Dr. Robert Sproull
1963-1965

Interview: December 7, 2006

Interviewer: Please give us your name and your title.
Sproull: My name is Robert L. Sproull, ex-President of the University of Rochester.

I: When were you the Director?
Sproull: About the first of September in 1963 to the end of June in 1965.

I: How did you happen to become the Director?
Sproull: Well, I was never completely sure. I'd been an ARPA contractor in a sense at Cornell. Cornell was one of the first of the materials IDL laboratories, and the biggest, and I had had a good deal to do in the founding of that and got to know the ARPA connection with that.

But then in 1963, I had about decided to go to be Dean of Science at Wesleyan and there was a new president at Cornell, Jim Perkins, who somehow or other got the idea that he would like me to stay at Cornell. And he was a good friend of Jerry Wiesner who was then the President's Science Advisor. And somehow or other, Wiesner had a recruiting job to do, getting new staff various places, one of which was the Director of ARPA. So, I got a call from him asking if I'd be interested and it never occurred to me that ARPA would be interested in me because I had no military background whatsoever.

But I went to Washington and, I guess, was interviewed. It didn't seem that way. I talked with Jerry and he sent me over to the Pentagon. I talked with Harold—Harold Brown—and then had lunch and walked the E-ring with Gene Fubini. At the end of the day Harold offered me the job. Oh, I talked with Jack Ruina a good deal, too, that day.

So, it was a funny kind of way to get aboard but that was the way it happened.

I: Did you know Jack Ruina before—

Sproull: No. The people we worked with in ARPA were Bill Bolton, who was a program manager, and Herb York, who was in many ways the designer of the program in DDR&E. ARPA was brought in as an agent without very much design. There wasn't a materials section in ARPA at the time, in '59-'60, when the IDL contracts were competed and let.

I didn't know anybody except Bolton and all the design of the program actually had been done in the AEC, the Atomic Energy Commission, and it was just gone, it went into the Pentagon in order to get authority to subsidize buildings, which the AEC couldn't write contracts for longer than a year, for example.

So, in a way, the IDLs were —how should I say—a kind of an assigned project to the Defense Department and so we didn't do much continual consultation with ARPA people at all.

John Kincaid was another person in DDR&E, along with Herb York, whom we talked to. So I learned about ARPA that way.

I: You had a couple of choices, didn't you? ARPA was one choice.

Sproull: That's true. The other one was to be Deputy Director of the National Science Foundation. But, clearly, the ARPA thing was much more interesting. It would've been a safer bet for the other job because it was something I knew but for that same reason it was less interesting to me. And ARPA was an intriguing opportunity.

I: What was your first day at ARPA like?

Sproull: (Chuckles.) Well, it was intimidating. I came down during the summer of 1963 because the partial nuclear test ban was under discussion, and there was meeting after meeting. ARPA was always one of the players.

Jack Ruina had left the first of May. And I really do mean left. He didn't come back. So I had to try to figure out what was going on there. I recruited a Director of Nuclear Test Detection, which was one of my major successes, getting Bob Frosch in. I don't know if you're going to talk with Bob, but he was an absolutely first-class director of that. But, of course, he was as fresh and new as I was to that.

So, my first problem at ARPA was helping the Joint Chiefs generate testimony leading to the confirmation of the Partial Nuclear Test Ban Treaty. They were being called to Congress and they wanted to know, you know, what were all these things about safeguards, et cetera. And ARPA had done most of the work—well, I don't know about "most," but done much of the work of securing the country in a partial nuclear test ban environment. The three environments: the oceans, the land and space, were all DARPA projects of one sort or another, mostly done in the National Labs.

The Air Force had done a great deal with Project AFTAC but the Joint Chiefs wanted assurance that the ability to detect nuclear test violations was there, and that was ARPA. So, I had to master that right away and help as far as

I can mostly with telephone calls with various, mostly flag and field staff, who went up to Congress in support of the treaty. It was a terrible way to get started but it was all I could do.

I: Had to have been intimidating.

Sproull: Yes. Indeed. But I was only a minor player on the—(chuckles)—world stage, you understand. You know, it was all based on questions of how good the technology was and I was pretty confident of that. I had been a consultant for AEC and I had contracted with the AEC, not on policy questions, but I knew some of the people and I'd kept alert to the arms control environment. And actually, later, I was a contributor to Pugwash for a little while.

I: The Soviets wanted some sort of test ban control.

Sproull: Yes.

I: The United States wanted a test ban.

Sproull: Yes.

I: The missing ingredient was what, and how did ARPA supply that?

Sproull: Well, we thought the missing ingredient was ability to discriminate earthquakes from underground tests because the fourth environment was not part of the treaty, although during the summer of '65 all of the meetings had to do with, "Can you make it part of the treaty?" And that came down to a question of how many onsite inspections would be in it. We went from zero to about ten or so, back and forth, with Soviets taking one position, we taking another. Each one of the meetings would then talk about various tests and try to discriminate.

