

**John H. Rubel Oral History Interview – JFK#2, 09/09/70**  
Administrative Information

**Creator:** John H. Rubel

**Interviewer:** William W. Moss

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**Biographical Note**

Assistant Director, Strategic Weapons, Defense Research and Engineering, United States Department of Defense, 1959 - 1961; Assistant Secretary, Defense Research and Engineering, 1961 - 1962. In this interview, Rubel discusses contractors working for the Department of Defense, communication satellites and missile systems, among other issues.

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**NATIONAL ARCHIVES AND RECORDS ADMINISTRATION**

Second Oral History Interview

with

JOHN H. RUBEL

September 9, 1970  
West Orange, New Jersey

By William W. Moss

For the John F. Kennedy Library

MOSS: Let me start right off by saying that the first thing I'd like you to talk about is the relationship between what we might call consultant institutions and the Defense Department. I think of outfits like Aerospace Corporation, Rand [Corporation], Atlantic Research Corporation, the big technical schools, MIT [Massachusetts Institute of Technology], Cal Tech [California Institute of Technology], this kind of thing, the Livermore Lab [Livermore Atomic Laboratory] or Harold Brown's old outfit.

RUBEL: Right.

MOSS: What thoughts do you have on this relationship? The new lefty types, I'm sure, would look at it with a jaundiced eye and say it's a big conspiracy going here. How do you view it?

RUBEL: Well, I don't have my thoughts too well organized. Let me think in a random way. First, I think you want to distinguish perhaps three or four classes of such institutions, and you've mentioned several examples from each of these classes.

First, there is the not-for-profit and largely software institution that was usually created for an ad hoc reason. Examples are: Rand--that was the first--the Mitre Corporation, the Aerospace Corporation. Each of those was created either directly or indirectly through government sponsorship of one kind or another. Rand was started by Douglas [Aircraft Company, Inc.] under the aegis of the Air Force and later spun off from Douglas to become a not-for-profit, Air Force-sponsored institution with the initial objective of studying war. The Mitre Corporation was originally begun to concern itself with MIT research and engineering in defense related spheres having to do with the SAGE [Semi-Automatic Ground Environment] system that was being developed at MIT and later various other more

or less ad hoc air defense related missions. It was chiefly concerned with SAGE-related radar, data processing and related technical matters. It was not limited to software, but was equipped with engineers, laboratories, instruments and the like. SDC, System Development Corporation was a spin off from Rand. It was set up to do the programming and training of people to operate the SAGE system. That was its ad hoc mission. Later it branched out into many other fields and, of course, recently it became public and no longer a not-for-profit organization.

The Aerospace Corporation was forced into existence by the Air Force and by various political pressures acting on the Air Force. It was initially composed of a nucleus that was spun off from (STL) Space Technology Laboratories [Inc.] which was a private, for-profit government contractor. It became an organization to do systems engineering and technical direction (SETD) for certain missile projects under the Air Force's aegis. STL conducted a great variety of space-related and Air Force-related studies including many that later led to specifications for new systems. Each of these organizations was established to fulfill an ad hoc mission, and each later broadened beyond that ad hoc mission to embrace a wider scope of responsibility. Most of them were Air Force sponsored organizations, but not all.

IDA, the Institute for Defense Analysis, is a Defense Department creation. A group of universities were used to bring IDA into existence and to govern its administration. Maybe it is a too cynical oversimplification to say that IDA was created to circumvent restrictions that hampered the government bureaucracy when it came to paying and hiring professional people for defense planning and analysis. This was a way to pay people more money and give them a non-governmental working environment, but, in fact, to do exactly the thing that a government employee would do if you could get the government employee that was able to do it. Thus the weapon system evaluation group (WSEG) under IDA stationed people in the basement of the Pentagon, collocated with the staff of the Joint Chiefs of Staff, where they conduct studies that are given to them by the Director of Defense Research and Engineering, by the secretary of defense or by the Joint Chiefs of Staff.

The FOCUS branch of IDA, located on the Princeton campus, was building and staff for certain kinds of cryptology-related mathematical research. That's one of the places students have picketed. As a matter of fact, several of the key people in that were ex-employees of the NSA [National Security Agency]--clearly a way to keep people doing work of use to the government who have left it in order to make more money somewhere else. In this instance, it could be argued that the institution, really created an incentive for people to leave, because where else does a key NSA employee find happiness if he's left the NSA other than in a place like FOCUS?

MOSS: Skills are not really transferable in many instances.

RUBEL: And all of those organizations belong to a class with spill-over into the university world. You see MIT running Mitre (which stood for M-I-T research and engineering). You see a group of universities, MIT among them, sponsoring and having a lot to do with setting the policy for IDA.

Now at the other end of the spectrum, groups like the Rand Corporation, SDC, Aerospace and so forth have no strong ties with the university world at all. Commenting on this branch of the phenomenon, it seems to have arisen in response to a sense of the fitness of things that is part of the American scene. Most people do not think it's right for an aircraft company to be a chosen instrument of the government for Rand-type work. One senses something unfitting about that. An institution to study war or advise the government or program the SAGE system becomes tainted in our minds when it is a profit making industrial organization owned by the public, managed by professional managers, governed by the laws of corporations.

Another element seems to be connected with the idea of profit. Aerospace Corp. is an example of that. Aerospace isn't doing anything that the Space Technology Laboratories wasn't doing. The people who are key officials in Aerospace today, were for the most part officials of Space Technology Laboratories. They moved into buildings that are right across the street from the buildings they used to occupy. What has changed? Nothing important, really, except that these human's material resources are "not for profit" under Aerospace Corp. Almost strangely, that accounting term, little understood by nearly every layman, made the huge policy difference. Officials deemed it inappropriate that STL should make a profit by serving as a servant of the Air Force, exercising system engineering and technical direction over other private contractors.

There's a lot of legislative material on this. You're probably familiar with it. The [Chet] Holifield committee held all kinds of hearings. The question of how [Simon] Ramo and [Dean E.] Wooldridge and certain other officials of TRW [Thompson Ramo Wooldridge, Inc.] made so much money became a very conspicuous part of those hearings at the time. The Air Force tried to get STL to spin itself off from TRW and become a not-for-profit organization, but when the STL people refused, Aerospace Corporation was begun. The Air Force put great pressure on the management of STL, as you can well imagine, to cause this splitting off of people, organization, contracts, and responsibility.

MOSS: All right. In what way would the Air Force put pressure of this sort?

RUBEL: They started by talking to the management of STL about spinning off from the body of TRW so that they could serve the Air Force without being involved, even indirectly, in any kind of hardware exclusion limitations.



You see, the Air Force developed a doctrine during this period-- and it's a good one--which said if you have been privy to the formulation of specifications for a weapons system, then you are excluded from bidding on the hardware to fulfill those specifications. A good deal of the pressure for that kind of policy arose by virtue of the role that had been played by STL. Here was a company that did help the Air Force draw up specs and then turned around and helped the Air Force administer those specs. Now companies like General Dynamics [Corp.], Boeing [Airplane Co.], Lockheed [Aircraft Corp.] and others certainly didn't want to see this company with an inside track to Air Force thinking in the formulation of Air Force specs permitted to bid on those same specs. So the so-called hardware exclusion doctrine was enunciated as such extra-governmental organizations and functions grew.

STL, however, belonged to a company that was in the hardware business and they didn't want to be excluded from any kind of hardware participation just because one part of a big company was involved in the STL aspect of things. So they began negotiating with the Air Force, trying to define circumstances under which the exclusion didn't apply, and to set up internal organizational arrangements that would allow the Air Force to apply the hardware exclusion clause and still permit TRW to compete in a fair and equitable manner. If one part of GE [General Electric Co.], for instance, is excluded by virtue of the hardware exclusion clause from bidding on contract X, it does not automatically exclude every other division of the General Electric Company from bidding on projects Y and Z, but the Air Force bore down much harder on TRW because of its STL operations.

In the early to middle part of 1959 they began to talk about ways to establish rules, procedures, and organizational arrangements permitting TRW adequate hardware opportunities while keeping STL in its by then traditional role. Later the Air Force began talking to them about making STL a not-for-profit division of the company, but the management of STL was not willing to do this, partly for ideological reasons, and possibly because many key people had an equity interest in STL. I used to talk with [Ruben F.] Mettler, who was then or was about to become the president of STL. He was going through a terribly agonizing period at the time because the Air Force had the power to negotiate or to withhold the negotiation of contracts, to affect compensation under contracts, and so forth. There were many ways in which the Air Force could make problems for STL and did.

Then public hearings began, in the course of which a very basic issue arose, raised by Representative Martha Griffiths on the House Committee on Government Operations: why were any STL charges deemed "indirect" when STL existed only to directly serve Air Force needs? It was a very important question because by virtue of this kind of categorization, overhead rates were negotiated that included sums for rent and other indirect overhead charges. Thus, although the profits of the company seemed reasonable, many things were paid for out of the overhead account, like buildings, for example, and at the end of several years people had amassed substantial

private fortunes while the TRW Company owned something like twenty million dollars worth of buildings and related assets. It seemed that all that had to have come out of the payments that had been made to this company during that period of time, or so it was asserted in the hearings.

The hearings often touched on the suspicion that accounting practices concealed the sources of substantial wealth accumulated by selling services to the government. I think the idea that a man can get rich by advertising cigarettes has recently fallen into slight disarray, but it used to be a sure path to respect and a good reputation. But if somehow or other . . .

MOSS: Excuse me just a minute.

[Interruption]

RUBEL: But I think that there's something about our national sense of the fitness of things that says that there is something wrong if you made a lot of money out of contracts with the government, especially personal service contracts. The general feeling is against big profits, or perhaps against any profit at all, especially profits made for rendering services without producing hardware. The element of risk is really not there to the same extent that it is in other business where profit is supposed to be a reward for risk. The exclusive arrangement suggests that profit really isn't a reward for greater efficiency because you have nothing to compare performance with. There are many unspoken, but felt, perceptions that have caused people to move that way, especially congressmen and, I think, a lot of administrators in the government too.

Well, STL refused to go not-for-profit and the government decided to create the Aerospace Corporation. They persuaded STL that they ought to transfer several big men to become vice presidents of the new company. Ivan Getting was selected to be its president. Many people and a lot of work were shifted out of STL to make Aerospace Corporation which immediately proceeded to grow until it became a lot bigger than STL had ever been. Now it must have about thirty-five hundred people.

Well, so much for the not-for-profit organizations. Each one arose at a different time in response to a different kind of ad hoc requirement, and almost without exception, each one has tried to go on living. Rand carries on, though no longer exclusively for the Air Force, and it has branched out far beyond its initial charter into fields like sociology and economics. Did I talk about Rand last time?

MOSS: A little bit. In the early days of the Air Force right around the Second World War.

RUBEL: Early days of Rand and the Air Force. That's right. I know now they're figuring out how the New York Fire Department ought to respond to alarms, and what are the optimum ways of disposing of waste, things of this character, in addition to more traditional tasks.

MOSS: You talked a good deal about some of the problems of the situation of these organizations. What are their virtues? Do they provide real cross-fertilization of ideas, critique of current policies, anything of this sort?

RUBEL: They fulfill their purposes; I think, very well. In some cases they've gone well beyond them. Take Rand. I think it's unquestionable that Rand has made very important contributions to thinking about defense. During the fifties the chief animus for the dispersal and hardening of our strategic strike forces came from Rand analysts, people like [Albert] Wohlstetter and Herman Kahn. Books were written by people at Rand that had some impact on the public mind. Some were influential, like the book "On Thermonuclear War." Kahn himself, in going around the country and giving his seminars, got a lot of people worked up. He created interest and improved understanding, not only of war but of how to think about complex futures. Some people began to see him as a kind of Strangelove. I remember seeing a book review in the Scientific American by [James R.] Newman--shortly after Kahn's book, On Thermonuclear War, came out. It began, "Is There a Herman Kahn?" But Kahn made a very positive contribution to defense and national thinking, and so did others.

For example, [Charles J.] Hitch wrote a book on program budgeting while at Rand and then went to Washington and did it. It spread to other parts of the government, with generally good consequences. It is a step forward in management, in perception, and in thinking about the allocation of resources. [Alain] Enthoven came to the Defense Department from Rand and set up the [Directorate for Weapons] Systems Analysis office. The virulence of the attacks on him as a person and on the work his office did is testimony to its worth. I think any time you can get Mendel Rivers that excited about something, it's got to be good. The approach to decisions emphasizing judgement on the basis of fact, weighing alternatives, doing your homework, all that is in the public interest, and the methods implementing and reinforcing this approach were worked out largely at Rand.

MOSS: What do you think was really the chief objection on the part of the people who were anti-Enthoven, anti-Hitch?

RUBEL: Well, I've never been aware of people being very anti-Hitch really. It's always seemed to me that Enthoven was the one that attracted the lightning.

MOSS: Who were the other targets? Who were the other "whiz kids?" It's always in the plural. I have a hard time isolating more than one or two. [Adam] Yarmolinsky gets thrown in, but that was for other reasons, I think.

RUBEL: There were some articles on the "whiz kids," and in one they had pictures of "whiz kids." I think Stewart Alsop wrote an article on the "whiz kids" in the Saturday Evening Post which included

[Eugene G.] Fubini along with several younger men like Alain, Adam Yarmolinsky, Harry Rowen, and others. He didn't have me. I was offended. I was about forty-two and I felt that I ought to be a "whiz kid" if Fubini was because he was forty-three. Well, who was a "whiz kid?"

MOSS: Harold Brown.

RUBEL: I guess Harold was one at one time. Herb [Herbert F. York] would have been one if "whiz kids" had been invented then because he was only thirty-seven when he went to the Pentagon. I don't remember if Jack Ruina was a "whiz kid" or not. I think anybody under forty, who seemed to have his head screwed on and didn't talk in clichés was automatically a candidate to be a "whiz kid."

But Enthoven became the prototypical "whiz kid." He had several young men in his group who would have been "whiz kids" if they had been a little more visible. I think [Henry S.] Harry Rowen was a "whiz kid" for awhile.

MOSS: Let's get back to the other question, then. What was the chief objection to these guys?

RUBEL: Well, number one, I think the objections to Enthoven and to "whiz kiddery" were very much the same as the objections of the same sort to [Robert S.] McNamara. Anything that challenges the established order is going to be the target for political attack in Washington. If you are going to weigh alternatives and exercise independent staff judgment for the Secretary of Defense, you're going to challenge the established order, that's all there is to it. Rarely or never had the secretary of defense or his staff mounted such a challenge.

Historically, the Secretary of Defense didn't get the legal power to exercise independent staff judgment and to insist on the submission of data from military departments until the Reorganization Act of 1958. Before then his requests were often refused. Defense Department historians can easily document the fact that before the act of 1958, Secretaries of Defense would often ask a military department to give them something, and be told "no" or ask for the re-work of something, and be refused. Now after 1958, they couldn't legally refuse and I never knew them to refuse outright. Instead, they often tried the idiot treatment, or they would pretend to be responsive while over-responding, a tactic known as "cooperating them to death." There were many variations on this motif - an excess of complex data with no conclusion, the omission of critical data, the creation of crises requiring DOD action which would otherwise have been unnecessary or withheld.

MOSS: Can you think of specific examples?

RUBEL: The Secretary of Defense installed the Program Change Proposal procedure in the latter part of 1961. I have a vivid recollection of its genesis. For several years I found myself



dismayed by the game of Defense budgeting and the related game of Defense procurement. I was hoping that the new secretary, McNamara, would do something about it. I felt that the Air Force was the most conspicuous offender in this regard. I began to keep a record of overruns on major programs. I was pretty convinced that many major overruns were either planned, or in any case were handled as if they were part of an over-all strategy aimed at increasing the service department budget. Almost every fall, around September, October, and even as late as November, a series of catastrophic disclosures were typically made requiring last minute revisions in budget estimates for the next fiscal year. These last-minute revisions were what Herb York used to call the "sacramental wine," so called because you cannot, under any circumstances, dispense with the "sacramental wine." We never had an overrun in a program for further investigation of left-handed, self-tapping, cadmium-plated screws, but we had huge overruns on Atlas, huge overruns on Minute Man, huge overruns on Titan, huge overruns on Midas. We had overruns in the programs that were uncancellable, unattackable, unassailable, unerodible, undelayable. In those days when many systems were not only new and innovative, which is a natural invitation for overruns, but when many were of great military importance, we always had to buy the "sacramental wine." It was obvious that the military departments, especially the Air Force, saw the picture that way, too. The last-minute submittals for new expenditures, heavily crowded into the last third of the calendar year, did not bunch up that way by accident.

