as you put it. Would you agree that that doesn't always make the most efficient system?

Zak: Yes, absolutely.

Student: Don't you get layered technology?

Zak: Without question.

Student: Especially the military systems you see. They're always adding on. Sooner or later you reach a point and they go in and say, "Ah, it's old technology, it's layered, we have to go ahead and kick everything out and put something brand new in."

Oettinger: But that doesn't work. If you look back at the record of earlier seminars, you will see the rediscovery of the need to be incremental or evolutionary, as some of our friends at MITRE put it, as we discovered long and laboriously when all of these leaps keep failing. In fact it may mean that the bloody things may not ultimately be the most efficient. The central tenet of the systems analysis religion is that good systems analysis produces optimal systems. The trouble is the bloody thing never gets finished and never works. The lesson I think that Mike is sharing with us, and my prejudice makes me agree with, is that, yes, you settle for the second-best incremental, because it's about the only thing that we really know how to make work, as opposed to the rhetoric of leapfrog systems analysis.

Student: There's another phrase in acquisition that I've heard my program manager use at Maxwell. That was, "Better is the enemy of good." In the midst of a procurement, if something great comes along, do you want to disrupt things by putting it in then, or do you want to finish what you're doing and maybe add it later? I think the prudent manager does the latter.

Student: I agree. I was going to try to express it somewhat differently along the same lines and talk about systems acquisition. The way I've seen it is that you have a basic system and you layer and develop incrementally for several years, and all of a sudden people decide that we know so much about it now we're ready to make a quantum leap and get rid of all this old software, hardware. You're out there at a new level, hopefully, and they start to layer again. They reach a certain point and that goes out the window. That goes on and on like that.

Zak: You're suggesting that that is less attractive or flawed?

Student: No, I'm saying that that's a fact of life. I think your statement where you say that information systems develop incrementally covers a certain portion, but then you get to a point where everything goes out the window and you make that quantum leap. You're looking at it with blinders from over several years, several months, whatever. But there is a point at which you make that quantum leap, then you start that incremental process over again.

Zak: I would disagree with that. I think the way it works is more like a conveyor belt where you're always putting something on at the front, but there's always something falling off the back. Maybe it's not a conveyor belt, but you're always doing some incremental expansion somewhere, and you're always retiring something somewhere else.

Student: That's convenient if it would always work like that. Unfortunately, the outdated technology is oftentimes at the heart of your system, and it doesn't just conveniently fall off the conveyor belt. The whole system has to go and you build on it.

Zak: If that's your experience then that's your experience. I think that getting painted into a corner like that is less frequent from what I've seen than perhaps what you've seen. Are you talking about communications systems, or tracking systems, or what?

Student: You can talk about the SAC (Strategic Air Command) command and control systems. You can talk about the radar that we have up and down the coast. You get to a certain point and now you're ready for phased array radar, let's say, or over-the-horizon radar. So all the old systems, all the old sensors, go out the window. But for decades they were constantly improved. The SAC underground command post has been in existence for years and years. That was continually upgraded. Now all of a sudden we have a project, a brand new hole in the ground, brand new equipment, etc. The argument

that they used with the congressional staffers is that years of layered technology no longer works.

Zak: I think what you're getting at is what I would call a step discontinuity.

Student: Is that the same thing as my quantum leap?

Zak: Exactly. In incrementally expanding anything, the big risk you're running is that you're going to miss a step discontinuity. If you're Digital Equipment Corporation, and your bag is minicomputers and you make an increasingly better, faster, cheaper minicomputer and all of a sudden the microprocessor shows up, you'll probably miss an opportunity and DEC did just that with the personal computer. Just like IBM blew minicomputers, for the same reason. What I'd submit, though, is that the frequency with which step discontinuities arrive is very low. You may miss it, but the tradeoff you're working with is, would you rather incrementally expand and risk missing the step discontinuity, or would you rather gear for the step discontinuity and not incrementally expand? The side of the line I would come down on is the incremental expansion.