And the Air Force was always on the side of needing more tests, and ARPA and ARPA's contractors were on the side of—and DDR&E was on the side of—doing fewer tests.

That's what we thought the issue was. In fact I think, in retrospect, nobody wanted an underground test ban, neither the Soviets nor the U.S. Certainly, the National Labs didn't. And so I think that all of that to-and-fro about the number of onsite inspections was really irrelevant.

But the partial nuclear test ban was, of course, the first real success leading to an end of the Cold War. It was only a step, but it was the first step, and I think it was important, and I think ARPA's role was important in having prepared for the Services to say, "Yes, we can assure the safety of the country in a nuclear test ban environment."

I: What were the ARPA projects that were going to deliver that assurance?

Sproull: Well, it was different for each one of the environments. VELA Uniform, the "U" for "underground," was one working toward discrimination of underground tests. As I say, that turned out to be at that time irrelevant, although later, of course, it became very important.

The oceans, the Navy, with SOSUS and so on was the principal player there and ARPA was not a big player. We did the atmosphere in space with a

veil of satellites and that was a program that must've been started by Johnson, if not then by Betts, was a very successful program. The launching was on my watch but I had very little to do with it. And Los Alamos did the sensors. But it was a very successful project and it took care of mostly the atmosphere and near space. So, those were the ARPA programs that led to assurance.

I: What was VELA supposed to do? How did it work?
Sproull: Well, it had a number of sensors and I can't tell you, in retrospect, all of them. But, you know, if you knew enough bomb physics I could tell— (chuckles)—tell you more, but I won't. I'm not all that certain of it myself nowadays.

But one of the things was the signature of light coming from a possible test in the atmosphere. In fact, VELA satellites did somewhat later—maybe ten years later—discover the South African test done in the Indian Ocean and identified it. The VELA team identified it as a nuclear test.

The South Africans were very silent. They refused to talk about it and there was a special committee appointed to decide what it was and the special committee decided that it was a lightning flash, or flashes. It was a case where the special committee had been chosen, I think, to get that conclusion. It was one of the many cases where politics trumps science.

But anyway, the VELA satellites worked and were interesting. They were a cost-plus-incentive-fee contract and, as you might guess, the incentive fee was used and they lasted much longer than the nominal time, so the incentive fee had to be paid. But it was a very successful satellite. I don't know they may still be up there. I never heard what happened eventually to them.

I: The success of VELA was based on all of the work that ARPA had started?
Sproull: Yes. And take advantage of the National Lab sophistication on sensors and the knowledge of bomb physics.

One of ARPA's great strengths is to bring together teams like that that ordinarily don't work together.

I: What was Project DEFENDER?
Sproull: Project DEFENDER was half of ARPA. DEFENDER was doing the science and advanced technology underlying the interception of intercontinental ballistic missiles. It was more than that. It was also playing the offense against the defense, helping the Air Force, I've forgotten what the Air Force's penetration aids project was called. It had a name, but anyway, ARPA would generate the defenses, in part to give something for the Air Force to worry about if the Soviets had them. The Soviets had a missile called Galash. We called it "Galash" which we thought was to intercept our missiles.

So the Defender not only did the defense but it also exercised, in a sense—in a paper sense—our penetration aids that we used against the Soviets.

So it was a big project because anything involving boosters et cetera automatically spends a lot of money. It was—I don't know—a $150 or so, $300 million project.

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I did relatively little in Project DEFENDER because Charlie Herzfeld was—that was his baby. He had been managing it with the very able assistance of Sam Rabinowitz who's one of the sharpest engineers that ever came down the pike. And I had enough problems elsewhere so that seemed to me to be in pretty good hands. And I was nervous because I always spent so much money and it was, in a way, the child of the National Labs.

But on the other hand it seemed to me it was in good hands and I would have to spend an awful lot of time to do any better on it. So I didn't exactly neglect it but on the other hand—and, of course, I had to defend it.

I still was responsible as Director, of course, but delegated pretty much the running of the project to Sam and Charlie.

I: What other problems were there to worry about?
Sproull: Well, the biggest single problem in my tenure was project AGILE in the remote area conflict, which was Vietnam. There was a little bit of money spent elsewhere but almost all of it was the Military Research and Development Center in Saigon and a little bit, well, a fairly substantial amount, in Thailand.

But Project AGILE was incredibly difficult to get one's hands around. It was also complicated by the fact that the nominal leader of it was Gen. Robert Wienicki, very fine officer, but not an imaginative or strong leader. And I suppose it was my lack of knowledge of the Services and lack of confidence that I knew what I was doing that kept me from replacing him with somebody else.