In about September of 1961 I was meeting in McNamara's office with him, Harold Brown and, I think, Hitch. The meeting had to do with budgets. When the right moment came I said something I had been saving for just such an occasion. "Do you realize" I said, "that the overruns on only four Air Force programs in the last fiscal year have more than equaled the entire Army budget for RDTE [Research, Development, Test, and Engineering], those four programs are Samos, Midas, Atlas, and Minute Man?"

I remember that on the ballistic missile programs alone they came in with a billion dollars worth of overruns in the latter part of 1960. As a matter of fact, I can well remember when they came in and gave a big briefing in the fall of 1960. [Samuel C.] Sam Phillips, who later headed the manned space program for NASA [National Aeronautics and Space Administration] at Canaveral, was then the Minute Man program manager. He gave a long and elaborately prepared briefing on Minute Man to a ballistic missile review committee that was headed by the Deputy Secretary of Defense. In those days the Air Force gave such a review briefing as often as every month or two. On this occasion, General Phillips must have had in hand the submission the Air Force planned to make only a very short time later, revising the whole thing, asking for huge additional sums, but he went through this exercise just the same. This is the way the bureaucracy functioned in those days, especially at the interface between the DOD and the military departments.

They would present a big, beautiful picture, and a month later come

back saying that essential revisions would cost another five hundred million dollars. These astronomical numbers added up to close to two billion dollars on only a few major Air Force programs in the latter part of 1960. The Army budget for RDT and E [Research, Development, Testing, and Evaluation Programs] at that time was in the neighborhood of a billion and a half, give or take a quarter of a billion dollars. The overruns--the overruns, not the basic funding--on these Air Force programs alone equaled or exceeded the Army budget for RDT and E.

McNamara responded to my disclosure. "That has to stop!" He said, "I want a system where from now on the service secretaries will sign that they have agreed that they are going to do a program for a certain amount. They will define the program, they will define its schedule, its performance, its funding, and then they will put their word behind the fact that they're going to make it happen that way. "I want you to work out a plan for that," he said. Hitch eventually created the new procedures, which embodied my thinking, Harold's, and that of others as well. A few months later came the PCP, the Program Change Proposal.

Now I'm recounting all this apropos of an example of cooperating people to death. Now, McNamara had created the five-year Force Structure and Financial Plan. This Plan divided the total procurement effort of the Defense establishment into "packages." Package number one was entitled Strategic and Central War Forces [Strategic Offensive and Defensive Forces], a series of line items comprising projects or groups of projects classified under the Strategic and Central War Forces heading. There were several "packages" for General Purpose Forces, Intelligence, et cetera. Thus, "program package" meant an ensemble of major projects and groupings of smaller projects.

Now the term "program" is imprecisely used to denote either a major weapon system development effort (e.g., the "Minute Man Program") or it can mean the program for Strategic Strike Forces [Strategic Offensive and Defensive Forces]. A Program Change Proposal was intended to mean a change in a particular project within a "program package." To avoid excessive paper work certain threshold rules were established providing that any change in a program (meaning a line item such as Minute Man or others) that resulted in a change of more than ten million dollars in any fiscal year or twenty-five million dollars throughout the life of the "program" had to be approved by preparing, submitting and securing approval of a Program Change Proposal.

To illustrate, suppose that the Navy had received approval for a project, like Polaris, an approval stipulating the project costs and schedules over a period of several future fiscal years. The Secretary of the Navy, in such a case, would have signed off on the program with its master schedules, specifications, budgets and the rest. Now suppose that it turned out after a year or two of growing development effort that something had happened causing the scope of the program to grow big, say,



\$500 million. Now, following the PCP procedure, the Navy, in this hypothetical example, would have to identify the reasons for the overrun, and propose a change in the program (submitting a PCP) that would result in the overrun. The procedure was implicitly based on the assumption--the very wording suggests the assumption--that if nothing changed, you'd come out all right, that it's only changes that cause the overruns. Of course, nothing could really be further from the truth, and many programs were started with built-in overruns from the very start.

So much for an outline of what was expected. Soon after the PCP procedure was begun the Services, especially the Air Force, began to submit Program Change Proposals which fell well below the threshold of ten million dollars in any one fiscal year or twenty-five million over the life of the program. Moreover, they began submitting such change proposals for things that didn't even exist but that were proposed as wholly new "programs." However, if they were embodied in the total "program package," they would result in more than a twenty-five million dollar change to that package because however small at the start, a proposed new "program" could easily grow to far more than the \$25 million limit in a few years. By defining "program" as the program package and submitting PCP's as if they were required if that total package might be changed were a new project to be approved, the procedure was interpreted so as to maximize the number of submittals. The amount of detail incorporated on the forms was multiplied beyond belief. Many submittals were far below the threshold needed for submittals by any criterion or interpretation.

The paper work was fundamentally fairly simple, but by the time it got multiplied by a large number of readers, each adding comments, and by a large number of items, it became horrendous. There was a time when I wasn't sure whether the system was going to stand up under this paper assault. The Air Force, particularly, flooded the OSD [Office of the Secretary of Defense] with PCP's, and many of us who had to read almost all of them spent day after day, night after night trying to plow through them. From our office the papers went to Enthoven, and he'd plow through them. Eventually McNamara had to read them all. McNamara was able to read more, understand more rapidly, digest more, and remember more than any combination of fifty other human beings that existed in the Pentagon. How he did it, I don't know. Had he been a normal mortal the future plans would have collapsed in a few weeks.

MOSS: Well, this was one question I was going to ask you because you impute to the military a sort of deliberate throwing-it-back-in-the-face-of-McNamara thing.

RUBEL: No question about it.

MOSS: And I was wondering how much of this was sheer confusion and inability to absorb and understand the new way of doing things.

RUBEL: Well, no, I don't think that was it at all. If anybody had any

question, he could have asked. All they had to do was pick up a telephone, you know, or walk downstairs, say, "Listen, John, we've got this PCP thing here and we could throw a lot of these at you guys. But what do you really want?" Nobody ever did that. The secretary of the military department who had to sign all these things could have said to somebody "Hey, listen. What's all this about anyway? All of a sudden we got all these PCP's." Perhaps somebody replied "Yeah, but you know, that's what they want down on the third floor." He could have said, "Just a minute." And he could have picked up the phone and called the Secretary of Defense and said, "I don't know about you, but I'm being deluged with these things. I'm not sure it's what we really want." I don't think any conversation like that ever occurred.

MOSS: The reason I ask was I saw this hit a much lower level organization that I was in and the people who were trying to implement it were running around like chickens with their heads cut off and not wanting in their pride to go back and ask these kinds of questions.

RUBEL: Well, there could be elements of that. But I've seen these staffs wheel around like a very slow-motion cavalry charge, but when they're moving in that other direction, they really charge. Don't forget, the Air Force alone had over seven thousand people in the Air Staff. They can write a lot of stuff. And down in the OSD there is a very much smaller staff to process all these things. Remember, too, that there was a great difference in the volume and character of submissions from the various departments. The Air Force predominated, vastly predominated. The Army sent in comparatively few. I can't imagine that the Army was that much less confused than the Air Force.

I'm not saying that I think that people sat around in back rooms with green felt tables and plotted all these tactics, but it happened. It was like a plague of 17-year locusts and like them, it went away. There, anyway, is an example of an extra-legal impediment to DOD administration.

To get back, you asked the question about Enthoven. Enthoven questioned the established order in behalf of the Secretary of Defense. I know him very well. He's a very good friend of mine, and he works with me now at Litton Industries, Inc. He lives close to me, has a wonderful family, a wonderful wife. He's a wonderful person. He's a soft, mature, sensible, intelligent, sweet human being, and his motives are as untainted as those of anybody that you'll run across. He wasn't trying to embarrass or to harass anybody. He was trying to do his job as a loyal public servant.

But in the areas where he worked there are many people who don't believe in objectivity for its own sake. They don't believe in analysis. In fact, they really suspect it. It arouses a combination of hostility and genuine fear. People who analyze, who calculate, who are cool, who are uninvolved in the answer until they've gotten the answer don't seem to have wide appeal to others. I once talked to a congressman on the Armed Service Committee Committee on Armed Services. He said, "I don't like this

this McNamara," he said. "I don't think that he's going to make out very well here in Washington." I asked, "Why not?" "Well," he said, "Number one, he thinks he's too smart." He said, "I suppose he probably is pretty smart, but the trouble with him is he lets everybody know it. Well, I'll tell you. This may sound kind of funny to you, but my favorite Secretary of Defense was good old 'Engine' Charlie [Charles E.] Wilson." "I'll admit," he said, "he put his foot in his mouth more than once, but he used to come down here in front of this committee, and one thing that I knew, and one thing that all the other committee members knew was that he was another human being. And he had something on his desk that it wouldn't hurt McNamara to have on his, and that's that little Dutchman with the motto that says 'Ve is too soon old, und too late schmart.' Maybe it wouldn't hurt him to have a little "Edsel" there too."

This was a typical reaction. I think it's the hatred and suspicion of the brilliant man, the jealousy, the fear and even awe that it inspires. It's like in a village that has only one schoolteacher who reads books and speaks articulately. That schoolteacher, in rural America anyway, will be regarded as an oddball, a person that you might be interested in talking to, that you might be willing to listen to, but whom you would never entrust with any real responsibility, who would never be elected to the town council. We have that streak in us, and the anti-Enthoven attacks show how deep and venomous that streak can be.

MOSS: [Richard] Hofstadter and the anti-intellectualism business.

RUBEL: It was very real in Enthoven's case. Here's a young man who is tall, handsome, personable, who has earned a Ph.D. degree, who was a Rhodes scholar, who speaks good English and fair French and rowed on crew and carries himself with grace and charm. What is wrong with this man? He wants to know the relative merits of the F-105 and the F-4H for a proposed mission with details. How fast do the planes fly? What are their low altitude characteristics? Their range, altitude, load capacity, logistic characteristics? Now you are comparing a Navy airplane and an Air Force airplane for an Air Force mission. Man, if it comes out that the F-4H airplane is the best airplane, you're going to cancel the F-105. We got nothing but trouble, and that's what happened. Whatever you might expect, you won't find enough dedication to national purpose, enough stewardship of the public trust, enough resolution to seek the right on the part of Air Force or any other public officials in their institutional roles to counterbalance their own private career and ego investment in having decided on the F-105, having bought the F-105, then having deployed the F-105.

MOSS: Well, this is one of the reasons I asked the question about confusion and then threw in that little business about pride also because I get the impression, reading lots of peoples' commentary on this, that there was a great pride in the seat of their pants, in effect, the intuitive background of the high-ranking military officers that they had something in this feel for the situation that they thought was unique and couldn't be had by the Enthovens.

RUBEL: You always have that. There may be something to it, but when you review, even superficially, the history of how far that great "feel" has carried armies led by those people in the past, you have to wonder. When you think of World War I opening with saber charges into machine gun nests, when you look at what happened to the French Army in the first thirty days of World War I. They had feeling. The French generals had this sense of what was right. They had the idea of guts, of the "offensive above all" doctrines and loyalties and self-confidence and iron will, but all that didn't preserve a million French youth from extermination by German machine gun nests. I suspect excessive reliance on any approach to complex matters, and I certainly suspect this vaunted "feel" the military is supposed to have.

If someone told me [Jascha] Heifetz cannot tell you how to play the violin, he just sort of feels it, even though he used to give lessons, I might agree that it could be: the violin is tough. All his life Heifetz has worked to perfect himself, training every nerve and muscle eight hours a day for a lifetime to draw the bow across the strings with absolute perfection. No doubt the man, exposed to the intimacy of his instrument to that depth, develops a unique feel for it.

But the majority of the generals today have never had any military experience at all. Harold Brown has seen more thermonuclear explosions than any military man. So I just don't know how valuable the presumed "military" intuition is. I don't want to discount it all together, but I don't think counting it for something is a basis for discounting everything else.

All too often the argument goes just like that. It becomes a frank, naked political attack. People attack the Enthovens, and him in particular, on a personal level. They call them "whiz kids" and other pejorative terms. That's as if Enthoven were to call them Colonel Blimps. They talk about the use of computers as a substitute for judgment knowing perfectly well that computers are not used for any of the Enthoven analyses, and that the Systems Analysis people are asking for no more than common sense, straightforward thinking.

No, I personally think that these attacks are simply a melancholy commentary on the state of our political development and the character and structure of our military and other bureaucratic organizations. That in the end the Enthovens lose is a further sad commentary, but in the end they cannot really hold the dike against the relentless pressure from the established military bureaucracies and their constituencies.

MOSS: Why do you think that is?

RUBEL: Well, I think it is that if you're little Hans with your finger in the dike, and nobody comes to put his finger in the dike too, sooner or later you just lose. The sea water comes through another little hole and then another, and pretty soon you have to go away because



you're going to drown. If there's a lot of pressure on that wall, and you're pushing on this side with a lever but the pressure from the other side is constant then if you relax for an instant, it moves toward you. When you relax another instant, it moves again. It just keeps moving whenever the opposing force relaxes. It's like a glacier and you can't keep pushing hard enough to hold it back. There's more of them than there are of you.

You saw this tremendous charge by McNamara and by the Enthovens and by a few of the other people, even myself to a certain extent: We made a certain amount of progress in a few areas. We won some high ground for a little while. Perhaps we did keep the Air Force out of space long enough so they missed their opportunity to build a huge, needless program. Only time will tell.

Every administration has to learn all over again the lessons learned by the ones before. The ABM [Antiballistic Missile] is a good example. Here we are, starting to go down the road on the ABM although I'll bet you anything that even Nixon will eventually figure out that it's not a good idea. By that time, there well might be another president coming in, who would have to start all over again. McNamara and his team made a lot of progress, but much of it has already been swept away. Old approaches will be dusted off under new slogans, but as new administrations learn the facts and the nature of the defense machinery they have to deal with, the constant pressures will push ahead and erase many former gains.

Finally, from the viewpoint of men accustomed to political processes, with their reliance on power, influence, trading favors and the like, the nonpolitical way erodes the power of important officials. Even if a particular analysis leads to decision in your favor, and you have lost your power to affect that decision merely by virtue of your position. That sense of power lost directed resentment against McNamara and Alain Enthoven and against many others who worked with him.

Another problem was age. Alain was in his early thirties, and so were many of his staff. One of his important assistants [Robert C.K.] Bob Valtz was only thirty-two years old when he became Deputy Assistant Secretary of Defense. Most general officers are well over forty and a lot of the really important ones are in their late fifties. And I think that makes a difference, just as it would make a difference in a private company were its president to hire a young "brain-trust" staff interfacing in an adversary relationship with major group heads and division managers. We see that in our company. Alain has the same problem in our company today. We've got people who are not very good managers, who understand only partially and inadequately status and prospects of their own businesses, but it is difficult to get them to cooperate with people like Enthoven in part because of pride, in part because in some cases they don't even understand what is being said to them. One of the best protective colorations for ignorance is aggressivity, the use of your line power to destroy the staff man.

I'm sure there are some military people who hold strong opinions to the contrary. They'll cite you chapter and verse of the horrible things that Enthoven has done. He's written a book that will be published fairly soon and has a number of examples in it of things that he did. The record eventually will speak for itself. I think he made some very good contributions, but I'm not optimistic that they will last long because I think they were achieved by individuals pushing them through a reluctant system and not by natural forces. These massive bureaucratic systems operate largely politically. The older they are, the more political they are.

Now to get back. You interrupted your original question by another question.

MOSS: Yeah, we've gotten well away from the . . .

RUBEL: The first thing you asked me was about the different kinds of organizations that were set up, and I had sort of gone through the ad hoc, not-for-profit corporation type of institution with some examples when you got me off on Alain Enthoven and things like that.

Now, let's turn to the universities because I think that's another class. And there they fall into a number of subclasses. Let's consider first the university as contractor, Cal Tech running the jet propulsion laboratory, MIT running the Lincoln Laboratory, and the Instrumentation Laboratory. There are other examples, but those are the most conspicuous ones.

MIT's defense contracts amounted to something in the order of eighty million dollars a year when I was in the Pentagon. While I don't know what they are today, they're probably not much less today. Now, there are many aspects to this. For one thing, those laboratories have served a variety of ancillary purposes. The Instrumentation Laboratory at MIT, trained many Ph.D.'s, both civilian and military, and created a cadre of people trained in gyroscope, accelerometer, precision machining, and guidance technologies that have made this country pre-eminent in this field. Its work has made an enormous impact leading to military excellence in the guidance of missiles, aircraft, satellites, ships, submarines. Men trained by [Charles S.] Draper went out to industry and into the military, making the military a most intelligent customer for this kind of thing. There are plenty of officers on the military side who have bought guidance and control systems from private industry who knew more about it, or at least as much about it as the people they were buying it from. That made them good customers, and it made for a lot of progress in that field.