Student: That's what top managers get paid for: to go ahead and pinpoint when that's going to occur.

Oettinger: To put that together with your earlier comment from an earlier incarnation about less statistics and more watching the other guy, it may be that from the early adopter's point of view, there is just a step discontinuity or quantum leap. Again, you observe that more in a unique type of government situation where there are only one-of-a-kind systems, and at some place somebody's got to make that first step. But even there, there are other services, other situations, that you can learn from. I think the reconciling of your two viewpoints is, yes, it happens. But it happens relatively infrequently.

McLaughlin: I think there may be another lesson learned there, and that is taking Mike's examples that the step discontinuity initiatives did not come from the normal circle of people you were watching. It wasn't the NCRs, or the Honeywells, or Sperrys who surprised IBM with a mini. It wasn't those people who surprised Digital with the micro. The surprises came from new players.

Zak: As a follow-on, I had one other lesson from this era, which I think is a fitting response to your question, and that is that there is an opportunity for boldness, but you'd better be spending your own money. What I mean by that is that there are things that one can point to where senior management took advantage of step discontinuities. The example that I'd penned in here for myself is Fred Smith of Federal Express. Here's a guy who saw a discontinuity. In this case it was perceptive, and he dove in with his own money. Granted he pulled a lot of investors with him, but the first multiple millions of dollars were the family fortune. He put his money where his mouth is.

If you're Mitch Kapor and you have just sold the license for Visiplot to Visicorp and taken that million and a quarter dollars and put it into a venture that ultimately is called Lotus, you can do whatever you want to because it's your money. But for the bulk of us who aren't fortunate enough to be in that position and are trustees of somebody else's money, I think our responsibilities are to lean more to the incremental than to the bold.

The last era that I will talk about I actually have less to say about simply because I'm not done yet. What I am now is an officer of a start-up company out here on Route 495. We manufacture and sell a standard-based local area network, and within the company I have two major responsibilities. One is that I am the chief marketing officer, which means that at some level I'm responsible for our company strategy, but to be more precise, I'm responsible for defining our product line; what's in it, what's not in it, how do we price it, what kind of cost targets do we shoot for in engineering and manufacturing. I am the company's chief program manager which means that I do the bridging across the multiple functions and serve as a champion for programs across disparate functions. Then functionally I also manage our customer support effort which means that I work with post-sale support and service of products we've sold and installed.

The three major experiences that I've had have to do with, first of all, the constituting of a company and the raising of capital. One of the things we did over this summer was we raised a little less than $10 million in venture capital. The creation of a company out of thin air was quite something to live through, and justifying its value to somebody who is really not able to see a lot happening yet, and justifying that value to the tune of $10 million, was quite an experience to have gone through.

The second major experience as a program manager and as a product champion, really, is getting the company into the personal computer networking business with some product efforts. The way small companies tend to get into businesses is very much

biased toward the product as opposed to anything grander. Things tend to be simplified very quickly in small companies. You either have the product or you don't. If you do, you can put the rest of the stuff together on the fly. If you don't, it doesn't matter.

Student: What do you mean by the rest of the stuff?

Zak: Channels of distribution, manufacturing programs, sales forces to go with distribution, promoting it, getting it advertised, getting salesmen trained. All the rest of that stuff in a small company tends not to matter. Large companies can cover any amount of sin with things like that, and IBM for years has been selling the wrong products for applications just because their salesmen are trained to be able to do that. When you're in a small company you tend not to have that luxury. You've either got it or you don't. If you don't, you're out of luck.

The last major experience I've had has been in what I call professionalizationing — that will be Al Haig's nonword of the month award, for those of you who read *Armed Forces Journal* — professionalizationing the support organization. In a small, product-driven, start-up company the thing that tends to get the least thought, until usually it's too late, is: What do we do once we have an installed base? We have customers and things start going wrong. It breaks, it doesn't play with something else, that sort of thing.