But I tried to buttress him by people under him. The principal one who came a little later was Harold Hall, who was a very able idea man, not an operator. But the situation was enormously complicated by trying to help the Vietnamese help themselves, which was what ARPA's role was. But there was no central government, as you know, and the French had done everything they could to keep them from having a central government so we were in the process of trying to help a government that didn't exist.

As you know, the ARPA role gradually died out and we came into a complete shooting role, but at the time of my tenure in ARPA we were just advisors. And we did some useful things, I think. The Vietnamese had been carrying around their soy sauce—their fish sauce—in glass bottles, which were breaking all the time and causing all sorts of troubles. We substituted polyethylene. You know, it doesn't take a lot of science to do that. It was that kind of simple, little tricks that ARPA did which, if we'd had the opportunity to work with a real government and work over time, we might've made a difference. But I think we made very little difference.

In Thailand, on the other hand, I think we may have been extremely helpful getting mostly communications and weapons and field gear of various sorts, radios...

But the other thing that complicated matters was an ex-Marine by the name of Bill Godel. I don't know if you've run across him before.

Very able, but very flakey and later on, as you probably know, he went to prison—but not for anything involving ARPA. The money that he was accused of —and finally the jury decided he was guilty of—embezzling was all funds in the

Secretary's office. They were representational funds going back, clear back to Washington's day as general, where the person in the field has to have some money that's not subject to a lot of auditing, et cetera. And Godel and two other people took advantage of that type of money to put some in their pockets.

But meanwhile, he was very knowledgeable about everything that went on in Vietnam. He was, in fact, extremely useful to ARPA but he was also a wild card that we couldn't really control.

We finally had to work out an agreement where he ceased to be an ARPA employee. I think that was the summer of '64 but I'm not quite sure. But we simply couldn't control our operation without knowing what Godel was up to. He may have been involved to some extent with an organization which I think was called Air America. I'm not sure, but it was a CIA operation in Vietnam. And we wanted to be sure we weren't tainted with that brush, so that ARPA-AGILE, was very complicated.

One of the other things that it was pushing—and it was largely by what Godel was pushing—was the M-16 rifle, which I think was called AR-15 or something before it became a standard American Government issue. It was a very lightweight assault rifle, whereas the rifle that the Military Assistance Group was pushing was a leftover from World War II, and even, I think some of it from World War I. It was so heavy that a Vietnamese could hardly lift it, much less carry the ammunition for it, so they didn't. We issued the rifles to them, but they didn't use them.

But the M-16 was not blessed by the Army and if Godel hadn't been pushing it as, in fact, our expert in that whole area, we might've gotten there. But Godel tainted the thing so badly that it took a long time. It wasn't until after ARPA really retired from the field that the M-16 became kosher.

So, ARPA-AGILE was a mixed bag. It had some successes but it had a very bad name around the Pentagon.

I was called into Secretary Vance's office several times. He had been Secretary of the Army before he became Deputy Secretary of Defense so he had the Army bible—how shall I say—cold. And the Army hated this. And to some extent we deserved it, I think, because to a considerable extent we were loose cannon in the field.

That was the biggest single problem I had, and I didn't do very well on it. But I'm not sure—(chuckles)—how well anybody could've done. I would have done better if I'd had more experience with the military.

I: What was your relationship with the Services, generally?
Sproull: Well, generally it was pretty good. We usually worked with, for example, ONR; we had excellent relations and many joint operations. With the Air Force, it was mixed. On things like nuclear test detection we had different points of view. It was more a question of emphasis than it was anything else. And the Army, well, I have said most of what our interaction with them was.

And the Navy. One of the things that I regret is that ARPA didn't do anything that really had any great risk associated with it in Naval warfare. We tried to get together some studies of fast surface transport on water. Nobody had

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any really good ideas and I think that's still the case. I don't think there's any really good idea out there, you know, replacing the aircraft carrier or the big transport ships. But we tried to. We put together some study groups, and I think we had some—I'm not sure—but I think we had a JASON study on sea transport. But that was the relation with the service. It was disappointing and it was our fault. We just didn't have the—we and our contractors didn't come forth with any—great ideas.

But generally speaking, we tried to be very comfortable with the Services and I think we usually were. Very few of our contracts I bled and died before I would get a contract out through the Secretary of Defense office, which we had the authority to do, as you know. And we did from time to time when no Service could be moved into participation.

We always tried to get into a Service because the Service would use it. And the transition from a research and development contract to use is the biggest transition. It's harder than getting the thing in the first place. In fact, we started a new project in ARPA in materials just on these grounds, trying to make the transition into engineering and production, which I don't think, in fact, the subsequent Directors thought very highly of and didn't develop. But I still think that's the really hard job.

So, our relations with the Services, I guess, are coming out mixed. But we tried to be friendly to them, and we tried to do everything in our contracting through them we possibly could. I don't think there were more than—I don't know—five or ten million dollar,s at the most, contracts per year that went out to the Secretary that didn't go through one of the Service agencies, usually Air Force, OSR, or ONR, or Army Office of Scientific Research.