Radar is more difficult to trace to a single laboratory, but many important developments in display techniques, computer processing techniques, antenna design and the like originated in the Lincoln Laboratory. Unlike the Instrumentation Laboratory, which virtually created the technology of precision inertial elements, Lincoln Labs came along years after the basic techniques were well advanced. The Radiation Laboratory at MIT, disbanded after World War II,



laid the foundations for what Lincoln Labs helped elaborate.

Now, you could ask, "Why did it have to be the Lincoln Laboratories? Why couldn't some private organization have done its job? Perhaps one could have done it, but the universities during that period of time were able to attract a particularly good group of people to come in as graduate students to work. There were staff members at MIT who worked or consulted in the Lincoln Laboratories and thus linked current state of the art with the training of students,

Also don't forget that at the time Lincoln and some others were set up in the late forties and early fifties, the pattern was a natural outgrowth of patterns that had already been in existence during World War II. MIT established the Radiation Laboratory during World War II; the Lawrence Radiation Laboratory in Livermore was set up for the AEC by The University of California, with outposts at Los Alamos and perhaps elsewhere; Cal Tech set up the Jet Propulsion Laboratory. Thus World War II experience prepared many universities for continued participation in defense activities.

After the war it was widely realized that there would be a technological arms race a long time. It seemed fitting and necessary to continue to tap university people and look to universities for administrative support in special instances like the ones just cited. Had we relied exclusively on American industry, during the late forties and early fifties, you'd have probably been much longer in building up an adequate capability, and I'm not sure you'd have ever built as good a one in those particular fields. It took a long time before industry was able to cope with some of these problems to the extent that these university cadres were, and in some fields they never because adequately competent. No guidance organization in the country has ever been as productive of new and useful concepts and devices as has the Instrumentation Lab, for example, even though there are dozens of guidance systems and guidance component development and production organizations in the United States.

Times have changed. With change, these organizations became less important relative to our national needs and, in relation to capabilities, less unique. There are plenty of other places now beside JPL that can do space technology and do it quite well. There are plenty of places beside Instrumentation Lab that have done, can do, and would, even if Instrumentation Lab got wiped off the map, develop guidance systems. Furthermore, even if they didn't, it isn't that important anymore once you reach a development plateau. After you've developed the capability to guide within a fraction of a mile, then the next fraction isn't as important as the fact that you got down to that point.

MOSS: Okay, will you hold it there, and I'll flip the tape?

BEGIN SIDE II TAPE I

MOSS: All right.

RUBEL: One consequence of the development of these large university-run business enterprises of the kind I've cited was that they began to have an important impact on the accounting structure of the university. A great many ongoing expenses of operating the university at the level to which it gradually grew were really in fact borne by laboratory contracts. If tomorrow you simply eradicated Lincoln Labs [Lincoln Laboratory] and eradicated Instrumentation Lab, MIT would have a tremendous financial problem because they would no longer have allocable overheads that were coming in against those contracts for university administration that is really not strictly relevant to the contract purpose.

MOSS: This, of course, is fuel for those who argue that the universities become too dependent upon this sort of thing for its primary purpose.

RUBEL: I think so. I think it is. And you can argue that, looking backward, it is too bad that that happened and that we're in that fix. But there we are. And I personally agree. I think it is too bad. We bought a lot of things with it, but we're starting to pay for it, and to work ourselves out of this is going to be tough. When you get students, especially very militant students, who want to close these places down-- whatever those motives may be--one of the byproducts, whether they realize it fully or not, is much, much more severe financial impact than most people appreciate. It isn't just a question of the university not doing the laboratory's work anymore; it is the fact that many university salaries and substantial university costs are going to be hard to meet the day that business stops.

There is another category--just let me carry this one step further-- which is the grants and contracts that were awarded not to big organizations but to individual investigators and small university groups for so-called research purposes. This varies all over the map from activities far smaller than Lincoln Labs but much bigger than individual investigators, such as Group Dynamics at the University of Michigan, to individual professors, some with a bevy of graduate students. There are thousands who have come to the defense establishment, and become accustomed to getting grants or contracts for special studies of various kinds. The range of topics is very wide: psychology of people in crowded places, the reaction of villagers to what happens when you have an invasion, disease investigations of all kinds, research into rare earths and special metals.

The funds became important not only because they supported professors in their work, but because they also supported graduate students in their investigations, and because more and more universities became accustomed to having a portion of the pay in engineering and science departments covered by such grants and contracts. Thus you develop a difficult structural problem if support is cut off. If the government were to decide, if the military were to decide, or if the students were to decide for them that it was undesirable or wrong for investigations of that kind to be undertaken under government contract or grant, many departments in many universities would be in financial trouble.

In some ways dependence on grants and contracts for individuals and small groups may be more pervasive influence than DOD-supported laboratories. My recollection is that something in the order of three hundred and fifty million dollars a year went into what was called defense "research," and of that amount, the great preponderance went for small grants and contracts. While it represented kind of a small fraction of all university research, perhaps twenty percent, it was big enough to make a large swing in those departments where it was concentrated.

Now is that a corrupting thing? Is it make-work? Does it tie universities too closely to the defense establishment? A lot of that is in the eye of the beholder. My personal feeling is that the answer is both yes and no. There are plenty of examples of such work, especially the work that used to be sponsored by the Navy, that's pure and good. They sponsored much basic research in cosmic rays and magnetics, fields that bore little or no relation to weapons development at the time they were begun. It has probably been a good thing to use money that way even though you can argue that it isn't clearly within the mission of the department.

On the other hand, a repulsive species of scientific and technical prostitutes was created by this marriage of convenience. People who earn a lot of their prestige and even substantial funds by going to meetings, serving on boards and committees, rendering so-called scientific advice too often become special pleaders for the military department they're allied with. I'm not sure that students who object to professors who over-consult fully perceive the extent of the corruption that afflicts some. What they perceive is more propagandistic and less to this point. Still, on balance, ties between military and academic are needed. There must be intercourse between these sectors, and between them and the industrial sector. We cannot afford, despite some current pressures, to throw out the patterns of past liaison, saying that the military corrupts our universities, or industry has no business being involved in defense matters. We live in a world that demands more of us than that.

MOSS: Let me ask you this. Did this kind of reflection that you've been doing and on this particular topic have any real place in the McNamara administration?

RUBEL: Oh, indeed. There was a lot of thought given to this sort of thing, a great deal of thought in almost every aspect of it. It was a frequent topic of discussion. McNamara himself felt very strongly that a military department should confine itself to its military mission, that it should not be a place where other public ends were served simply because at that time it was comparatively easy to get money for military purposes. He was very skeptical, for example, about research that was supported by military funds, felt that if the military departments went too far in that direction it would corrupt. He didn't think that was good for the country. We talked about it. Harold and I talked about it a lot. I felt that way too, very much.

MOSS: Under what kinds of circumstances, situations would you discuss these things?

RUBEL: Budget time.

MOSS: Budget time?

RUBEL: Yes, his position . . .

MOSS: Justifications and that kind of thing?

RUBEL: Why should we spend any money for research in the Defense Department was the question one year. I remember that.

MOSS: What would you do? Go up to McNamara's office and sit around and chew it over, or would you have skull sessions in a conference room or what? How did you go about this process?

RUBEL: Well, of course, the formulation of the budget took place over a period of several months.

MOSS: Okay, that's one thing. I think this is another.

RUBEL: Eventually you get to the point where you have to finish the budget submittal. The question then is: what to put in for research. We structured the budget so there was a category for research. Incidentally, every year it went up. It went up because of cost inflation, and such inflation was created, in part, because the budget went up. I took the position that the research budget should not buy more than a continuing level of effort. I didn't think we should be expanding the amount of research the Defense Department supported in universities. Harold agreed.

I remember a conversation with McNamara--I think Harold was there--where this was discussed. McNamara expressed his view, questioning that the Defense Department should support any research. Why should science be supported by Defense? Why shouldn't science be supported by the institutions in our society that exist for that purpose? There are many of them including HEW, the National Institutes of Health in HEW, the National Science Foundation, many other sources of private and public funds, et cetera. A philosophical question was raised as to whether Defense ought to have any role in this at all. The general resolution was that as long as Defense supported research was a very small fraction of the Defense budget, for one thing, and not a very big fraction of the total amounts of moneys in the country that were being spent for such research, and if Defense-supported research was not growing, it was probably all right. The feeling was that while one might not be able to justify it from first principles, there was no particular reason why you shouldn't go on doing it, and it probably did serve useful purposes, et cetera. I think about five percent of the RDT and E budget went for such "research," which represented about 20 percent of university-supported research of a more or



less basic character, as I remember.

I remember having several discussions on this and it was often brought up in public forums. One of the arguments in favor of Defense support was that these moneys were allocated by the military intelligently and fruitfully. They had come to depend on all kinds of committees, and pay decisions were heavily weighted by science advisors. In the field of rocketry, for example, money for materials research, for propellant research, or anything like that, was subject to committee review. Some were committees of professional societies. The scrutiny to which investigators were subjected was reasonably good. Most important, it was by their own peers. Thus, the military turned out to be a pretty good customer, and many scientists would tell you that they'd rather get their research money from the military than from, say, the AEC or from some of the other agencies supporting research. They told us that the military really meant it when they said they were supporting the investigator and not the project, that they did leave people alone, they didn't interfere in the work, and that "they're really all right and they're not corrupting the universities." People did think about it quite a bit.

MOSS: Okay. The other topics that I have here are bits and pieces of things, and it's going to seem like skipping around a good deal, so I hope you'll be patient with it, but it's drawn from what was left over from our last outline. I don't think we talked about COMSAT [Communications Satellite] at all last time. Did you have much of a role in COMSAT and in any other . . .

RUBEL: Yes, I thought we did talk about it, didn't we?

MOSS: Just so briefly that I wondered if there was more, what your role was in it and then the other communications satellites, Transit, Advent, and so on.

RUBEL: Well, I thought we had talked about that. But incidentally, in these files that I have, I've got some real good files if we can just find them. Well, yes, I had a lot to do with it.

Let's go back to the [Thomas S., Jr.] Gates administration. In the Gates administration, I wrote a couple of little white papers on communications satellites. I remember that in 1963 there was going to be a meeting of the International Telecommunications Union [ITU]. As I learned more about the subject we began to realize that this country really didn't have a policy to guide its representatives to the ITU. Many agencies were involved in the issue of allocating the radio frequency spectrum which was to be a major ITU concern. Agencies involved for the U.S. include the FCC [Federal Communication's Commission], the military departments, the Commerce Department, the State Department, and others. It was clear that if you were going to have communication satellites, you better start worrying about the frequencies that they were going to operate on because first thing you know, you might find the ITU would close off some frequencies for that.

type of emanation that would affect development of communication satellites, possibly adversely.

So I wrote a couple of white papers in the latter part of 1959 and the early part of '60, and we set up a committee, chaired by [Roswell L.] Ros Gilpatric, at my recommendation, to insure the full coordination of the Defense Department position on frequencies and their relationship to satellite-based telecommunications in preparation for the ITU conference.

Then came McNamara. One of his ninety-six questions had to do with Advent, the communications satellite then under development by the Army. General Jack Cushman, then an Army colonel, was assigned by the planning office then under Solis Horwitz, to work with me in reviewing Advent. We came to the conclusion that Advent was not a very good program, but that it ought to be continued for awhile. That was in about the middle part of 1961.

Now, at that time, there were several active communication satellite programs. There had been a couple of unimportant, ad hoc projects in earlier years, such as the short-lived satellite broadcasting a message recorded by Dwight D. Eisenhower. Among current efforts was an Air Force project called Westford or Needles that had not yet been launched, but had long been in the planning stage. Another, and the major one, was Advent, an Army satellite that was to be put into a synchronous equatorial orbit.

It was an enormous satellite. It was going to be launched by an Atlas-Centaur, a combination then under development. There were several passive satellite projects, reflectors of various kinds, either proposed or in the case of Westford, in one stage or another of development, nearly all of them Air Force projects.

At Hughes [Aircraft Co.] in Culver City there was a group of people working on company funds developing the Syncom satellite [synchronous global communications satellite system]. It was a very small satellite in the form of a cylinder about 2 feet in diameter and a foot or so in length that spun generately around its longitudinal axis. The cylinder was covered with photosensitive cells uniformly exposed to sunlight by the notation and keeping batteries charged. It was a low power satellite of simple conception that was also to be a synchronous satellite. It looked attractive to me.

NASA also had some ideas about developing satellites. The Bell Telephone Laboratories developed the Telstar and launched it sometime in 1961 in an elliptical, near-earth orbit. The Army was even then contemplating a program of medium altitude satellites that would have required an elaborate array of ground radars and control stations to make it functional. The Navy had ideas about putting up satellites of various kinds for so-called tactical purposes, none of which had been approved as of the early part of 1961.



Well Cushman and I wrote a paper on Advent. We recommended that it be continued for awhile and that the Air Force not be permitted to develop satellites of its own, that the satellite development mission be restricted to a single service for awhile, knowing that the Air Force meanwhile, at TRW and elsewhere, were starting the development of a medium altitude satellite program and that they had many studies going on that at STL on satellites of all kinds in a satellite group that they had established there. It looked like the Air Force was going to try and get in this in a big way.

One day Colonel Cushman came in around the middle of 1961, and he said, "John, I've written a paper here. I'd like you to look at it." It was called "Toward a National Policy for Satellite Based Telecommunications." Cushman, on his own, had pulled together many bits and pieces, studied how the country was organized for telecommunications policy formation and implementation--what the State Department did, what the Commerce Department did, what the FCC, NASA, the Defense Department did, what the laws were and so forth. He showed that there just wasn't any such thing as a "national policy" in this new field. It was just about impossible to imagine that the U.S. could create a satellite system, cause one to be created or even allow one to be created without some institutional changes. The paper pointed out that we had all these developments going on, that it was an explosive field, and that one of these days there was going to be a satellite that by its very nature could easily become the basis for a global system.

Cushman wanted to know what I thought of the paper, and I thought it was great. I rewrote a lot of it; and after the two of us finished it up, we sent it down to McNamara with the recommendation that he send copies all over the government to the FCC, the Department of State, the White House, and so on. And he did. The paper recommended that we do something about getting going on a national policy for satellite based telecommunications.

I went over to see [Jerome B.] Jerry Wiesner about it, took the paper, had a meeting with him. Judge [James M.] Landis was then in the White House and had some kind of responsibility for telecommunications policy. Later he was involved in some kind of an income tax scandal or something. I've forgotten what it was, but he disappeared. On this first meeting we talked about some of our ideas. It wasn't too long before a White House committee was established to articulate an administration policy with respect to communication satellites. This committee was headed by [Frederick G.] Dutton, though perhaps Landis started it and Fred Dutton took it when Landis left. Various people were designated to be representatives to this committee from different parts of the government. There was a representative there from the anti-trust branch of the Justice Department. I think his name was--what was it--[Thomas J.] Lowery, Lowie?

MOSS: Lowery.

RUBEL: Lowery, was that it?

MOSS: I think so.

RUBEL: He had a very strong anti-trust input. I believe I was the Defense

Department representative to this committee, but I didn't go to all the meetings and a fellow named Ralph Clark filled in for me quite a bit. This committee certainly must have had available to it the white paper that Cushman had originated, and that Cushman and I had finalized.

I'd say it was early '62 or late '61 when Cushman and I went back and took another look at Advent. On this second look we recommended that it be cancelled. We recommended that chiefly because it had become obvious that a lot of the promises they had made were not going to be fulfilled. The satellite was a terrible monster. There were many reasons why we didn't think it was a good idea. We recommended this to McNamara and he cancelled it. Just like that.

Now I've forgotten the exact timing, but it must have been close to Advent's cancellation that I became interested in the Syncom satellite. I had worked at Hughes, and although that had nothing to do with my interest in Syncom, I knew a lot of the people there quite well. They acquainted me with the satellite, and one day I went to Hughes and looked at it. They had a working model functioning in the conference room.

I was immensely impressed with it. I have described its cylindrical form; on second thought, this first version may have been smaller than I stated earlier. The control system was marvelously simple. This light, efficient satellite could be put into orbit, they said, with an Atlas Delta combination, as I recall. . . . I'm not even sure that didn't say a Thor Delta. Anyhow, it took much less rocket power to get it into orbit than to launch and inject Advent. It was cheap, comparatively speaking, and wonderfully versatile if it worked. I believed that it should be tried.

On the other hand, nobody wanted to do it. You couldn't get the Army interested in something that competed with Advent. The Air Force was not interested because it was their position that they didn't "believe in" synchronous satellites.

So I went over to NASA and talked, especially to Robert C., Jr. Bob Seamans. We worked out an agreement whereby NASA would fund the satellite, and we got the Army to fund the ground stations. We got the frequency allocations worked out so that they were compatible as between NASA and the Army. This was done at a very, very intimate kind of a level. I don't think there were more than a half of dozen men involved. I guess I was the only one from Defense. Bob Seamans represented NASA, and Dr. Leonard Jaffe, who worked for him, did most of the NASA work. Jaffe did a real good job of making many things happen inside of NASA.