It's a little early to talk about lessons from this era, I guess, and I'm very wary of trying to derive any. I have a few comments that fall short of lessons and I guess there are more observations than anything else. One is that at this stage I'm really quite taken with how frail organizations tend to be, and I guess that's something I never really understood. When you are a senior manager in however large an organization, and in this case let me assure you this is a tiny little company that we're talking about, the organization is really quite frail. The other piece that is that leadership does make a big difference. In some cases, it can make the difference between success and failure. It is a much more precious and valuable quantity than either capital, or location, or proprietary technology, or any number of other things that any good business school course on business strategy would tell you is important.

The third observation that I would make is that I've learned to be much more of a salesman, because in a small company, everybody's a salesman. The thing I've learned is to keep as many deals going as you possibly can, because a lot of them are not going to come through. What you need to do is, if you can keep 10 deals going and maybe deliver on four or five and ultimately ship and declare as revenue three, you will have been a hero. This, perhaps, is another version of incrementalism.

McLaughlin: Another version of throwing enough up against the side of the barn, too.

Zak: Something like this might run smack into the face of a good strategy course at any well-known East Coast business school. They would accuse you of being defocused and uncertain, but I would counter that by saying that this is nothing more than prudent. It's nothing more than a form of contingency planning, knowing what your options are and doing your very best to go after the ones that seem to be panning out. Again, knowing that some aren't going to pan out and to cut your losses as quickly as you possibly can on the ones that aren't working.

I guess the last thing I've observed is in some ways coming full circle to my days as a young, company-grade officer in the Marines. I've been amazed at how much overhead there is in good C^3I. Let me give you a few anecdotes so that you understand what I mean.

In our field service organization we detected that we had a huge problem in distributing information out to our operatives, our field sales people, our field service people, some of our distributors in Europe. I decided to take a flier, to take a risk, on a technology fix to this problem. What I decided I would do is put as much information as I possibly could online, and make it accessible through a cluster of DEC VAX computers that we have and use, and that by making all this information available, and accessible, we could keep all of our field people up to date. Some of you may be familiar with bulletin board systems. This was nothing more than a fairly sophisticated bulletin board system.

Once I got this system up and running, I then had to face what it would cost me to maintain it. Needless to say, it is not being used right now. The cost of keeping the information current was prohibitive. It was very easy to get the system up. There was a flurry of energy, and enthusiasm, and everybody saw it as a quick and implementable fix, and we got it up. Then once the enthusiasm faded away and the reality set in, we realized how expensive it is or was. So what we do now is once a week my manager of customer support types up, on his own, a four- or five-page summary of all the things we want people to know and we mail it to them, and they love us. It is not current, it is not accessible on-line, but they love us. We've now been doing

this long enough so that all of our people in the field have started to learn things and they believe it's a credible system. They use it and it works.

Opting in this case for a technology fix was exactly the wrong thing to do. Although in some cases when we type up the thing that we send out, we actually FAX it, use a facsimile device to send it, that's the closest we come to being any kind of a technology fix.

C^3I is very, very expensive. I now have first-hand experience with it. It has made me very hesitant.

Oettinger: Wait a minute. What you've just really said is that certain types of C^3I systems are very expensive. Command, control, communication, and intelligence functions are unavoidable. It's not a matter of price, it's a matter of functional necessity. What your example says is that certain highfalutin' technical ways of doing those functions may be expensive and, therefore, wrong.

Zak: Let me try to be better at this. If C^3I is a necessity, and I'm not here to argue that it is or it is not; we all recognize that it's there and that it can do good things....

McLaughlin: If you don't know what's going on around you, you might as well be blind, deaf, and dumb. When you say I don't know that it's a necessity or I'm not here to argue....

Oettinger: I think you're speaking of it as if it were systems.

Zak: This is a very technology-specific, or a specific-to-technology, comment that I'm making here.

Oettinger: Okay.

Zak: They are expensive. The technology is expensive. The observation that I have is that now I'm in a position in some ways to make a judgment call at least up front as to whether or not we will seek technical fixes, I have been burned now at least once, and I will be less aggressive, let's say, the next time. I solved the very same problem with a much cheaper, simpler fix that worked much better and which is sustainable on an ongoing basis.