And of course half of our professional staff was military. And I don't know how that is now. Is that the same now?

I: I don't know.
Sproull: And we had good relations with the service personnel agencies. We got good attention when we had a replacement. They honored our needs and desires very effectively. There wasn't any great tension on that score.

I: I want to go back to AGILE —how far-flung were the projects that were all under this umbrella called AGILE? Conceptually.
Sproull: Well, they covered everything that was happening in the warfare area, you know, shooting, communications, transport. We had an airplane, a Canadian Convair type of airplane. And communications were a big thing. Their radios didn't work and the Army's weren't suitable for the high-moisture, high-temperature environment, so conceptually it covered the whole grounds of warfare.

Geographically, it was just Vietnam and Thailand. We thought some of Lebanon—but then we actually went there—and we tried to help the Indians, but neither one of those resulted in any kind of projects nor any money spent in those places.

So, I don't know what the dimensions of far-flung are.

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I: The whole notion of command and control—how that later developed into studies in information sciences.

Sproull: Yeah. Well, I'd like to talk about that. But I don't know how the command and control started, but I think it was before Jack.

I: It was?

Sproull: I think Johnson started it but I'm not sure. And I don't think it had its origin in AGILE or in remote area conflict. I think it was a general need that was being felt by the Services, of command and control that was getting out of hand. The communication gear was getting more complicated. The computer was coming along and everybody was saying, "Well, the computer will take care of that," and nobody realizing what a terrible misstatement that was.

But it may have had some origins in project AGILE. Do you want to talk about it?

I: Yes.

Sproull: In science, quite frequently, it happens that you're working on an applied problem and you suddenly discover that buried in it is a really very fundamental problem. A number of Nobel Prizes have been found that way.

Well, this was a case where a very strongly applied process, command and control, contained a very powerful underlying problem, namely how an individual uses a computer. Not how a bank uses it but how an individual uses a computer.

And so Jack Ruina had brought with him from MIT a really brilliant guy, J. C. R. Licklider—unfortunately now dead— a very soft-spoken, modest individual, but a real genius. And he had a vision of the computer that was different from anybody else's at the time. I say that not knowing everybody in the world, but anybody who raised his head above the water. Licklider was the only one with the courage to say the things he did about the future of the computer as it related to the individual.

Anyway, I didn't know how far Jack had gone in this, but it was clear to me that there was a very fundamental problem there and I think Jack had seen that. He had a fundamental approach and he had—how shall I say—succumbed to Licklider wizardry and, in fact, MIT had produced a good deal of it.

My first reaction when I came to ARPA—I had not known about this project before, but I looked into it—I couldn't understand why Big Blue wasn't doing everything that needed to be done. It seemed to me anything that was open; Big Blue had the money, had the base, and had the technology. Why wasn't it doing it?

Licklider said, "Okay, look. Before you cancel this program"—and it was almost canceled, I'll get to that maybe a little later—"why don't you come around and look at some of the labs that're doing my work?"—"my," meaning Licklider's. So, I said, "Okay. "

And some of these I visited with Gene Fubini, getting him aboard, because

I realized that he was essentially Harold's man on computing. And I went with Licklider to three or four of them, to MIT, to Bolt, Beranek, and Newman to Utah, to one of the places on the West Coast. I've forgotten now which.

Anyway, I began to realize that Licklider was dead right, that there was a huge, open field here for the interaction between man and the computer and using the computer in imaginative ways and seeing the beginnings of things that man-machine interface was completely different from batch processing. And the ARPA programs that Licklider started in time-sharing and teleconferencing, networking, you know, the whole business. All the things now that we think of as part of personal computing, Licklider started.

Now to be sure, these places: Bolt, Beranek, and Newman, for example, were doing the work, and all of these would have been done elsewhere by somebody else. There's no question about that. It was only a matter of time before a computer would be used in these imaginative ways but Lick must've shaved years and years off the thing and started these programs. So it became clear that it was not just a military program. We changed the name to Information Processing Technologies. I think our little booklet says "Information Processing Techniques," but what's it called now? IPT?

Okay, so it is "technology". My memory's okay. It's a little book. Someplace along the line "techniques" was expanded to "technology." Interesting sidelight. Anyway, that was, I think, the most successful ARPA project during my tenure. And I didn't start it, but I did say something about canceling it.

Harold told me when I started that I might as well know at the beginning that I had to get rid of $15 million, at least, of ARPA programs. That the programs had been static for two years, static in the sense if you looked at it from outside, they looked static because the same amount of dollars was being spent in the same programs. Of course, the programs had a great deal of life and vitality to them.

But, anyway, ARPA had to continue with its mission and do the things we said it was good for. We just had to move along and get rid of some programs and start some new ones. So I said, "Yes, sir," and then started hunting.