I've forgotten who we had on the Army side, but I remember going over to NASA one time for a meeting of Army and NASA representatives who were trying to agree on frequencies. It was just lucky we were working in a small group where we could say: "Now I want you guys to get together on this, and if you don't I want you to tell me you haven't and I want to know why you haven't and I don't want you to go away till you have."

We had a lot of personal leadership in this thing.

We put the Syncom program together for a comparatively small amount of money. And it was a cooperative program. If it worked, you'd have a satellite technology developed both by NASA and by the military, which seemed unusual and unusually good!

They launched Syncom I, but something fizzled on the control mechanism, and it didn't go into orbit properly. In July of 1963 they launched Syncom II. As far as I'm aware, Syncom II is still operating today seven years later somewhere over the Pacific, and has actually been used for a long time in direct communications between Vietnam and the United States. I've forgotten all the details of how come the military has Syncom II and NASA had something to do with funding the early Syncoms. I don't remember how that worked out.

It's interesting that while all this was happening, they were also holding hearings. The White House committee had created a set of twelve alternative ways to proceed toward a satellite system. The first was to give AT&T American Telephone and Telegraph the job. The last was to create a new government agency for communication satellites. Between these extremes were ten different proposals combining private and public power and institutions in varying degrees. The Comsat Corporation idea was about in the middle of that spectrum, a profit-making company chartered by the government, starting from scratch with the ad hoc purpose of being the "comsat" agency for the United States.

Eventually the administration submitted a bill creating comsat. Other bills were also put up on the Senate and, I think, on the House side. Ultimately, the administration bill passed.

There was a filibuster against the bill by Senator Wayne Morse on allegedly anti-trust grounds that I always felt was ridiculous. As I recall, the common carriers, representing about half the Board, were allowed to own about half the stock. Senator Morse claimed that AT&T would really control the Comsat Corporation, though in fact Comsat was a pretty good vehicle for attracting public investment and there was no trouble raising the money.

Some very good people were brought in. Joseph V. Charyk became the president. Several experts came in from Rand and other centers of knowledge on the subject. They quickly created a pretty good staff to run the Comsat Corporation. I have felt that the fact that as far back as the Gates administration, I had written white papers in an effort to get hold of the basic policy issues, had caused the Defense Department committee to be set up and had created some awareness, through testimony, of the need to move toward a single system and the policies to support it helped set the stage for the later actions the Kennedy administration. Cushman deserves the lion's share of credit for having written a very definitive and influential paper. Our partnership was productive, McNamara's quick grasp and support were essential factors, and many others made important contributions.

MOSS: Where did Vice President [Lyndon B.] Johnson's Space Council come in on this?

RUBEL: I don't recall it came in on it at all. I'm not aware that any important decision was ever made because of or in spite of what the Space Council did.

MOSS: How much contact did you have with that?

RUBEL: Very little. We had a few meetings that I went to, talked about a few things, used to know [Edward C.] Welsh. That's about all. They really were not an active agency.

I did get the Syncom started. Syncom, in a larger, more powerful and more complex form is the satellite being used by the Comsat Corporation. I cut all kinds of bureaucratic red tape and all kinds of corners to get Syncom launched, and if it hadn't been for me it wouldn't have gotten started when it did, and perhaps not for many years. Had we not cancelled Advent and started Syncom instead, we'd have had all kinds of horribly expensive programs, and who knows what the outcome would've been, but I can assure you that it would have been very bad compared to what it really was. We saved a lot of money and we got off on the right track.

My colleague and very dear friend, Fubini, who took my job when I left the Defense Department, never believed in the synchronous satellite. This normally very brilliant and objective guy became very prejudiced. I thought so then and still do. He and a fellow named [Arland] George Sponsler, who was at that time in one of the Navy laboratories, wrote a paper which was published under Sponsler's name (Fubini withheld his own to conceal his official position) which showed that given the reliability that could be attributed to launching devices and to electronics, based on the then available statistical data, the synchronous satellite was a far less economical investment than would be a medium altitude satellite.

That paper came out in about the summer of 1963, just about the time that Syncom first went up. When I left the Defense Department, Fubini took my job and began to change the policies bearing on Defense communication satellite. By that time the Joint Chiefs of Staff, through the Defense Communications Agency, had written a specification for a medium altitude satellite system to be used for military purposes. Fubini, aided and abetted that with enthusiasm and vigor. Philco, STL, I think G.E. all bid on various versions of a medium altitude satellite. There were many configurations. Some called for many satellites in medium orbit, each tumbling as it rotated around the earth. Others called for stabilized satellites. In all cases of satellites in these medium altitude orbits was very high to insure adequate coverage. Since a satellite rose and set in about 6 hours at the stipulated altitudes (about 2000 miles), you were constantly tracking satellites, predicting their future path (ephemerides) and switching the receiving and transmitting antennas from a satellite about to set to one recently risen above the horizon. I always felt this was a



very complicated system and not a very good one. Nevertheless, Fubini allocated funding to this after I left. A lot of money was spent, and eventually, as the years went on and the program didn't come along, as Syncom kept working and more Syncoms went up, as the Comsat Corps Early Bird Satellite went up in, I guess, 1965, in a synchronous orbit, the bloom faded from the rose for all of these competitive systems that the Sponsler paper had predicted were going to be so much more reliable and economical.

Sometime around 1965 or 1966 an experimental Titan III rocket became available to launch something. They arranged to put some communication satellites on it for the Air Force. By this time the orbits had been changed and I remember reading in the paper that these were going to be put into a near equatorial orbit, something like nineteen thousand miles above the surface of the earth. I must say that for the life of me, I could never figure out why anybody would want to put satellites into a near equatorial orbit where they would move around the earth very slowly, requiring precisely those elaborate ground tracking mechanisms of ephemerides calculations, extra satellites to populate the annulus around the earth for uninterrupted communication et cetera, when one satellite in a synchronous orbit would eliminate all that complexity. I felt this was one of Fubini's poorer decisions, and though I never talked to Gene about it, I still feel that way.

I have observed that all the competing projects have died away. The synchronous satellite seems to be here to stay. It's the logical thing, and what we have seen in the synchronous satellite since 1963 is what we gambled on: one, that a very simple satellite would have much greater reliability, and second, that an almost entirely solid state device would exhibit life in space considerably different from earlier satellites which still had, even in those days, some vacuum tubes in them.

There was only one vacuum tube in this satellite, the power output stage. It was a Watkins-Johnson travelling wave tube, and the only thing that is likely to fail, and eventually will fail in such a device is the filament. Eventually it'll burn out if it hasn't already, though I don't think it has. I think that Syncom II has run out of gas, it's moving in a figure eight orbit, and eventually radiation pressure will drive it out of the proper orbit and it will disappear. It has had an unbelievably long life. Nobody, not its most ardent supporters, thought it would live as long as it has. All of the follow-on satellites have proved to have much more reliability than pre-1963 experience would have suggested.

I think I backed all the right horses in communications satellites at the right time in the right way. We cancelled the right programs, we started the right program. I don't think we were as smart as it looks like we were, but I think we were on the right track. By that I mean that we didn't really foresee how successful it was really going to be, but we were on the right track, and I think that in writing some of the papers



and in getting some of the conversations going and in talking about policy and in trying to get the Defense Department to take the lead, I probably did my little bit toward moving us much more rapidly toward a national policy in this area.

MOSS: On another satellite, on the Midas and Samos business, it's my understanding that there was a fight between CIA and the Air Force on the kind of thing that was going to be concentrated on, whether it was going to be a search type of operation, or whether it was going to be a high resolution, narrow focus kind of thing.

RUBEL: I don't know much about that. Fubini does. He can tell you all that intelligence stuff much better than I can.

I always thought that Midas really had no intelligence mission at all, that it was really nothing but an early warning satellite. Unless they had something on Midas that I never knew about, that's all there was to it. Samos was the intelligence satellite. But for its advertised purpose of early warning, Midas was ridiculous, and I always thought so.

When I first started in the Defense Department, Si Ramo came to see me. Ramo is a very glib, persuasive, almost charismatic individual whom I had known for a long time. So he said, "John, you could become famous the way Trevor Gardner became famous. What you need to become famous is a program." Now Trevor Gardner had the ballistic missile. Of course, I don't know if he pointed out, or if I did, that Trevor Gardner had to resign to become famous.

Anyway he said, "What you need is a program." He said, "The program for you is SAINT [Satellite Inspector and Satellite Interceptor]." And that was you know, the satellite identification interception, or whatever it was. As a matter of fact, maybe it wasn't SAINT. Perhaps it had another code name. It was a system where you put up jillions of satellites that would intercept Russian missiles on command. These satellites were all in orbit, zinging around continually. When the Russians put up a missile, you gave instructions to the nearest ones to go out and intercept it. That was what it was all about.

We had him over for dinner, he sat on the couch, had a couple of drinks, gave me this big pitch, and I sat there thinking to myself, you know, "he must think I'm out of my mind." But at that time in the late fifties and early sixties there was a steady stream of proposals emanating from the Air Force that had to do with things like that. I developed a kind of paranoid's view of what they were really trying to do, and I think I might have covered this in the last interview . . .

MOSS: A little bit.

RUBEL: It always seemed to me pretty absurd that you'd spend all this money

to put Midas into orbit and then support it with costly launches to place satellites that stopped working, all at the cost of billions to start and hundreds of millions to operate, and the best that it could do for you was give you fifteen minutes more warning about an impending missile attack which you wouldn't be able to do anything about anyway. That seemed just crazy to me, and I long felt that Midas should be cancelled.

Now Samos was something else again. Here they had fancy ideas about collecting realtime intelligence. TRW had a big project going in Denver, where they were going to have all kinds of displays and files and access to data banks. Samos' pictures were going to be continuously displayed on video scopes. I suppose someone imagined that operators would sit at their scopes and look at the license numbers on the ZIS limousines driving up to the Kremlin and figure out whether this was Khrushchev or something. That was crazy too.

Discoverer, not Samos, became the successful "spy in the sky" satellite, sending a capsule of exposed film, not a TV picture, back for analysis. It finally became a black program and sank from view. My impression is that the Air Force wasted a billion dollars in launching Samos satellites and never got a single thing back. I looked into Samos launchings once, but it was a black program by then and I never got the data wholly straight. Still, I counted the value of failed launchings and the cost that went in before the launches and found something like a billion dollars almost all wasted. Just unbelievably bad.

Then Discoverer became the vehicle for the photographic and Ferret satellites. Now just what the CIA, Air Force intelligence community hassles over all those projects were, I really don't know. Most of them are probably technological, but I think most of them have probably long since been resolved because you've got a great resolution in these things now, a great capacity, and all kinds of special films so it really doesn't matter, you get all the information you want. Their biggest problem soon became what to do with all this "take," how to get enough photo-interpreters to use it and so on. Fubini knows a lot more about that than I do.

MOSS: Okay. Another subject, and that's the whole question of nuclear power for propulsion both in rockets and in ships. We talked a little bit about the ANP Aircraft, Nuclear Propulsion aircraft thing last time. What about the business of using nuclear propulsion for rockets.

RUBEL: Well, there was one. I think it was called Orion, wasn't it?

MOSS: Let's see, I've got Rover and Nerva and Orion. I don't know what else.

RUBEL: Oh, there were all kinds of nutty things around, there always will be, I guess, but I've forgotten. Orion, as I remember it, was a

proposal to launch a rocket by a series of fairly small nuclear blasts. You had a great big rocket and you had a lot of little bombs in it, and then they went pocketa-pocketa, and this thing went whizzing off through space or something like that. I never knew much about it. I always had a sort of revulsion of spirit when things like that came up. I never got very interested in them. I always felt they were just too insane. They were so insane that even in America that wouldn't happen, you know.

MOSS: What about the idea of an ion engine?

RUBEL: Well, that's something entirely different. Then the Rover, that was a rocket that worked on direct heating of a working fluid which I think was hydrogen. It consisted of a ceramic in which was imbedded the nuclear material. They had control rods that they were able to pull out, whereupon the ceramic got very hot, and that in turn heated up the working fluid, which exhausted through a nozzle, and you were off and away into the wild blue yonder.

MOSS: That's really nuclear combustion, isn't it a trigger for combustion, isn't it?

RUBEL: Not really because the hydrogen was just a working fluid. It didn't burn. It just was a gas that they heated up and used as a jet. You could have used air, but hydrogen is more efficient. It's a very light gas compared with air and you get a greater momentum transfer than with a heavy gas. They developed Rover sufficiently to test it at Jackass Flats, where I think it finally blew up. It became pretty apparent that this was a very costly project and you really had to be a lot more committed to an extensive space program than we were to continue it. I guess it eventually died.

Now the ion engine is quite different. Assume for a moment that you're going to go on a very long space mission, not to the moon, but maybe to Mars. Well, you don't have to accelerate very much in order to develop enormous changes in speed and direction by accelerating for a comparatively long time. So if you just apply a very small force to a spacecraft and keep that small force acting for hours or even days, you get the effects that you need. You don't need big forces if you have time. Ion engines were developed with that idea in mind. They are a very efficient way of exerting low level forces that are highly controllable for long periods of time. The preferable ion in that case then is a heavy ion. The effects stem from shooting any kind of a molecule out, whether it's a water molecule or a gas ion, or whatever it is. If you shoot it away, there's an equal and opposite reaction. If you shoot enough of them away you'll create a motion, and ion engines were developed with the idea that they would be useful for interstellar, intra-solar system maneuvering and trajectory correction, and things like that. And a lot of them were developed.

There's nothing so mysterious about them, but they were refined to a

high degree of perfection well beyond any near-term needs. I guess they probably are used now. I'm not sure how they do course corrections on spacecraft like the Mars probe--if they use ion engines, or if they use little bottles of gas. There's something horribly simple about a little CO<sub>2</sub> container with a little valve on it. Poof-poof, and you have a course correction.

MOSS: I think they were using peroxide in the Apollo, weren't they?

RUBEL: Something. Well, on that they'd have to. I mean they wouldn't be able to get fast enough reaction from an ion engine. But for a small satellite that only weighs a few hundred pounds where you're going to be gone for many, many months and you can afford to spend a couple of days in course correction, that's all right. Just a very tiny fraction of a g-force can lead to changes in velocities of tens of thousands of miles per hour if you keep that force active for a long enough time to. Acceleration multiplied by time is velocity.

MOSS: Okay. How about nuclear propulsion on ships? My understanding is that everybody bought the submarine program, that it was a great thing, but there was a lot of question as to whether this was applicable to surface ships.

RUBEL: Well, you know, that's another thing that's been well hashed and rehashed.

MOSS: Yes, I think it has.

RUBEL: The great applicability of this to the submarine stems from the fact that the submarine cannot burn fuel that takes oxygen when it's under water. A surface ship is not limited by this constraint. Conventional submarines run on batteries charged on the surface by motor-driven generators that cannot be operated when the boat is submerged. The batteries store energy for a comparatively short time, so the submarine must come up often and stay up long enough to replenish the batteries before it can again operate submerged. The batteries don't recharge right away, so during the time they are recharging you're really out of commission for a submarine mission.

All of this is a great operational limitation, especially in a day and age when you're going to carry thermonuclear missiles on the submarine and you want to use the ocean for concealment. If you're forced to surface to replenish your oxygen or to recharge your batteries, you greatly diminish the potential performance of the system.

So I don't think anybody argues with the fact that an atomic powered submarine that can stay under the surface of the sea for months at a time and still have enough oxygen for its crew to breathe--it can even make oxygen for that purpose--gives you a very important new dimension of military capability.



But, now, if you talk about a surface ship like a carrier for example, both the ship's mission and its operational constraints are quite different and the economics and utility of nuclear propulsion are correspondingly altered. To begin with, the nuclear plant costs a lot more to install, and it costs more to operate. The life cycle cost, which includes the cost of acquisition and ownership, is much greater for a nuclear plant than it is for a conventional system. Secondly, the advantage that it gives you, making it unnecessary to stop in ports to get fuel or to have tenders come out to refuel the ship isn't really all that much of an advantage because a surface ship requires considerable and frequent servicing by either tenders or port facilities to service the life-support needs of the crew. Submarine crews are much smaller--a few tens of men, not hundreds or even thousands--and submarine service attracts and is open only to elite crews accustomed to relatively less shore leave and other logistic support efforts required for surface ships.

Moreover, the surface ship must travel in consort with other ships. If they require refueling the relative gain of not refueling the nuclear powered ship is greatly lessened. If you just look at the economies, apart from operational factors, a carrier alone is a sitting duck. It has to have destroyers. It must operate in a task force. It carries a couple of thousand sailors. So the support requirements go well beyond the ship itself and include task-force ship support requirements as well. The submarine is a loner, by contrast, and its smaller and a more elite crew is serviced by tenders as well as port calls with fewer limitations than those applying to surface ships.