Oettinger: If we wanted to program you for that particular message, we couldn't have done better.

Zak: That was unprompted. That has left us with 15 minutes to sum up and ask questions. What I tried to do as a final set of remarks is look back over these four eras, and I tried to distill the theme that ties them together. For the life of me, I wasn't able to. So, I'm not even going to try. I did realize two things as I thought about it. The first one is that my view of C^3I tended to be a function of what I took for granted. As a young network operations and systems guy, I tended to take nothing for granted because I was out there making it happen. If somebody told me there was a circuit from point A to point B, I didn't take it for granted because I knew I had to put it in. I knew there might be all kinds of expense, and trouble, and delay, and ultimately failure in trying to do that.

What I would contrast that with is the executive who picks up the telephone and expects to get a dial tone. I would submit that probably one of the most powerful C^3I devices in business today is the telephone, but nobody looks at it as that.

Oettinger: As long as it works.

Zak: As long as it works nobody even notices that it's there. The other thing that I could come up with that was worth thinking about, for me anyway, is this notion of incremental change. The note that I wrote to myself was incremental change is best; you might miss a step discontinuity, but probably not. So that goes back to what we talked about earlier.

That leaves us with 10 or 12 minutes for questions and arguments (violent), disagreements, all of which I hope there is at least one of.

McLaughlin: Let me start with a quick note. You talked about your company-grade officer days and I think your lesson there was that a little more competence would fix things; a little more of something right done here or there. I think that's a sign of youth and innocence. I'm reminded of a boss I once had who started in government as a GS-4. This was a private conversation. When I was working for him, he had become a GS-18 and he was a Deputy Assistant Postmaster General. He said, "All of those years when I was a GS-4 I thought, if I only became a GS-7 I could have some influence. If I was a GS-9, you know.... Now I'm an 18 and I'm here to tell you it don't work." I think the idea of a little more or a little better at the beginning level is sort of universal.

Oettinger: In government as you near the top you begin discovering the fragility of the whole edifice.

Zak: The whole thing might cave in. It could come right down around you and you wouldn't know it happened until it was too late. It's very, very fragile. Some people never get past that, though. I remember General Westmoreland saying, "One more regiment." He was wrong, but much more senior. I think some people don't get beyond that, but in this particular case its part of a past incarnation.

Does any of this strike any of you as being either worthwhile, phantasmagorical, useless? How do some of these things strike some of the breadth of experiences in here?

Student: I can identify with a number of them. I was going to ask you a question if I could. The system that you built, I think you called it a bulletin board or something, that you ultimately replaced with a weekly, five-page typewritten summary.

Zak: Which we mailed.

Student: In the government, particularly in the military, would you comment on them ever looking at sustainability costs, or the cost of keeping a system current? Once it's in, information systems, do they ever look at what it's costing them to obtain that data? Is it worthwhile?

Zak: I think the intelligence community is better at that. My experience has been that anyway.

Student: I was not thinking as much about intelligence as maybe, let's say, maintenance data collecting systems, something along that line. Routine record communications, let's say.

Zak: What I've found personally, and I don't have any recent experience, is that information exchange grew to fill the bandwidth available. The only place where it was ever challenged was when you ran out of bandwidth. One of the rules of networks, in fact the only rule of networking, is that networks grow. It's an opiate of sorts, and once people figure out how to use it they tend to use it more, and more, and more, and ultimately you've got a capacity problem, and somebody's got to look at whether or not it's going to continue to be expanded. My observations have been that the question you're suggesting only gets asked when bandwidth gets constrained.

Student: The bandwidth you're talking about, tactical communications, etc., with the use of personal computers, and mini databases from individual workers and everything, I can see in the government this is just growing by leaps and bounds. No one is looking at the cost of maintaining them.