And the most likely one was command and control techniques. So as I say, that was why I was alerted to find out as soon as I possibly could, I think it was probably the second thing I took on after the work that we talked about before on nuclear test detection. And I'm certainly glad I did because it was perfectly clear that Licklider knew what he was talking about and had a vision greater than just about anybody else in the field.

There was another thing that helped us a little bit, namely PSAC, the President's Science Advisory Committee. It had a special session, the committee on computing, and this group had understood the open-endedness of the computer when it got beyond the batch processing barrier. And I remember a very bright engineer, J.R. Pierce, in fact, I worked in his lab one summer during the war at the Labs. The brightest engineer that ever came down the pike. He was the chairman of this PSAC committee and wrote the report and the opening of the report, I think I can do from memory. This is 1963 I'm taking about.

Says, "After two decades of unprecedented development, the computer is approaching its infancy." And that's true. And that was the insight that Licklider had, too, that the computer wasn't being used at all in the way it should be. And ARPA must have shaved twenty years, maybe only ten, but more likely twenty years, off the development. As you know, the networking became ARPANet and then Internet—in later watches, not mine.

I: I'm sitting here with the man that almost killed the Internet.
Sproull: (Chuckles.) Yes. Well, you know, it wasn't subject to a straight shot. I had—(chuckles)—studied it pretty hard.

I: What other projects were there?
Sproull: All right. Propellant chemistry. This was a leftover from the big booster days. The idea was that we ought to be able to do some science that would lead to a higher specific impulse fuel for rockets. And there was a case where industry was doing it, and NASA had grown up in the process, while ARPA had not shown any great successes. There weren't any really—how shall I say—mystery fuels that had been developed.

And, furthermore, more to the point, there wasn't anything on the horizon. There wasn't anything in their proposal list that gave them any chance of doing that. And $15 million was a drop in the bucket compared to what NASA was spending on fuels.

So with great crying and screaming from the community, I killed it. And I was as careful as I could about preparing the ground for the kill, study, et cetera. I'm not at all sure now just what studies I did have done, but you know, you always protect your rear to some extent. And after a while the crying went away. Even the chemical fraternity, who thought I was anti-chemistry, finally decided, you know, "It's probably a good thing." So, that took care of that. That was the only thing I really had to kill.

I: Did you start anything?
Sproull: Only the engineering part of materials. Also, Project STAR, that you might want to talk about, which was a very small project. We started things in those original projects, particularly in nuclear test detection. Frosch had a very agile mind and started things. There were lots of phased-array radar developments done with Sam Rabinowitz in charge there, but the project stayed the same and it looked the same from the outside. Spent about the same money at year end plus one as it did at year end. But there really wasn't a lot of—there were no new programs with a program title, I don't think.

I: Was Christofilos around when you were there?
Sproull: Yes.

I: What was ARPA's relationship with him?
Sproull: Nick Christofilos? Oh, he was a kind of a resident wizard, but nonresident. He was at Berkeley, I guess—wasn't he?—or at Livermore.

I: Yes.

Sproull: Well, you know, he was one of the inventors of the strong-focus synchrotrons but he was never given credit for it. You know the story?

I: No, tell me about it.

Sproull: I don't know if you know about the strong-focus synchrotrons, but all the synchrotrons and big machines like that use that principle now. Wexler and Currant got the Prize for it as inventing it. But shortly after the announcement was made of the invention the people at Berkeley, Lawrence Berkeley Lab, or, I guess it wasn't Berkeley Lab then it was just Lawrence, got a letter from this Greek elevator engineer, Nick, Nicolas Christofilos. Said, "That's my invention, and you look in your files and you'll see my letter. "

They looked in their files and they did see his letter. And he did invent it but it was done in such a way it was one of the letters that anybody involved with the physics department at Berkeley got all the time. You know, everybody was inventing things and they would send their invention in. And the people got the usual brush-off. You know, "Thank you very much for you interest in our problem. We're unable to use your...this no doubt an interesting invention."

He had invented it in connection with, I can hardly explain it, power transmission, rather than nuclear accelerators and so it didn't appear to be of any interest to the nuclear accelerator community.

Once they saw it in that light, though, once he said, "This was the idea of strong focusing," everyone said, "Oh, my God. He's right. "

So, they hired him. And then the question was, "How do you put him to work?"

And we spent a little bit of money just sort of keeping him alive.

I don't know why you asked. It's—somebody else's—

I: No, it's a high-particle beam.

Sproull: So, anything he invented we had to sort of look at—(chuckles)—give a little bit of money to follow it up for a while.

I: There was an interesting interplay between basic and applied sciences that runs through ARPA/DARPA; finding immediate solutions and laying the groundwork for the potential in the future, could you talk a little bit about that?