So nuclear propulsion for surface ships really doesn't make too much sense, but the advocates of atomic energy, not the least of whom are the Joint Committee, have been pushing hard. There has been a strong movement to make all carriers nuclear powered and even a lot of the other ships. One begins to hear talk of a nuclear navy as if that were a good battle cry. I don't think it is, and I don't think anybody who looks at the facts in detail would support that notion.

MOSS: How about on the development of small reactors for the propulsion plant. Who's in the lead on this? Is it Westinghouse or who?

RUBEL: Well, I don't know much about that field, but it's my impression that Westinghouse is the only one. The Navy, especially Hyman G. Rickover who is the Navy in this field, has controlled the development of nuclear propulsion systems. He's made Westinghouse essentially his chosen instrument for this purpose, and there just ain't no other.

MOSS: Okay, let me move to the Nike program. We didn't talk about this at all last time, and I think that's worth some talking particularly in the light of the new interest in ABM [Antiballistic Missile System]. What were the considerations in dropping one and moving to another phase of this, Hercules, Zeus, Nike-X, and so on?



RUBEL: Well, if you go back far enough, the early missiles that were part of the Nike system, like Nike-Hercules and Nike-Ajax were essentially anti-aircraft systems. In the early days of air defense, when the missile was not the potential threat, a surface missile designed to operate against an attacking airplane was a practical weapon. Systems like Hawk and the Russian SAM systems have proven to be quite effective as a defensive weapon against airplane attacks. None are perfect weapons, of course, but in the war against airplanes armed with conventional (not nuclear) bombs, attrition is a powerful tool. The Israelis are not afraid that every airplane is going to get hit by a SAM missile, but they can't afford to lose very many airplanes. To lose 5 percent of your airplanes on any one mission doesn't sound like much, but it means that in twenty days you've lost 100 percent of the airplanes that went out on initial mission if the same number go out everyday. You can't afford that. So in a war of attrition against airplanes the surface-to-air missile can be a very powerful weapon.

But in the thermonuclear age such "defenses" are greatly degraded to the point of virtual uselessness. If an enemy is going to attack with airplanes carrying nuclear weapons, what good is it to shoot down 5 percent of them? If 95 percent come through, 5 percent wouldn't seem to be very important. In fact, if 95 percent were shot down and only 5 percent dropped megaton hydrogen bombs the catastrophe would be unimaginable if 5 percent were a fleet of any size. They only have to come once if they have thermonuclear weapons. So that I think the role of anti-aircraft in a thermonuclear kind of situation is suspect from the very start.

Now you come to the missile age where you're going to be attacked not by airplanes, but missiles carrying thermonuclear weapons where a single hit is quite sufficient. I happen to be one of the people who believes that it doesn't take many hits by thermonuclear weapons to end any need for military calculations. If you can imagine an American civilization after one bomb each has landed in greater New York, Washington, Los Angeles, San Francisco, Chicago, Philadelphia, Pittsburgh and Detroit, I say you are dreaming. We'd still have a country, but it would never be the same country again. If you look at statistics about such everyday matters as the forty-five percent (45% or so) of the bank clearances clear through New York City, 80% of all physicians live in a few metropolitan areas, as do most of the lawyers, of the intelligentsia, of the scientists and so forth, a few urban targets affecting a small percentage of our land area can be fatal. Lots of people live in Appalachia and would continue to after a thermonuclear attack, but those fine people would comprise a vastly different country than the one we know today. Air defense technology erects a picket fence in order to keep something out where a very small penetration between the pickets spells catastrophe and even a medium penetration means essentially total destruction of civilization. This kind of a futile gesture just doesn't make much sense to me from an economic point of view. Why do it? That's argument number one.

Now nobody has ever questioned that you can make an anti-missile missile that will hit an incoming missile at least some of the time. Technically

it is feasible to design a missile to hit another one. We come to the second point which is another aspect of economic kind of consideration and that is that if you have X defensive missiles, and the enemy has Y offensive missiles, and he attributes 100 percent success to your X, then the number of his missiles he thinks he will get through is Y minus X. If that isn't enough, then he has to add some increment to that. Any increment that he adds is net because you've discharged all of your defenses. The quiver of arrows is empty. If it turns out that an offensive missile costs less money than a defensive missile, then every time you deploy a defensive missile, it's easy for him to deploy an offensive missile for less money, so you're in a race you never can win. Multiple warheads carried on a single missile worsen this ratio in favor of the offense quite rapidly. It's absolutely impossible, the attacker can always saturate your air defenses for less than you can build those air defenses. To deploy such a system seems to me a very foolish thing to do from a military--or from any kind of an economic point of view. Do you want to change that thing?

MOSS: Yeah, let me change this.

BEGIN SIDE I TAPE II

MOSS: Okay, did you want to add more?

RUBEL: I felt that there was something almost pathological about the semantics that had to be used, or that were commonly used in talking about the Nike-Zeus and the ABM. It is always spoken of as a "defensive" system. I well remember having a meeting in the Pentagon during the Gates administration when Douglas Dillon was the under secretary of state. There was intelligence information, at that time, indicating that the Russians might be planning to deploy some kind of anti-ballistic missile system. The State Department people were quite concerned about what the impact on world opinion would be and what the impact on our people would be were this to develop and be disclosed. Also, this was during the period when we were going to make a test, where we launched a ballistic missile from California, from Point Arguello to Johnston Island and intercept it with a Nike at Johnston Island. There was a question of press coverage to be given to this and worries about what if it didn't work. I don't recall if they talked about foreign observers there or not, but there was a lot of discussion of that possibility in connection with the test. I remember sitting there thinking to myself how sad it was that the idea that this missile, under these highly artificial circumstances, might and probably would knock down, or at least be said to have knocked down (no matter what happened they'd probably say it. They'd say it came close enough so that a nuclear blast would have knocked out the attacking missile) the hypothetical attacker and would be construed by the press, and probably by the readers of the press, to mean that sure enough, there was a defense against missiles after all. My belief was--and I think the intelligent man on the street knows--that if there's not 100 percent defense, there's no defense, and therefore, there's no defense.

The word "defense" has become such an Orwellian kind of a thing that its meaning is no longer sharp at all. We don't speak of the War Department, we speak of the Defense Department. Now we speak of "missile defense," and the next thing you know, if your town is protected, we want our town protected when really there's no defense and there's no protection and the whole thing becomes a set of unarguable premises that are invested with meaning only because the words themselves convey a sense that they oughtn't. Our vocabulary, unfortunately, isn't rich enough to equip us with the right phraseology. The right phraseology would not speak of a "missile defense" system or an "air defense" system. It would speak of a system that was deployed in the hope that it might scare the enemy into thinking that we had a sufficient capability to knock down at least enough of his missiles so that it would deter him somewhat from launching an attack against us under certain circumstances. There's just no word for that and it's very hard to get it across. So I was against the AICBM on ideological grounds, not just economical grounds.

MOSS: Who was really pushing it?

RUBEL: Oh, the Army was certainly pushing it. In the Gates administration, Wilber Brucker pushed it with great energy and vehemence. The professional knee-jerk, anti-Communist, far-right type of military person, like General [Arthur G.] Trudeau in the Army, was strong for it. The kind of people who on radio talk shows say, "Well, you know, all these scientists have their arguments, but what I say is we can't let the Russians get ahead of us," those kinds of people were and probably still are for it. The people who say, "They want to leave us naked, those liberals want to leave us naked to an attack by the missiles, but I say if our Army tells us that they have an ABM that works, then I say we better deploy it," such people are for it.

MOSS: How much does this carry in Congress?

RUBEL: A lot. If you've read The Money Game [Adam Smith], a cynic says, "If two hundred and some odd out of three hundred and some odd congressional districts have a subcontractor of some importance on the ABM program, you can predict there'll be an ABM program." I wouldn't discount that completely.

But you asked me originally why were there so many changes. In other words, Nike-Zeus and then there was, I guess it became just plain Nike, and there was Nike-X.

MOSS: Ajax and Hercules.

RUBEL: Those were the old ones. I'm talking about the new ones. Then you got Sentinel, and now. . . .

MOSS: Sprite. Sprint, excuse me.

RUBEL: Yeah, Sprint's a version of it for a different purpose, for hard point defense. Well, there are two principal reasons: One is that people's perception of what the threat would be kept changing. We kept elaborating decoy devices and multiple warhead devices and then, finally, multiple independently targetable re-entry vehicle devices (MIRV). We then figured they can do it if we can do it. So that puts an enormous additional strain on the supposed system. The original Nike-Zeus missile didn't have enough acceleration to get to the intercept point at a sufficiently high altitude after atmospheric separation had begun to distinguish decoys from warheads, so you needed more acceleration. Sophisticated decoy techniques called in turn for further refinements in the radars and in data processing. Higher speeds meant shorten response times and more automatic decisions about whether or not you ought to launch, and if so, exactly when and so forth.

Changes in geographical deployment stem from changes in the perception of what the system is for. Despite all kinds of arguments about that, there's darn little difference between Safeguard and Sentinel deployment. And all the talk about how it was for the Chinese, not the Russians, which even McNamara allowed himself to give, is really pretty absurd. The difference between Sentinel and Safeguard really isn't a substantive difference of any real consequence.

MOSS: How much does the addition of the phased array radar make? Does this make any real difference in the calculation?

RUBEL: I don't know enough about it. My feeling is that none of these technical advances mean very much by themselves. To begin with, I don't care how you figure it, the radar has to be a soft installation, very easily destroyed by a hit that doesn't have to come too close. There are not very many of them, so there don't have to be very many thermonuclear blasts to knock out all or most of them early in the assault.

Secondly, there's a long list of technical impediments even if you stipulate a perfect system. If you assume perfect radars, perfect signal discrimination, perfect functioning of the rockets, perfect functioning of the guidance systems and perfect functioning of the warheads in the rockets, you still have the severe requirement that the system, to be effective, has to be constantly ready to be triggered almost instantaneously. You'll have a maximum of a very few minutes of tracking data and no warning ahead of time that you're about to track something, which means that these systems must be prepared every minute of the day and night, seven days a week, fifty-two weeks a year, year in and year out to respond to an attack that might occur anytime, but would occur only once in a generation or more. The system has to be continually on the qui vive, with all systems "go" all the time. It's not like launching an Apollo, where you know that three days from now you're going to launch it, and everything has to be ready to go from then. It's not like launching a ballistic missile where you say, "We are going to launch thirty minutes from now." And somebody says, "We can't launch thirty



minutes from now." You say, "Okay. Then launch that one forty-five minutes from now." You're not picking that time when you are the defender, you must be ready instantaneously. Not only that, a few seconds is all the difference in the world. The attack arrives at fantastic velocities. If you're off by a few seconds, you can miss your only chance to fire.

With the requirement that the system be ready to go all the time you have the urgent requirement to be certain it will never be launched accidentally or without proper authorization. That's a very difficult technical problem, and very difficult human problem to solve. A very secure, error-free system will be less free to react quickly. Furthermore, everybody knows from experience with machines, whether war machines or domestic machines, that if a machine isn't exercised, it is more likely to fail when needed than a machine in constant service. Since no AICB can ever be fully operated in situ, you will never know for sure that the entire system is free from defects detectable only through operational tests.

But even if the system were perfect, you still have the problem I've cited: a hair trigger is needed, but it is incompatible with the need to guard against launching on a false alarm or inadvertently, or without proper authorization.

A further and related consideration is, what trigger do you pull when the time comes? You're the president of the United States. Let us say that you still have the legal responsibility to decide what you're going to do when the red phone rings, and somebody at the other end of the line tells you that it looks like we've under a missile attack. And why would it look that way? Well, the BMEWS [Ballistic Missile Early Warning System] system has picked up some signals, and there's some other indication that maybe it is an attack, and now while the guy's still talking on the telephone, lo and behold, some of the area radars maybe have picked up some signals. Now you have to decide--you're the president--what you are going to do, and you have to decide it right now. If you say, "Well, wait awhile" that thirty seconds, a minute, two minutes, is itself a decision to pass up the opportunity to use that forty billion dollar system forever. So you either have to decide that if someone tells you "attack" you're automatically going to say yes, or you're not automatically going to say yes because you can't think fast enough.

There's a great tendency to say that since no human being can make that decision rapidly enough, we will have a computer. It will see the signals. It will know what direction the trajectory comes from. It will determine where the missiles would land if they were really missiles, and if indeed they are, why should we ask the president that question? Why shouldn't the computer automatically fire the system? The pressure for that will become very great when the fallibility, and in fact, the true unworkability of our normal decision-making and political apparatus under such hypothetical circumstances becomes manifest.

Assume you have the system and assume all the things I've assumed about



it, none of which are true. It will work perfectly. It will not have 100 percent reliability. It cannot be kept ready all the time without a very high danger of responding to false alarms or to unauthorized or inadvertent launch. It cannot be a 100 percent effective system if it's never ever been tested in situ. But even assuming that, how can you have a president who might be playing golf near San Clemente pick up his little walkie-talkie and talk to someone on the phone and decide yes, we should fire the Nike-Zeuses. Here it's a nice sunny day, but up in the northern part of the United States the rockets will fly. So if you can't decide that that way, won't people say, "You know, Mr. President, we really ought to design this so that it tells and it goes."

I say anything that moves us closer to a situation where we begin to fire off warheads of that lethality with the international implications that it has is bad. If the bombs actually go off up in space, there's going to be fall-out, a lot of it on the United States, a lot on Canada. If you get to the point where this can all be done automatically by machines, almost all of it by machines, and it almost all is now, you've almost constructed a version of the "doomsday machine" that Herman Kahn talks about where the system, including both sides, automatically detonates itself. I think that's a dreadful prospect.

MOSS: You also have to program in your expectations of what the incoming signals are going to be too, don't you? I mean this is a variable that you can't count on either.

RUBEL: That's right. There are many such factors. Well, I think factors such as these make any kind of an ABM a bad thing to have. There are further and other ramifications. It clearly fuels the arms race. At the political level, it has another obvious consequence, and that is that when we saw that the Russians were ringing Moscow with ABMs we were stimulated to increase our deployments of ballistic missiles and to equip missiles with multiple warheads, so now Russians would need more AICM missiles to hit all these warheads. Next we went beyond the MRV Multiple Reentry Vehicles to the MIRV Multiple, Independently Targetable Reentry Vehicle and we made warheads with indigenous guidance systems that enabled them to go to quite different targets with some propulsion boost that was given them at the apex, or near the apex of their trajectory.

Next in this vicious circle, we asked ourselves, "Suppose the Russians had that." Once upon a time when we deployed land-based missiles in quantity we could compute that if the Russians had, say, a thousand missiles and if the Russians were able to launch a thousand missiles all at almost exactly the same time, and if all thousand missiles worked perfectly, they still did not have anywhere near a 100 percent chance of destroying one thousand Minuteman missiles because the attacking missiles are not perfect nor perfectly accurate. Thus, for them to counter a thousand land-based missiles dispersed and hardened, requires them to have a great many more missiles than a thousand to make up for errors in the pointing of the missiles and their unreliability.

But suppose they had MIRVs (Multiple Independently Targetted Reentry Vehicles). Suppose that everyone of their missiles has six, just to use a number, and, suppose we attribute some fairly low level of reliability like fifty percent to the system. We assume that for every missile that they have in the ground, three reentry vehicles rather than six will actually go to its target. If we assume further that their guidance accuracy has picked up and that instead of coming within a mile of the target, they might come within a quarter of a mile of the target, then an attacking force of one thousand missiles, each with six MIRVs on a missile could put three thousand warheads against a U.S. force of one thousand Minutemen and now they might very well destroy a very large percentage of the force, maybe most of it. Now it turns out that in responding to the Soviet ABM deployment by Moscow we no longer can presume an attacking missile against our missile once the MIRV exists or to be believed to exist. The many versions of AICM systems have sprung up in response to the technological arms race sparked initially by our discovery of the Soviet deployment! Among these versions is Sprint.

Sprint waits until you find out it really is a warhead destined for you before you shoot. Then you shoot with an extremely high acceleration rocket that goes off fairly close to the ground and leaves a lot of fallout but protects your missile.

Just think of how all this has fueled the arms race. The Russians put up anti-missile missiles to "protect" something. We develop MRVs. Perhaps the Soviets then put even more ABM missiles around. Then we developed MIRVs, and to be "safe" we assume the Russians have them, or will have them, too. Now we deploy ABMs. What will their next move be? When we deploy ABM? If they begin to think that our ABM might be able to save enough of our rockets so that even if they knocked out most of ours that we would still be able to retaliate with a few, then they would worry about our ABM. And so they would increase their offensive missile forces, its lethality in some way.