Oettinger: But wait a minute, that's because there might be no costs. Because in fact it may be worse than you think, and in other words, they're not being maintained. I will hazard a half-generalization that by and large systems which have information in them that is not operationally relevant will not be maintained. There is no sustainable way of enforcing the discipline. It may be archival. If it's operational one day and archival the next, that's fine, but if it's a bunch of stuff that requires care and feeding to update and so on and it is not of routine operational significance you might as well write it off.

Student: I think maybe we're talking about different things. I'm thinking of when we go out and collect data. Let's say we buy a new system and we go to the contractor and ask for data in several different forms. Systems Command asks for it one way, and the user at TAC (Tactical Air Command) asks for it another way, and the maintainer asks for it a third way. Rather than having anyone sit down and ask the question, What are we really buying here and does this information in block A suffice with block B as well?

Oettinger: You're now describing the statutory role of the Office of Information something-or-other in the Executive Office of the President. That was created under one of the amendments to the Brooks Bill and their mission is precisely to do what you say. It used to be the forms approving people, now they're supposed to address questions like the one you're describing. If you'd like to talk to the first administrator of it, it's a man named Chris DeMuth who was a colleague here and is now still in Washington and would be happy to arrange for you to swap yarns with him and get a sense of how it looked from that hot seat.

McLaughlin: Germane to that point, and what triggered the question about maintaining the system, is the fact that he had to cover the budget for it.

Student: Yes! In Mr. Zak's example, he was one man and he had total control. He saw it, he built it, he knew what it was used for. You had the say whether or not it would be replaced and you knew how much it cost to keep going. So you could make the decision.

McLaughlin: Now you're talking about the glory of charge-back in terms of exercising some control on people who otherwise will say "I want to know everything." If you say, "Fine, you can know my piece of it but it's going to cost you $40,000 a quarter for my recording system, and you can have it if you want it," it makes a difference.

Oettinger: A lot of the nonsense about information and the economics of information has very little to do with the economics of information or the nature of information. It has to do with the fact that over the last couple of generations we have tended to treat information and information-related things as overhead items. Therefore, they are devoid of

either marketplace or internal control and charge-back and other kinds of things. You find then that a lot of the mystical nonsense about information gets demystified. It looks very much like what happens with any other item, distinct from one that is handled as an overhead item that is given a market value, including all the notions about the properties of information, this, that, and the other thing. You used to find mysticism like that about wheat, and the staff of life, etc., etc. Once you start having commodity markets in wheat a lot of these mystical questions — it's still there if you're philosophically minded — but as a practical day-to-day matter they get translated into the price of bread in the store, and the questions of hoarding and shooting profiteers in wartime and practical things like that have very little mysticism.

In framing the kind of question you are framing I would urge you to look at it in terms of what is this context and is there a marketplace there or any kind of fiscal responsibility? The answer is usually, "No," when these kinds of questions arrive.

McLaughlin: The fascinating thing to me is the proliferation of PC-based subsystems floating around any large organization. There are an awful lot of cases where people have decided they can do it themselves much more cheaply than they can if they go to the central MIS (management information systems) people. That's almost been the death of the timesharing industry, for example, because there were lots of us in the bureaucracy who used to buy things from timesharing rather than deal with our MIS organization. Our needs were so small compared to what the MIS people wanted to provide. They wanted to assign four systems analysts to us to write a program which any one of us could do on a PC with Lotus 1-2-3 today. That's why these things are springing up like mushrooms throughout any organization you look at. Users can do it themselves.

Student: Just a few comments about communications and information. In our agency we set up this system of information gathering and at the same time we improved our technical capacity of circulating information to speed it up. It's amazing what we got in return, let's say how powerful we became in improving the speed of circulation of information. And then we start trading power, having relations of power, because we increased our capacity of getting information, getting the right information in the right time. We had information available that other institutions didn't have. When you have something that the others wanted, you can trade favors. You trade information with other agencies or other departments. It was just a very smooth kind of investment.

McLaughlin: Knowledge is power.

Zak: It certainly pays, in my observation anyway, to have as many of those small investments going as you possibly can because you never know when one of them is going to pay off.