Sproull: Well, I touched on that before in information processing technology, seeking of general questions to what looked like a localized problem or an applied problem. ARPA does this over and over again. In the case of DEFENDER, the radar, for example, the radar was the big thing there. ARPA didn't do an awful lot with respect to interceptors, although we did have a program called HIBEX which was a very high-acceleration interceptor, but that was more or less routine.

But the more interesting thing was looking at the revolution in radar done by using phased arrays and getting them exploited in other fields than just nuclear ballistic missile defense.

There was a case in materials, I've only touched on the case, where the materials program was essentially designed by others to be more scientific in bringing together disciplines: engineering, physics, chemistry—not biology, although it should have been included then and now is. And the ARPA program that we started was called a "coupling program," coupling the science and engineering, not altogether successful even though that was my field and I should have been able to do more on it. But I was also constrained a little bit because I didn't want to be, you know, pedaling my own bicycle too much.

And it turned out to be very hard because you don't have the opportunity you have with many things where the military is your customer. In the case of materials—advanced materials—you have a whole field of customers, all of them with their own proprietary products, et cetera. So, the transition from science to engineering to production is much more complicated in materials than a thing like radar, for example, where there're a limited number of very high-powered companies in the field and all of them interested in expanding with one customer in the end, the Defense Department.

I: Can you give me an example of how coupling works?
Sproull: Well, it was mostly done by getting people in the labs to go to industry and industry going into the labs. To some extent, it was a project on individual materials, notably composites. Composites were the big thing then, and the open-endedness in materials. So when you wanted talk about engineering materials, ARPA put a good deal of money into developing the composites.

The surface chemistry that goes into composites is fascinating because, you know, it's the binding between the filler and the resin that is the key to the whole material's strength and fatigue resistance and things like that.

So ARPA put money into what we thought was the major open-endedness for engineering materials. We had some interesting developments, mostly on high-temperature composites. But I haven't followed the field since, so I don't know how it worked. But as I say, the weapon we used mostly was transporting people from one place to another, going with the projects.

I: During your tenure, there were revolutions in science that had ARPA in the background; usually seismology. Arecibo....
Sproull: Yes. Those were all buried in individual programs. I couldn't do anything with Arecibo because I was on leave from Cornell and Arecibo was a mess. Cornell had chosen to be their own prime contractor, which was a terrible, terrible mistake. It's a mistake even in the U.S. but offshore it was an accented mistake.

But as a project, it was a total success. You know what its original purpose was—I think it was. Nobody ever told me this, but its original purpose, I think, was the expectation that it might get Soviet communication traffic reflected from the Moon. But I don't know whether that was a possibility or not. I never tried to work it out quantitatively to see whether that was a possibility or not. But, anyway, with the development of satellites, it became useless in that respect, if that was its original purpose. It became a very valuable tool for studying radio

astronomy in a very expanded sort of way. Some beautiful science has been done over and over again with it.

But the seismology, ARPA did, in fact, revolutionize. It had been, up until ARPA times, the seismographs were almost invariably in small, Jesuit colleges. Why the Jesuits took on seismology I don't know. I'm not a Catholic so I'm not quite sure what the situation was. But, anyway, they had done the best they could with smoke-covered black drums as recorders and no money and very little science.

Our seismologist was Charles Bates, who's a very accomplished guy, and his boss was Bob Frosch, who was even more so. And Frosh, in addition, had the smarts to deal with external people like Congress, et cetera, whereas, Charlie was a very a fine guy—still is, still in contact with him—but he's modest and modest almost to a fault and needed all the help he could get from his boss many times.

But ARPA set up these 125 seismic stations around the world, in part to develop the field but mainly to have people who would detect a Soviet test and not be somehow dependent on the U.S. If somebody in Ghana said there the Soviet had made a test it would be different from somebody in Lawrence Livermore lab.

But the other thing and the more important thing is to revolutionize the advance seismometers and the whole science. What was happening then was that plate tectonics was finally being understood and accepted. It had been discovered, really, a couple of generations earlier, but nobody had paid any attention to it. But in the early sixties plate tectonics became respectable and, of course, revolutionized the whole field of seismology, in fact, the whole field of geology.

And ARPA was instrumental in getting the instruments and the people. Frank Press, for example—later became the President's Science Advisor—was one of our contractors at Caltech. And the whole sci..., well, it's hard to say the whole science of geology. The whole subject of geology was changed from a non-science to a science during that period and ARPA was one of the leaders, but it doesn't show up as a new program. It was new projects within programs.