MOSS: Does a full orbiting system get into this at all?

RUBEL: No, I think that's a very crumbly idea, and I don't think anybody'll ever worry about it seriously. It seems to me that this technological approach to military security has failed and that the failure of it is far more profound than is generally realized or admitted. The public must be made to realize it. The ABM is only another useless and probably dangerous step in the direction of further fueling the arms race and exacerbating the insecurity that the arms race has already foisted upon mankind. That fact must be brought home to people. The level of the dialogue must be raised to the point where people can understand it. It almost happened, thanks to several scientists like York, [George B.] Kistiakowsky, Wiesner, [George W.] Rathjens, and a handful of others whose articles and testimony have so lucidly highlighted the issues. York has recently written an excellent book on the broad subject of the arms race. All of them worked hard in opposition to the ABM, and for awhile it looked like ABM might go down in defeat. It didn't. In this age of communications saturation and complex issues, the oversimplifications defy real understanding. It looks

like the ABM issue is taking a back seat again. We're going to have it, or part of it, and it's not going to be vigorously opposed. Here we are off to another lap of this arms race, this one more harmful and destructive than many early laps.

Everything that I have said has been perceived by people for a long time. Way back in the Nike-Zeus days, long before many of the developments we're talking about were even conceived students of the field understood all the things that I am telling you now. I've understood them myself for nine years or so, even though I didn't understand in the beginning and even though I have never been at the real center of these matters. There was even a time when I thought that if I were McNamara, I'd give in to the pressure and make a modest deployment of the ABM. Later I realized that that was wrong. When you're sitting in those seats of power, the pressures are fantastic. Eventually, near the end, even McNamara caved in with a "limited" anti-Chinese ABM.

MOSS: Again it's the boy with his finger in the dike, isn't it? Just out-numbered?

RUBEL: I think so. There is only a handful of people really fighting it, a handful composed almost entirely of former scientific and technological government officials. And on the opposite side you have all the people that are always for more weapons. I'm sure Edward Teller has testified in favor of the ABM. The active military will be in favor of the ABM, but not all the retired military. General [James M.] Gavin, a very sensible man, will be against it. If you brought General Trudeau to the stand he'd be in favor of it. If you could get industrialists to be candid, many who understand it would be very much opposed to it. McNamara would be opposed to it even though he came out at the end of his defense career for it. [Charles B.] Tex Thornton, our own chairman of the board, would be very much opposed to it, but such men won't speak out. They are afraid to take any public stand on controversial issues, especially those which might offend customers. Many people don't stand up and are not counted because they feel that they are in an exposed position. I'm sensitive to that myself. I regret it, but it's time. That's been the history of this thing, and others like it, for a long time.

MOSS: Okay, you said you wanted to talk about Minuteman and safety.

RUBEL: I think, you've got a lot of other subjects there, but I don't feel that I have any particular claim to expertise on them compared to other people who know a lot more. Let's talk about Minuteman and one aspect of Minuteman which is safety and provisions to protect against inadvertent or unauthorized launch of a missile system. This is a story that is quite relevant to the attempts that were made in the Kennedy administration to bring the arms race under some measure of control. The president and McNamara understood the necessity for that and they had a pretty good appraisal of the political factors with which they had to come to grips in order to make that happen.

There were factors fueling the arms race other than mere political pressures for more bombers or the demands of right wing congressmen to start weapon systems, though we had a lot of that. The claim was made over and over again in the Eisenhower administration that many new weapon systems had been started, but that the Kennedy administration was no longer starting a sufficient number. Against all such pressures you had to stop the deployment of Polaris, of Minuteman, the B-70 program, the production of B-52 bombers, you had to retire the B-47s from the bomber force, do something about the B-58, in each instance at some point in the production or development cycle. Every program must be stopped sometime.

There was still another problem which this anecdote illustrates--what to do about a dangerous condition designed into a system and virtually concealed, partly to implement a particular strategic perception by a military department. Minuteman safety is a vignette illustrating such an issue.

In the middle part of 1959, when I had been in the Defense Department for only a few months, I was made an ex-officio member of the panel on strategic weapons of the President's Science Advisory Committee. The panel was headed at that time by Franklin Law, then at Cornell University. Harold Brown was on the panel. I think [James C.] Jim Fletcher was on the panel, too, along with about eight or ten scientists from various universities and laboratories.

I was then the assistant director of Defense Research and Engineering for strategic weapons. I had gone to STL a couple of times to learn about Minuteman and some of the other strategic weapons for which STL had SETD (Systems Engineering and Technical Direction) responsibility. The project manager was Bob Bennett whom I had known at Hughes Aircraft Company for a long time. I learned a lot about the system from Bennett, but there were a few things that I was curious about that I felt were not being explained adequately or disclosed fully. One of these was the launch philosophy and related technical provisions.

By June, 1959, when the committee visited STL for a periodic updating on what was going on on Minuteman and other major systems, I had developed a feeling that Bob Bennett was holding out on me, that he was deliberately vague about specific questions I was probing. I wanted to know how the Minuteman system was to be launched. How does it really work? How do the commands come in, how do you respond to those commands, and just how does the system function just prior to and during launch. I had some intimations of how it worked, but I lacked details that I thought were important.

The committee met in a conference room at STL and Bennett got up and began giving a briefing. He went through all kinds of system details, such as how it's comprised of three rocket stages and what the rockets are made out of, what kind of guidance system it contains, control signal characteristics, how the gyroscopes will work, and how they're floated on air bearings, in short, a comprehensive highlighting of technical characteristics. The recitation of such details took hours. It's interesting to observe



at this point that the Minuteman system was always advertised as a second strike system. The missiles were widely dispersed and buried under ground in concrete cylinders hardened to withstand an over-pressure [REDACTED]

[REDACTED] It would have required a near-direct hit with a very powerful bomb to destroy any one of them. [REDACTED]

A squadron consisted [REDACTED]

[REDACTED] no one bomb could ever destroy more than one launch control center (LCC) or one missile a time, and the launch control centers were hardened to [REDACTED] making them even more invulnerable.

All of these missiles were to be installed in the northern part of the United States in gently rolling farmland somewhere in Montana. About the only thing that would show above ground would be a minimum structure surrounded by a cyclone fence.

I was curious about procedures for launching: how are the decisions to be made, and what happens when the launch commands are given. What if you decide you really didn't want to launch them after you've launched some? Can you launch selectively? What if some operators decide to launch without authority?

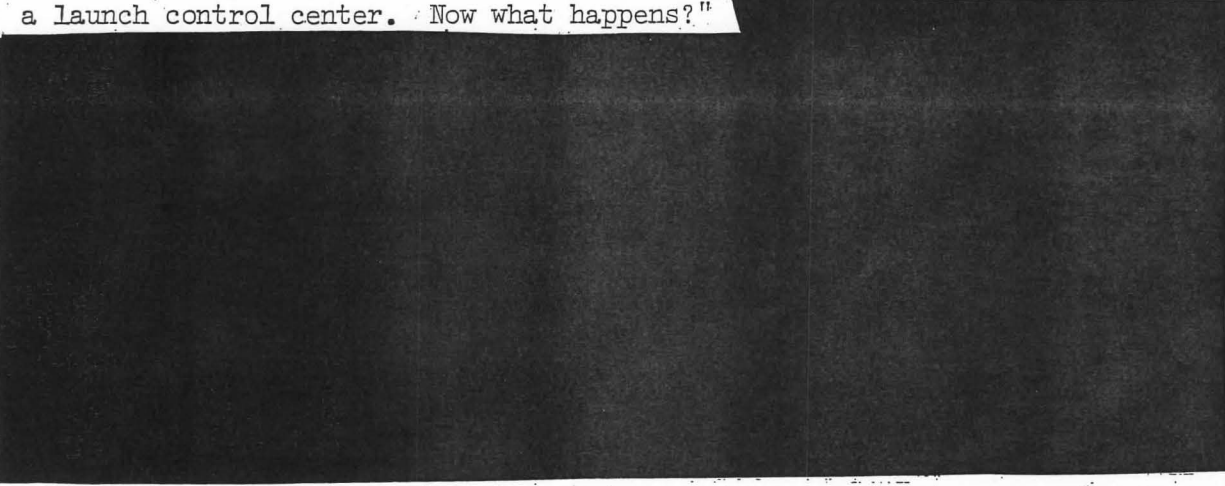
Certain features of the system suggested that it really was not just a second strike system. Now, a second strike system is one that is designed really to ride out an attack. If you intend to ride out an attack, why was it so important to make these missiles out of solid rocket propellant that can be fired like a firecracker in a very short time, like thirty seconds? Minuteman was the first missile to be designed for solid propellant rather than liquid fuel launch--a good feature, but one that endows the system with continued propulsion readiness for almost instantaneous firing. True, there are other advantages to solid rocket propellant beside its non-cryogenic or its nonhyperbolic characteristics. Its launch readiness is not a sufficient, but it is a necessary condition for a quick-response, potentially first-strike system. Moreover, why was it necessary to have gas bearing gyroscopes in the system, gyroscopes that were to spin all the time, twenty-four hours a day three hundred and sixty-five days a year. Why should the gyroscopes always run? [REDACTED]

[REDACTED] Why should the system be ready for launch within thirty seconds? If you're really going to ride out an attack, what is the rationale for being able to keep an entire squadron of fifty missiles in readiness to launch instantaneously, or almost instantaneously all the time? I didn't have the answers to those questions.

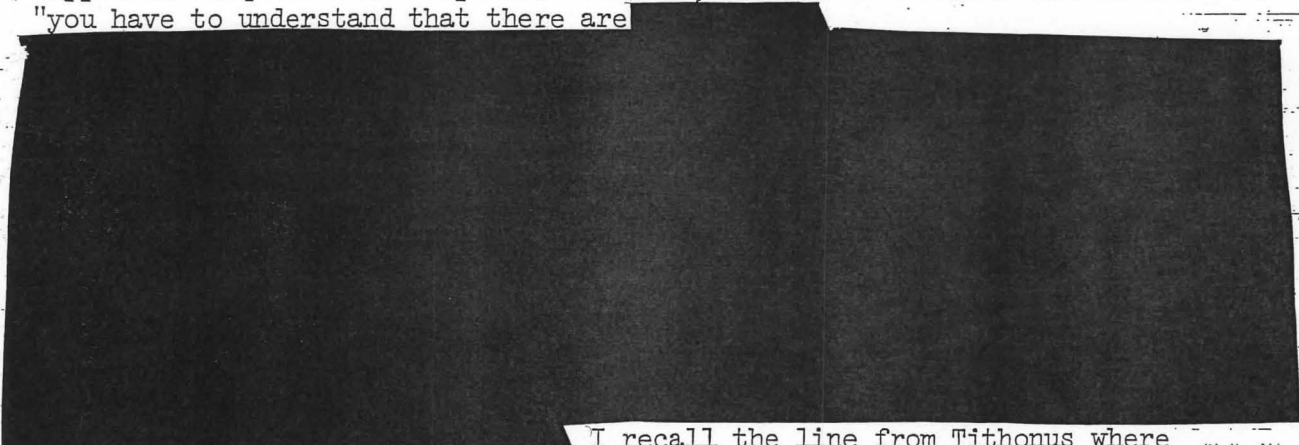
Well, a moment arrived in this briefing in June of 1959 when I could ask the question I wanted. I had the feeling that if I asked the question, surrounded as I was by members of the President's Science Advisory Committee panel, that I might elicit a better more relevant answer than I had been able to get before.



So I said something like, "Bob, can you describe how the missiles are launched?" Now I began to think that he was made uncomfortable by the question. He seemed reluctant to grasp its simple meaning. I asked him to describe the pre-launch sequence. "Let's say that a launch message reaches a launch control center. Now what happens?"



Well, I said, "When you say the missiles will be launched, do you mean all fifty missiles will be launched?" Well, he said, "That depends." And I said, "Depends on what?" "Well, it depends on whether all the missiles are ready and so forth to be fired." "Yes," I said, "but assume that the missile silo doors are not locked shut and assume that all the missiles are ready to launch, then if two or more launch centers vote to launch, will all fifty missiles be launched?" Well, he said, "Yes." Now, he said, "You have to understand"--and I think at this point he sensed a certain ripple of disquiet that swept the audience, the small audience that he had-- "you have to understand that there are



I recall the line from Tithonus where  
he says to Aurora,

Why wilt thou ever scare me with thy tears  
And make me tremble lest a saying learnt  
in days far off  
On that dim earth be true. . . .  
The gods themselves cannot recall their gifts.

Well, the committee was pretty shook by this revelation. I don't think anybody had ever realized before that there would be

I don't think anybody had thought that the Air Force was developing a system like that. At that time I made up my mind that this was one of the greatest menaces not only to world peace, but to the security of mankind that had been perpetrated on the unknowing world by our military up to this time.

I was new to the Pentagon and I didn't know just exactly what you did about something like that. I was a minor official, just one of six assistant directors of Defense Research and Engineering. Furthermore, this was not the McNamara Kennedy administration, and the whole atmosphere was vastly different from what it later became. People then were very upset about the so-called missile gap. Hysteria that was partly a holdover from Sputnik and partly the result of the public trumpeting of people like General [Thomas S.] Power and others whipping up public fear about the Russian missile menace didn't improve the climate for somebody that was worried about how we might start World War III by designing a hair-trigger fail-unsafe system. Safety and protection from unauthorized launch was not then a popular cause. Few people thought that was the most important thing to worry about or even a worry at all.


In the summer of 1959, directly after the STL briefings, I began talking to General [Bernard A.] Schriever about this. General Schriever pretended that he would look into it, but I realized after a few months that he had no intention of doing anything about it. I talked to [Joseph V.] Joe Charyk, then the under secretary of the Air Force about it and I began to realize that he wasn't going to do anything about it either. I brought Dr. Marvin Stern to take my job when I was promoted to deputy director, and I told him (about a year later, in 1960) when nothing at all had been done about it that I considered that his most important job was to get something done about Minuteman safety in launching and that there wasn't anything else that I could think of that was anywhere nearly as important as that.

Marvin Stern knew General Schriever and many other Air Force people. I said, "You will not get this done without getting a directive that orders the Air Force to do something about it." "Oh, no, John, that's not the way to operate in the Pentagon," he said, so he tried personal persuasion and reason to get something done about this essentially political issue.

In the fall of 1960, when I was the acting director of Defense Research and Engineering (Herb York had had a heart attack), Clark Millikan, then the chairman of the Scientific Advisory Committee on Ballistic Missiles, asked me what I thought the committee ought to work on. Herb was not available to talk about it, and I told him that I thought the issue of command control of strategic weapons was the most important single issue facing us. I asked him to have the committee review the provisions that the military had for command and control of strategic weapons. He agreed to do so.

We bought twenty-five copies of the book Red Alert, an excellent and realistic novel which Strangelove was based. It is a very serious book and portrays a vivid scenario that, in my opinion, could have happened, one well within the realm of possibility. Whatever the probabilities were that Red Alert could happen, Minuteman made it much easier and thus even more likely. We gave them the book to read with the idea that it would get their mind turned towards the essential problem--unauthorized launch of a major strategic weapon system.