I: One of the quotes about Arecibo was, "It was good science for humanity."
Sproull: Yes. Well ARPA did that. And it's still doing good science. It's upgraded to...isn't it true that it's now a millimeter wave dish, that the dish is now accurate to a millimeter? Amazing! But you know the story of the problems with it. The whole point of having it right there was...first of all, it had to be in the tropics so that you use the rotation of the earth to scan the biggest possible field of view. So the ARPA people, this was before my watch, put out feelers, or proposals for the geography. There was a guy at Cornell—gosh I wish I could remember his name—who did aerial photography around the world for corporations looking for sites for plants and things like that. One of the people at Cornell, an electrical engineer, went to this guy and said, "Do you have anyplace where there's a bowl, a natural bowl, in any of your photographs?"

He had file cabinets of photographs of sites. And he looked and said "Sure enough. There's this place in Arecibo, which is almost a natural bowl a thousand feet in diameter. "

That's the way it was discovered and that was the cheapest place to do it.

The problem occurred when Cornell started its contractors to reshape the bowl. The bowl wasn't, of course, perfect. It was a paraboloid, or a sphere, rather. It's not a paraboloid. It's a sphere, a spherical surface. It wasn't perfect. It had to be shaped with bulldozers.

As soon as he started doing that the natural drainage of the bowl went away. He'd plugged up the natural drainage so the bowl started filling with water. All the other contractors say, "Hey, we're land contractors. We're not 'seaborne' contractors—(chuckles)—we can't work with the bowl full of water."

And these other contractors were standing there with very expensive equipment, waiting at the docks, and they couldn't bring it to bear. And, oh, you can imagine what a mess that was.

See that was what was difficult about changing command-and-control research to information processing technology. The Congress was alert to how the Pentagon tried to masquerade things as if they had a military mission when, in fact, it really was just something somebody wanted to do. So there was a little bit of a problem with Congress. Maybe you want to talk about Congress later. I don't know. But we managed.

I: What is ARPA? What is it?
Sproull: Well, it's a group of people. That's all. But it's a group of people with a tradition. And—you want to go farther...

I: How does it do so many projects?
Sproull: Well, the tradition is getting good people and not having them last too long. I've asked myself over and over again, how come this agency is still vital after 50 years? You can't find...I don't know any other federal agency that you can say that of. I think part of it is that the Directors last an average of two years, I think. And the Assistant Directors sometimes last longer. But still, the same rotation goes on.

But also, I think that there's a spirit at ARPA of wanting to get involved with exciting things and interesting things. And I think ARPA—you feel somehow or other that you're not doing your job if somebody else discovers—(chuckles)— something. Obviously you can't discover everything, but the general spirit is that ARPA ought to be at the forefront of anything that it's mixed up in.

Now, it can't be mixed up in everything. I don't know what the program list looks like now, but it's partly choosing the right programs so that there's enough open-endedness in them to stimulate the kind of talent that goes to ARPA. You have got to be a little bit in a bad way because I'm telling you that ARPA has good talent, and I was one of the ARPA so you have to discount that. The fact is it took a chance on me. It took a chance on a lot of people that came to ARPA. But it did that.

In my watch what made ARPA what it is was, was Harold Brown. Harold is really a fantastic character and he was willing to give ARPA its lead on anything, really. He used to say when we got into trouble with his staff—he had a staff man on just about everything we did. For example, on ballistic missile defense, Dan Fink was his man on that. You just had to be friends with Dan. There was no problem. He was a very friendly and very able guy. But some of Harold's people were protective of their turf, and Harold would say, "Look, I selected ARPA people. I don't have to control the programs." And that stopped the argument.

With that kind of connection into the Defense Department, you know, you felt you just had to generate interesting stuff. And you had to be selective and think and cull out the dead wood, et cetera. You just had to.

Incidentally, I never met the Secretary of Defense, McNamara. I was at many of his briefings but I never actually physically shook his hand. But Harold did quite frequently and sometimes there would be something that the Secretary asked to be done that Harold would then ring my red telephone and ask me to do.

But it was a great relationship. I was very happy. As I mentioned before, relations with Cy Vance, although he was friendly and of course, very able, he was not exactly tuned in to project AGILE. When I was in his office it was because I was being called in and spanked. But I was a big boy, so it didn't hurt.

I: Was it easy to talk to Brown?
Sproull: Yes, of course. You could save whole pages of preliminaries, always. You always came away knowing that he knew more about it than you did, so there wasn't any difficulty, wasn't even any slowness in dealing with Harold.

And that's also true with Gene Fubini. Gene Fubini was the original person where the Pentagon expression came, "To gain guidance from Fubini is like getting a drink out of a fire hose." That's an expression that's been used for lots of other people. But it was very appropriate for Fubini.

And if I couldn't get a hold of Harold because he was out of town or something like that, I could get a hold of Gene. And Gene was very sympathetic to ARPA. He loved ARPA. He didn't—how should I say—mother us, but he was always available. For example, I was thinking back when you were talking about Harold.