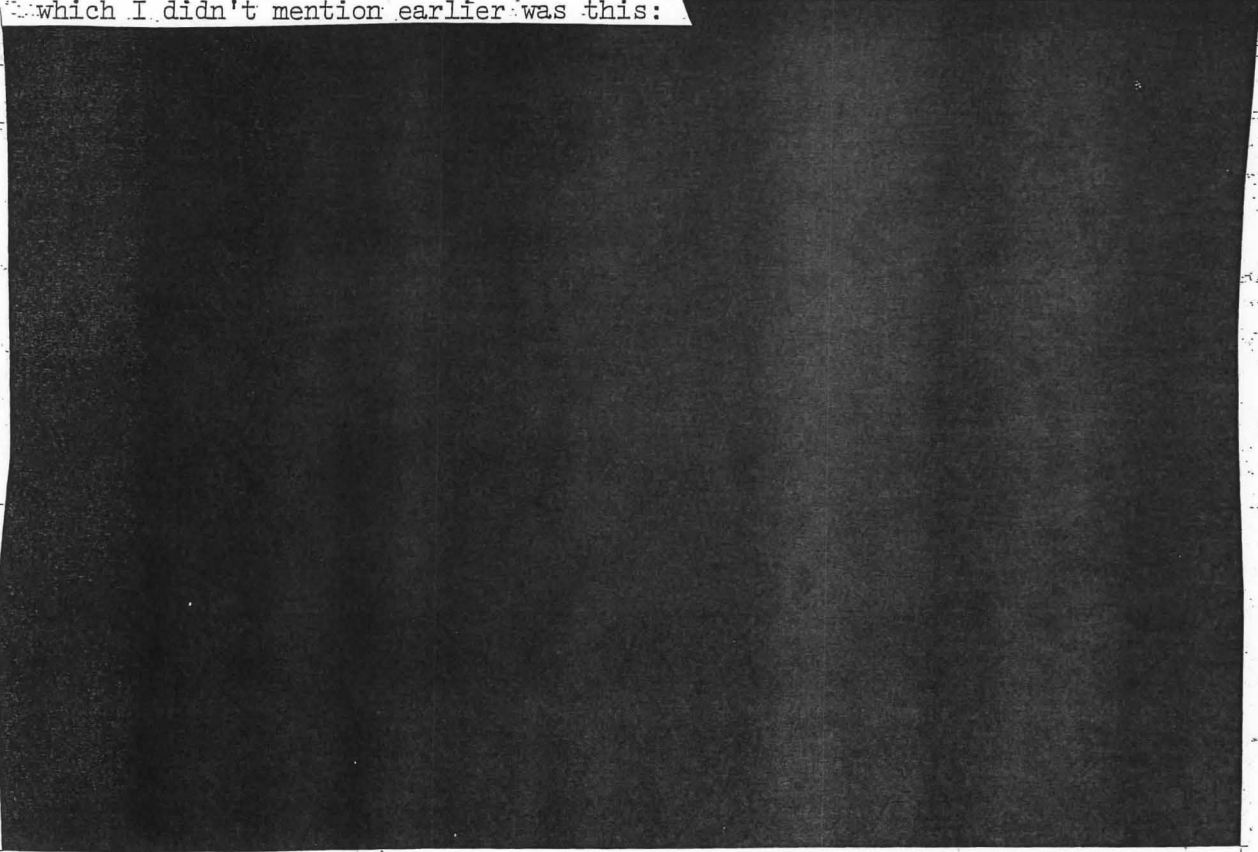
Now Red Alert dealt with the unauthorized launching of a few B-52s carrying bombs flying against conventional air defenses going into Russia.



Don't forget that in all of World War II, the Allies dropped something in the order of two megatons of explosives in over all of Germany. So you're talking about ten times World War II happening in a few minutes, and even worse considering the fallout effects of nuclear weapons. The consequences of such an event are simply unmeasurable in any kind of human terms.

We had the Air Force come in and brief the committee on Minuteman and other systems. The Navy briefed Polaris and some other systems too. As it turned out, a startling revelation was made during that briefing in connection with Minuteman.

One of the features that we had learned about a year and a half earlier which I didn't mention earlier was this:





[REDACTED]

I talked to Marvin Stern about it, stressing that the situation was much worse than either of us had apparently realized and that something had to be done. The first deployment of this system, as I remember, was then scheduled for the following summer, or maybe about a year from then, something like that. But you know, the commitment to that set of concepts and designs was already made, and it was obvious to me that Marvin was never going to get the Air Force to do anything about it.

I talked to [James H.] Jim Douglas, who was then the deputy secretary of defense, at a private lunch.

[REDACTED]

I don't think that would make you feel that the Russians were really trying to stabilize the international military equation by deterring us from attacking them. Not at all. I think you'd think the Russians had deployed a first strike weapon of unbelievable lethality with a ridiculously short hair trigger." He agreed that there was a problem there; sounded like I was right about that. That was about as far as that conversation got.

About December 1960 or January 1961, Marvin Stern had bet me a martini that he was going to get a directive out of General Schriever that would correct these situations in the Minuteman missile. When he finally put the bee on General Schriever, he realized that they'd been lying to him all along. I say lying. And he never got the promised changes. At that point he became convinced that he'd better get a directive.

In January McNamara came in and this was one of the first things that was brought to McNamara's attention. McNamara prepared a revised budget for submittal to the president, in which was included thirty-five million dollars for Minuteman safety and launch provisions.

MOSS: Do you recall how that got in, and who brought it to his attention?

RUBEL: Well, not exactly, but this was something that I was really hipped on. Herb York had come back by that time. Perhaps he got it in.

I had made many other people aware of this, including Jerry Wiesner, who was the Science Adviser to the president. I talked about this to everybody I could get a hold of, and Jerry Wiesner, new in his job, became quite alarmed about it. Wiesner talked to McNamara about it, so it got on the list of priority things to fund and to do. Perhaps Jerry even talked to the president, I don't know. But safety and beyond that, command and control, was decidedly on the list of things that people had really begun to worry about in early 1961.

Sometime in the spring of 1961, Charyk came down and convinced Hitch that the thirty-five million wasn't really necessary in the budget, that the thing it covered was already taken care of by something else that was already in the budget, which was not true. The money was removed from the Defense Department's budget submittal at that time. I never talked to Charyk about that, but to me it was all part of a pattern, a pattern of deliberate, purposeful Air Force effort to deploy a weapon system that would have the characteristics I've defined for you, that would have the capability if not actually the purpose of launching, not just a second strike, but a first strike, minimum or perhaps no warning.

I'm not saying that I think that the Air Force was in favor of having an unauthorized or inadvertent launch of Minuteman missiles, but I am saying that I think that the Air Force definitely was in favor of a system which, under their control, could be launched any time they decided. When I say the Air Force, I don't know what I mean. I don't think the Air Council sat around and said, "Gentlemen, we have a system here called Minuteman and Colonel Schmertz is here to brief you on it. Notice the interesting fact that we have designed this system so that we at our discretion can decide to launch the missile at any time, but practically nobody knows it. No, I don't suppose things happen that way. I'm saying, though, that Bob Bennett at STL was part of a plan, and his attitude reinforced it; that his military counterparts who were stationed at STL were part of a plan, which their attitude and their actions reinforced; that the whole air research and development command headed by General Schriever was part of a plan and his actions and his attitudes reinforced it; that the same was true of Dr. Charyk with whom I talked on this subject many times, and his attitude and his actions reinforced it. How these people got together, how they decided it, whether they ever decided it, or instead of actually deciding it only backed up what somebody else had already decided, or what their motives really were, I may never know, but I'm saying the facts speak for themselves, loud and clear.

They tried in every way they could think of to obfuscate the issue, to conceal the facts first, and then to get me off the track. Bob Bennett came to see me after that meeting that I told you about, saying "Now, John, I'm sure that I can explain things to you to your satisfaction," and so forth. They tried everything, soft soap, delay, confusion, resentment, hostility, lies. I say lies. I realized that's very strong language, but that's really what it amounted to.



It could have been quite different. The Air Force could've said, "I can tell from the way you fellows are asking questions that you're worried about something. What is it that you're concerned about?" We would have told them, and they could have said, "Maybe that is a problem. We ought to worry about that problem, too. I wonder what we ought to do." They could've but did nothing like that.

The Air Force could've said, "We can tell from the way you're talking and the questions you've asked for the last several months that you're worried about unauthorized or inadvertent launch of this missile system, and we're worried about that too. We want to tell you the provisions we've made to protect it." They never did anything like that, never, no way. So I have to say that I regarded their organizational, their bureaucratic and their individual behavior as grounds for deep dismay, concern, anxiety and even suspicion on my part, and I still do.

MOSS: Okay, what was the impact of this on McNamara and Kennedy and so on?

RUBEL: All right. So in April when Charyk went to Hitch and got that money taken out of the budget, Marvin Stern woke up. He went to McNamara and got him to sign a directive to the Air Force saying, thou shalt come down with a plan for what you're going to do about this thing. That was early April as I recall. May went by and June came along. Jerry Wiesner was over one day and asked about the program. I told him I was not aware that anything was happening. I told him about McNamara's directive, and of my impression that the Air Force was probably ignoring it. He said, "You ought to talk to Bob about that and get something done." He said, "That's really serious."

So I went to see McNamara and said, "I've been talking to Jerry and he suggests I talk to you. You wrote this directive in April but I'll tell you right now, and I've been involved in this for two years, they are ignoring you, and they're not going to do anything about it." "Well," he said, "we'll do something about that. We'll direct them to come down and do something about it, that's what we'll do, but they're not just going to ignore me. That they're not going to do."

That got the action started. He contacted the Air Force. Then he got hold of Harold Brown, and in a few weeks the Air Force did come down with an elaborate briefing. They showed that it would cost something like two hundred million dollars to give the Minuteman system the capability of

They created an impossible alternative: either you take it like it is or you delay it and besides that you spend two hundred million dollars more. It was a typical example of Air Force chicanery that came up again and again in those days. Perhaps I shouldn't say "Air Force chicanery," but I'm afraid that they were guilty of that type of thing in my experience more often than the other military departments.

Well, McNamara then decided to act. And he got Harold Brown to get the

Air Force to set up a committee to investigate the situation in detail and make recommendations. Harold decided that the committee ought to be under Air Force auspices, not DDR&E [Defense Development Research and Engineering]. I said, "My gosh, Harold, why do that? They're just going to whitewash the thing, you know that." He said, "Look, if it's our committee, they'll pay no attention to it. If it's their committee they probably will."

Jim Fletcher was available to head the committee. I think Fletcher had been a member of that original panel that I was on. Pretty sure he was. I had known Jim Fletcher for many years. We used to ride to work together when we were neighbors both working at Hughes in the early 1950s. And at the time of this story he was in semiretirement. He's a very good man, now the president of the University of Utah.

And so Jim came down and Brockway McMillan, who was then the assistant secretary of the Air Force for R and D, told him what they wanted him to do and gave him a charter. And I found out he was in the building on that particular day, and I called him and asked him to come down to see me. When he did I asked him what they had told him to do and he told me. I asked if they had shown him this memo--no; or this memo--no; or told him this--no; or told him that--no. So I gave him the total story and showed him my files. I was convinced right then and there that Brockway McMillan was part of the plot. I really became paranoid about this thing. I think rightly so, by the way, like all good paranoids.

If the Fletcher committee had done no more than what the Air Force asked them to do, they'd have probably never gotten to the heart of the matter at all, and the thing would've blown over. But Fletcher accumulated an excellent committee and proceeded with a good understanding of the true picture as I had portrayed it. His committee did one of the most thorough and most fruitful jobs of its type that I'd ever seen done. They came back with a comprehensive description and analysis which was much more horrifying than you can imagine.

I remember one feature they discovered that I had not known about.



You could be sitting there working chapter three of integral and

differential equations when all of a sudden there'd be a loud noise, and that would be one of your missiles going off

Well, this was a chamber of horrors like you have never imagined. And when this report was finally submitted, even the people running the Air Force had to admit something had to be done about it. A number of changes were made in Minuteman I, the initial Minuteman to be released, and then many new features were built in to the subsequent versions of Minuteman that went in the field, all of them designed to correct these basic difficulties. The missiles were arranged so they could be

In subsequent versions, they had a different system that wasn't susceptible to that kind of glitch. Many other things were done. I was told that [redacted] was fixed so that you couldn't [redacted] et cetera.

I talked to Herb York about this fairly recently, and expressed my feeling that over a long period of time the natural tendency of the military will always be to get back to the position they were in before. They wanted this to be an instantly triggerable system, and they're always going to want it to be that way. Anything that interferes with its instant triggerability, even if it's there because of safety, will be undesirable from a mere weapon man's point of view. And it seems to me an independent knowledgeable inspection of some kind needs to be made of systems of this character on a continuing basis.

MOSS: Excuse me a moment. Let me turn the tape.

BEGIN SIDE II TAPE II

RUBEL: Herb and I have agreed that that's really very desirable. Somebody like Herb York or Jim Fletcher, not a military person, ought to go out once a year at random under the proper auspices and visit a Minuteman squadron to find out what is going on. What is the clock set to? Let's actually look at it. What about the man in the ICC silo studying for their master's degree-what do they say, how do they feel? What about the [redacted] What are the changes that have been allowed to creep into these systems over a period of time?

For all I know while you and I are sitting here the United States is moving another microinch closer to the brink of utter, absolute and final disaster because of some little clock ticking up under a hillock in Montana that some Air Force idiot put there. That's not as far fetched as it sounds. I personally believe that the Kennedy administration and the McNamara administration, at least for a short time, did something about these kinds of issues, but I don't suppose any administration ever will be able to or ever should rest easy with these weapons.

There was the much-discussed PAL, the Permissive Action Link,



contemplated to deal with this sort of problem. The idea there was that, yes, you can launch your weapons all right, but there's a little gadget on board that's got a radio link to the ground, and even if you launch your weapon, if I don't push my PAL key, then that warhead is inert not actuated until I, a second and higher authority, decide to arm the weapon. So we have a whole separate way of institutionalizing and converting into hardware form the task of putting enough redundancy into the system of weapons control so that the risk factor is diminished. I don't know that any PAL links were ever installed in any weapon, and I'm almost certain there aren't any in the most lethal of all weapons which are the ballistic missiles, especially the Minuteman, but the Polaris should be counted, too, as far as that's concerned.

There's a difference between Polaris and Minuteman.

I have the impression that nobody on that boat, not even the exec, necessarily knows whether or not the captain is telling the truth. Suppose he orders the crew to fire up the missiles and launch them. What do they do? Do you have another Caine Mutiny or something? I don't know what you do.

MOSS: Okay, is that your . . .

RUBEL: That's my story on Minuteman.

MOSS: Okay, let me shift gears on you a little bit and ask you to talk about people in general, or rather specific people, but general kinds of things. For instance, how did you and Harold Brown divide up the shop? Did one of you have particular areas you concentrated in? I begin to get that feeling.

RUBEL: Well, yes. For example, Harold did almost all the testimony. He liked to do it and he was very good at it, and I think it was right that he did it. I carried the ball on NASA relations. I co-chaired the committee that we had for NASA and DOD, and I pushed the national launch vehicle program and the communications satellites. I handled Titan III and Skybolt. I initiated the whole business of contract definition and all the effort concerned with procurement procedures. I took certain initiative that he followed up on like the PCP, the Program Change Proposal, and I guess there were some others. I pushed for the way of dividing up the budget into the five categories of the RDT and E budget, but he followed up on that, too. I handled the bulk of the white-paper load on the systems I mentioned. I did Polaris vulnerability and all the space stuff, all the strategic weapons things. And I did ANP. Harold got much more into ARPA [Advanced Research Projects Agency] and so did Herb York who had come from there. Harold, and before him Herb, worked on the Nike and the ABM generally.



MOSS: Did this division of effort cause you any problems in not being cognizant of what each other was doing at any time?

RUBEL: I don't think so. Harold is a very brilliant individual with an uncanny ability to keep his finger on a lot of things, a great memory. He was a very good administrator for that kind of a job.

MOSS: What feeling do you have for the way that McNamara and Gilpatric divided things up?

RUBEL: Gilpatric handled almost all intelligence matters and most of the liaison with the Department of State other than what was done by ISA [International Security Affairs]. He handled the defense-industry advisory council [DIAC] and external relations tasks like that except in the case of NASA where [James E.] Webb and McNamara dealt with each other directly. Gilpatric frequently was involved with foreigners.

MOSS: You've mentioned Wiesner two or three times in specific instances. What was the general relationship between his scientific and technical outfit?

RUBEL: McNamara established close relations with Wiesner. Wiesner had lunch with McNamara once a week. I had established an arrangement where I had the assistant secretaries for R and D from the three military departments to lunch with me and Wiesner, and then when Herb came back he often joined us. We kept very close ties with Wiesner's office over there. Everybody knew about the big policy issues, and we never held back on giving them any information that they might want. I think also that their views and our views tended to be pretty much the same on almost everything. The military is somewhat justified in their anxiety about the scientists. It's really true that they did have a tendency to think alike about things.

MOSS: All right. You've got a couple of scientists who don't think the same way, [Wernher] Von Braun and [Edward] Teller. How do they fit into the picture?

RUBEL: Well, Von Braun is not in the picture. Von Braun really is a very special and limited and narrow case.

MOSS: On the NASA side, really, isn't it?

RUBEL: He's NASA. He's rockets. That's about it. He has nothing to do with Defense, and never has. And I think that Von Braun--I must say that people have sort of had to give Von Braun a sort of grudging admiration over the years. He started out with a lot of strikes against him, a flamboyant individual, a former Nazi. Many scientists don't like Nazis very well, and I think that he'd gotten his face on the Wheaties box probably once too many times. On the other hand, Von Braun could have had lots of big high paying industrial jobs if he had wanted them, but he

never took them. He was a stubborn, dedicated man, who has grown into middle age and beyond in his job at Huntsville, devoting himself single-mindedly to the NASA programs. They've been successful. He made the Saturn rocket succeed.

I met him a couple of times in Washington, and one day I invited him to come over for dinner because I wanted to know him better. That was when he was a children's hero, about ten years ago, when Von Braun was on the Wheaties box. I think he had maximum popularity with kids and minimal in the scientific community at that time. We had a very dismal evening. I was very impressed with him--he was very charming and I was willing to co-exist with Von Braun. But the kids didn't behave too well. I remember my little girl got sleepy and she fell sound asleep at the table and it was sort of a bad scene all the way around that night. I had thought they'd be pretty impressed that here was Wernher Von Braun, eating at our table, but they weren't. I think a lot of people now feel that here's a man who's done a pretty good job, and he ought to get the credit for it. Perhaps he got much too much credit before he really earned it, but now I think he ought to get what he's earned.

Teller is a horse of a completely different color. He's a big bomb man. In the orbit of the big Air Force generals, the man that helped crucify J. Robert Oppenheimer. That's what he is to me. He's brilliant and he certainly made great contributions to national defense, but I don't think he'll ever have much standing in circles where scientists are called upon to render advice that is listened to by non-legislative organizations. I doubt that the executive branch of the government will use Teller as a scientific consultant for anything anymore. He's not going to become a member of the President's Science Advisory Committee. He's become controversial and polarized. . . . You can almost predict what Teller's going to say ahead of time.

MOSS: Was this always true, or is there a turning point?

RUBEL: I don't know.

MOSS: I was going to ask another question before you said that he wouldn't be considered for this kind of thing. I was wondering if you and York and your orbit ever sort of confronted Teller at any point and tried to thrash some of these things out.

RUBEL: I don't know. I remember I had a cocktail party for Teller one time; came over to the house and we had a lot of people and had sort of a bull session about things. He's interesting and also charming. They all are. All those people are. But--no, I don't think so. To me the turning point with Teller was his testimony in the Oppenheimer case.

MOSS: Which goes back a way.

RUBEL: Goes back a long way, but it's unforgiveable. On the other hand,

the man had his convictions and he stands on his convictions and that's all right as long as you know where he stands. To me he's about as predictable as Senator [John G.] Tower.

MOSS: Let me throw a couple of names from left field at you. Herbert Scoville?

RUBEL: Well, I knew him a little bit. When he was in the CIA, we used to see each other quite a bit. Like so many of these people you meet in the government, I don't think I ever got to know Pete--they called him Pete Scoville--very well. Typical of the better CIA type of person, very intelligent, bright, sharp.

MOSS: Your job paths didn't cross very much.

RUBEL: Well, they did in some areas. I don't even remember where now. We used to see quite a bit of each other from time to time, but I don't remember what it was about.

MOSS: What about a fellow named [Arch C.] Scurlock, Atlantic Research Corporation?

RUBEL: Oh, I know Archie Scurlock. I remember him.

MOSS: Have anything in particular?

RUBEL: Well, everybody remembers Archie Scurlock. He started the company and they developed a rocket, which I think is the Athena rocket. I seem to recall that before the Athena rocket, they had some kind of a propellant gel they were pushing. This company--what's it called?-- Atlantic Research, became an SEC [Securities and Exchange Commission] scandal or an SEC issue, and Scurlock was forced out of the presidency of the company. There were many allegations made by the SEC and counter allegations made by Scurlock--became very flamboyant, very dramatic sort of a thing. He used to come and see me quite a bit, talk to me and push his rocket ideas. I probably had lunch with him a few times, but I must say, I never visualized Archie Scurlock as the kind of SEC manipulator the SEC said he was.

MOSS: I asked you last time, I think, do you recall a Captain Frietag?

RUBEL: By name, but I don't remember him.

MOSS: I think that about takes care of. . . . Well, perhaps, you could do a sort of sketch of some of the people on the British side, Solly Zuckerman, Peter Thorneycroft and so on? You mentioned them in connection with the Skybolt thing. Who are these birds?

RUBEL: Well, Solly is the one that I really do know pretty well. Solly was a pretty good friend of mine. We met in the early days in connection with Skybolt, and I had him over to the house, and we

got to know each other well right away. Very interesting person, and his views matched mine on almost everything. We hit it off nicely. I developed a good personal relation with Solly, and when I went to England on a couple of occasions, I stayed at his home. When he came here we would entertain him, and we had some nice parties for him. I got to know his wife pretty well.

Solly originally came from South Africa. When he was a young man he went to England. He became a biologist, and I think he may have been a medical doctor at one stage, though I'm not sure about that. When in his late twenties he wrote a famous book on the social behavior of monkeys and apes, based on his observation of the baboons that had been brought in the London zoo, observations that have subsequently been held to be rather particular of baboons in the London zoo and not to baboons outside of captivity. He did a lot of work not only on behavior, but also on some aspects of the physiology of these and other animals, especially the functioning of reproductive systems in mammals. He became professor of anatomy at the University of Birmingham.

During World War II he had many monkeys that he was experimenting with. He told me that the British were worried about what would happen when people were exposed to shock waves emanating from exploding bombs. Early in the war they were digging trenches in Hyde Park, and they began to think that people in the trenches might suffer injuries from bomb-induced shocks, though I don't know why people wondered about that considering all the World War I-trench warfare experience. Anyway, he was asked to put some of his monkeys in these trenches as an experiment. They detonated charges and found that it didn't hurt the monkeys. That was how Solly got involved in wartime research according to Solly.

He was one of the very early people to develop the discipline of "operations research." In fact, the term operations research, I believe, emanated from the idea of analyzing wartime operations in a quantitative way, using more or less scientific tools and disciplines. What's the best way to search an area if you're looking for something in it; what's the best way to sweep out a volume of space if you're going to detect with a radar beam; these and like problems were typical of situations to which mathematical models could be profitably applied. Solly became very active in this and met all the wartime leaders. Solly also met a lot of Americans including General [Lauris] Norstad during the war. In fact, I think he lived in the same cabin with Norstad in North Africa for awhile.

He was a kind of a bon vivant. He loved champagne. Whenever he'd come to the house, I would open a bottle of champagne. One night just before dinner, he and I together drank a whole bottle of champagne and I think he drank most of it, not me. He had quite a capacity to follow that up with more champagne. Very vigorous, energetic sort of a person.

At the same time he is one of these people who has the ability to write a lot, and he wrote many papers and gave himself all of the credentials that



publication gives one. He belongs to some of the best clubs, Brooks, the Atheneum, and he loves the life of the English gentleman. He has a small apartment in London and where he lives during the week, or did in those days. Typically he would have dinner at one of his clubs, going home to Birmingham or to his summer place in Norfolk only on weekends.

I always was very titillated by this; it's so different from anything I've ever been exposed to. There's nothing quite like it in American life that I know of. The men there--the important men--live a totally different kind of existence than we do. Their wives are elsewhere during the week, perhaps not even be in town, and this is no deprivation for them. They move in circles that are much a function of the clubs they go to, and it's really fascinating to find yourself in one of these clubs in the evening, talking with a man who's just been appointed the ambassador to Moscow or another who's just come back from being the high commissioner in Lower Swahili-land or something. They all seem exceptionally urbane, articulate and detached, not in a big, competitive rush.

MOSS: I know what you mean.

RUBEL: I don't know how they do it. I'm always thinking of what I'm going to do next. Just a minute ago I was thinking, "Well, it's getting to be a little late. We better wind this up. I have some things to do. I haven't read the paper today. I have to call my wife. Tomorrow I have to get up and do something in the morning. I don't want to go to bed too. . . ."

They don't seem to think that way. If they don't get to the office at 8:30, they get to the office at 9:30. Everything is nicely done up in little dossiers with a little funny pin with a little red ribbon on it. About twelve o'clock they say, "Well, how about a sherry?" Then after that if you can stand it--you go down to one of their clubs for a two hour luncheon. You come back about three o'clock, and as for me, I'm already groggy. Then about five or six o'clock, you decide it's about time to go and take a bath or something. I don't know what you do after that: go to another club for dinner, and somehow during the day you do read the news and you listen to a lot of people. Life flows on this way, and you have the impression they're really in control of the situation, and they really know what they're doing.

MOSS: Far cry from Robert McNamara.

RUBEL: So different you can't believe it. Solly was then the executive secretary of the London Zoo, really the London Zoological Society.

The London Zoo is built on Crown land that is rented by the Society for a very minimal amount. The Duke of Edinburgh was then the president of the London Zoological Society. As I understand it from Solly, his job as executive secretary meant that he really was in charge of seeing that his eminent sponsors raised the right amount of money to run the zoo.

They have a little clubhouse there with a small lawn outside. If

you're a member of the Zoological Society you have the privileges of the club and of the lawn, both very nice.

My wife and I were in London one time and Solly had a cocktail party for us at the London Zoo out on the little lawn. He had laryngitis that day. And I always liked these British affairs--they are so nicely done. I remember, incidentally, reading a short story in the New Yorker about a woman who had visited a British home in the North. They kept a weasel-type of an animal in the house. The weasel (or whatever it was) was running around the house and all of a sudden it ran up this woman's skirt to her shoulder and bit her ear. The blood began to drip out of her ear, but she remembered, although she was an American, that she was in a British home and so she in a very nonchalant way simply dabbed the blood off of her ear and went on with her conversation. It's really nothing if a weasel has just bitten your ear.

Well, we were out on the lawn and Solly had donated a lot of his ex-monkeys to the zoo. He said, "Would you like to see the monkey house?" And I said, "Oh, yes. I'd like to see the monkey house." We were all holding drinks. So he had a fellow named Hansen who was dressed in the uniform of the zoo and he had Hansen announce a visit to the monkeys. "Hansen," he said, "tell them that if they wish they may see the monkey house." Hansen strode about ten paces away from our little knot of people sipping drinks, spread his legs apart, put his arms behind him and in a stentorian voice, proclaimed: "Ladies and Gentlemen: Sir Solly Zuckerman wishes to announce that those who wish to do so may see the monkey house." With that he turned around and with giant steps strode off toward the monkey house. We all followed him, carrying our cocktails. As we got in the monkey house, the chimpanzees seemed to recognize Solly. They were in large cages, the sides of which were sheathed with steel panels. Solly started to clap his hands and the monkeys got very excited, they ran around the cage faster and faster, slamming the iron sheets, grabbing a trapeze and then giving a flying kick to the iron sheet on the opposite side of the cage. They set up the most unbelievable noise you've ever heard.

We passed the chimpanzees, some other kind of monkeys, and went around to the other side where the baboons were housed. Solly was explaining the baboons to me. The female has a certain kind of a tissue on her chest which turns color as a function of her menstrual cycle. He's done extensive research on the hormones that cause these color changes and related changes in fertility. While he was explaining this a male baboon moved off to the back of his cage. Then all of a sudden he took a ten feet tremendous flying leap, grabbed the trapeze, flew through the air and landed spread eagled on the bars of this cage. Then he urinated in a well-aimed stream that was launched upward at a forty-five degree angle and then arched downward grazing my cheek, most of it going into my drink.

MOSS: Beautiful.

RUBEL: Everybody saw this happen--and I remembered the story of the weasel

in the New Yorker. So without saying a thing about it, I simply took another sip out of my martini, and then I very slowly took out my handkerchief and just daubed very gently on my cheek, saying, "Solly, that's the only martini I've ever had that was flavored with baboon piss." His reaction was just right. He said, "Yes, I suppose it tis."

I had a lot of fun with Solly. He had a wonderful Restoration house in Birmingham that's about a hundred years old or more. It seems to me to be characterized by having no windows that really fit properly and rooms that are very cavernous. We walked into his house one day and he went up at once to a thermostat on the wall, and said "Out of deference to your American taste, we'll have some heat." It was then about three or four o'clock in the afternoon. The thermostat controlled an oil burning furnace. On the furnace they had a clock mechanism like you have on a swimming pool filtration system. It was adjusted so that the heat could be turned on at seven o'clock in the morning and left on until eleven. It didn't go back on again until about six or seven o'clock at night, when it stayed on until perhaps nine or ten, when it went off again. So even though you could adjust the thermostat, he had to go out and readjust the timer to get any heat in the afternoon. I said, "Solly, why do you need a timer when you have a thermostat? If you don't want the heat in your house, all you need do is turn the thermostat down. That'll turn the heat off. When you want the heat, you turn the thermostat on. You don't need this timer. Just leave the little thing there off, that will disconnect it, but he said, "Oh no, that's the way it's made."

The temperature of the house, was only about fifty-four degrees when we arrived, and it was damp. Outside a fine mist was falling and now and then it would hail a little bit.

"John," he said, "how about a bit of a walk?" I said, "that would be lovely," so we went off in his car to some moors and tramped around. The frost crunched under every step. I was absolutely paralyzed with cold when we finally went back to the house. I didn't think my feet would ever recover. Gradually the house got up to about sixty-two degrees, and about then Solly thought it was about right.

I must say these British are very rugged people. They live at such a low temperature that they must have great resistance to every disease.

Well, he was an interesting person. I used to correspond with him, but we've fallen out of touch recently. He was pretty effective for awhile in his own Ministry of Defense, but when the administration shifted he finally left. I don't even know what Solly's doing anymore.

MOSS: Well, suppose we wrap this up by my asking you what--why you left and when and how and that kind of thing?

RUBEL: Well, I left in June of '63. I always knew I was going to leave

eventually. I didn't want to make the government my career. I had the idea, though, that I would like to come back to the government sometime. I felt that four and a half years in the government was probably about right. I felt that for several reasons. First, I had bought Fubini in and he had been there a couple of years, so it was about right for me to leave so he could take over my job. That made for good continuity. I had been there since 1959 and if Fubini stayed for another two years we would have had six years of pretty good policy continuity. It worked out about like that.

From a personal point of view, I found that I became much more agitated, concerned and disturbed by things I learned and things I saw in Washington than was good for me or good for my family. McNamara's wife got a stomach ulcer, and my wife's health wasn't any too good near the end either, even though my job was far below McNamara's, I began to suspect that quite a bit of her problems were psychosomatic, partly and probably caused by me. My disposition got worse and worse.

There's a peculiar combination in some people of ambition and frustration and tremendously long hours and hard work and anxiety that create a very artificial state in a man. Some people seem to be much more resistant to that than others. Some people seemed almost unflappable, whatever was going on inside, beneath the surface, but I was flappable. When I thought things were wrong, I became personally bothered. When I saw what I thought was ruthlessness in the wrong cause, or in even no cause, as I thought I saw quite often, it really disturbed me.

I really became alarmed by the momentum of the American military machinery and bureaucracy and commitment, and that alarm disturbed me a lot. Other people don't seem to be so disturbed by it. You see people who serve in the Congress as a career. They don't seem to get all shook up because things aren't like they want them to be. People serve as president for a long time and seem to stand the strain. Anyway, it wasn't too good for me. Periodically, I had some psychomatic problems. On a couple of occasions I began to think I had a stomach ulcer. Well, I didn't have a stomach ulcer, but my system was telling me that I was pushing too hard, and I finally decided after four years there that I just wasn't going to work at full throttle anymore.

That happens to a lot of people in Washington. I was not the only one, it happens to many. Sooner or later, since everyone's made of the same components, sooner or later it's bad for you. Near the end I started to slow down psychologically and physically a little bit. I have the capacity to work longer hours and put out energy at a much higher rate for a much longer period than a lot of people do, but the requirements that I was up against there began to push me too hard from time to time. I finally decided that this had happened once too often. What's the use? You only live once.

So I guess it was a combination of all those things. It was the right



time. I'd sort of had enough of Defense and I thought I really owe family a respite from it all, so we left. That was seven years ago, and things have changed a lot. And I guess I don't really think that it's likely now that I'll ever be able to go back. When I went there the first time, I was thirty-eight years old. Now I'm fifty years old. More and more this is a young man's world. There aren't many in their fifties who get called back to Washington, and those there are the Paul Nitzes who stand on the sidelines waiting for the call, are available when it comes and have the qualifications for it.

MOSS: The [John J.] McCloy's, the [Robert A.] Lovetts, the [Hugo LaFayette] Blacks, the [W. Averell] Harrimans, this crowd.

RUBEL: Yes, but most minor officials are not very likely to have that happen to them. I don't expect it to happen to me. And I wouldn't seek it anymore either, I think. I've probably had it. It was a very wonderful experience. It sounds bizarre, but in a way everybody should have it. It's the greatest civics lesson there is. You never read a newspaper again the same way. You never hear a radio broadcast the same way. And you make contacts and meet people that you never would have made otherwise in a context and with bonds that are in some cases remarkably enduring. I've got a lot of good friends now that I didn't have before that I don't see very much, but whom I feel very close to. Wiesner is one of them. Ruina, Yarmolinsky, Herb York, certainly Herb York, Gene Fubini, Alain Enthoven. A lot of people. And there are others I haven't seen for a long time who I would feel very much in rapport with if I did, Bob Seamans, a lot of other people over in NASA probably, Rathjens who was in State Department for quite awhile and so forth. It broadens your horizons, and for me it was great. I'm sorry I can't play my life over and do it all over again. It doesn't work that way.

MOSS: No. Perhaps that's an appropriate note to end this on.