There was only one occasion I really had a serious disagreement with Harold and that was about the replacement for Licklider. And I had talked to Licklider. I'd talked with some of our contractors. I'd mainly listened to them and come up with the idea that there was a young man doing his military service at NSA, a graduate of Lincoln Lab and MIT, that I ought to have talked to and see if I could recruit. And that was Ivan Sutherland.

And I did that. I made up my mind that Sutherland was my man. But I had to get Harold's approval and Harold said, "He's too young." I think it was a $15 or $20 million project then. "He's only" (I think I've forgotten) "what? About 27 years old. He'd never done any managing. And you've got too much at risk in a program like that to put Sutherland in charge".

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And so I temporized somehow or other and got Fubini in the act. And Fubini, in fact, had met him. Fubini went to the same sources I did and came up with the same conclusion. So the problem went away. He told Harold that was the man. So we hired Sutherland. Sutherland was the beginning of the ARPANet and so on—oh, I've forgotten. Golly sakes. How can I forget the successors to Sutherland? Taylor was one of them, Bob Taylor. Oh, golly. Well, I'll think of them later.

Anyway, Sutherland was a key appointment. I'm very proud of it. That was the only time and I don't know whether the subject ever came up again. Harold defended information processing technology to Congress, as did I. Nobody ever mentioned any problem.

I: What was it like trying to manage ARPA?
Sproull: Well, I don't know. I've never paid much attention to the professional management business. We have a rather fast-developing management school at Rochester now that I've had something to do with. But I'm nervous about the universal manager. Studying management is distinct from managing something that you understand what the something is and what its particular problems are. So, I'm never really alert to management as a profession. I can't really tell you how I managed except that it was always through people. I always tried to manage, or tried to identify the guy or gal, and then see what that person needed to support him or her. It was always "him" in our ARPA days.

And, you know, I couldn't possibly, with ARPA's spectrum of activities, I couldn't possibly understand everything that was going on, but I understood that Sam Rabinowitz was a first-class radar engineer and I never had any cause to doubt that later on. As I got deeper and deeper into ARPA I found he spent money more than anybody else in ARPA. And, you know, it could have been a disaster if he were less good, or if he was dishonest, or bluffing.

The first thing you have to do as a manger is to be sensitive to bluff. And I don't know how you do that but I've certainly spent most of my life doing it. But you have to rely on people and you have to spend most of your efforts selecting them and then supporting them, and then making sure that they're not having you on.

I: That's one of the things that I really like about from my reading on Harold Brown, "I select the people, I don't have to worry about the projects," but, where do you find this kind of quality? Where do the people come from?
Sproull: Well, they come from universities. They come from national labs. They occasionally come out of the Services. I met some brilliant flag officers and field officers in my time. One of them—and I wish I could remember his name—he later became famous in the arms control community. I remember I wanted to get a briefing on—this was early in my career there—I wanted to get a briefing on something involving ballistic missile defense. He came in with a field of other people around him as the military usually does. And he started doing this and I asked a question and he didn't answer the question. He said something else not completely different, but quite different.

And I almost said, "General, answer the question."

Then I remembered that Sam had been telling me about this guy. And he said, "Watch out. He's a very bright general."

So, I didn't ask the question. So I didn't say, "Answer the question."

Sure enough about three or four questions later I realized that he had skipped over a lot, he knew what question I was going to ask him—(chuckles)—about five questions later and that was—he had answered that. So, you know, I broke out into a cold sweat. But there're people like that situated around. You have to find them. And with all the interactions that ARPA gets into, you find them. Then the ARPA contractors; not only universities and national labs, but also industry. And they're out there. You just have to be alert to them. And then you have to make it worth their while to come, which isn't all that easy sometimes. You only have government salaries, and you have restrictions on what you do after you serve, so it's not all that easy to get them

I: Kennedy was killed. What was DARPA's reaction?
Sproull: Yes. Well—(chuckles)—that's interesting.

Well, everybody immediately realized that if we couldn't do something about this, what were we doing? The big thing, of course, was the realization that it was government by assassination. You've got a President picked by an assassin and that's the last thing you wanted to do with a country.

So, there was a realization that we ought to try something. So, over that weekend, I was consulting most of my associate directors, and they were consulting their people. "What do we do?"

On Monday, we started a project called project STAR, which was the protection of the President. It was vastly complicated by the fact that Lyndon Johnson was going to be running for President in a few months. So we knew that we couldn't possibly let the project be known. As soon as it became known, it would be killed. And that was complicated because ordinary security isn't enough. You know the Pentagon leaks like a sieve. So, how are we going to keep it quiet?

We did it by having only two people in ARPA do it, though they were reaching out to get ideas from everywhere they could. They started in ARPA. I think they started an IDA contract on the Monday following the assassination but I'm not sure. They could easily have. This could be one case where we had to go through the Secretary of Defense office.

I immediately talked to my boss Harold and told him what I was up to. He endorsed it and, in fact, produced some ideas. But we were short of ideas, and I'm not sure but I think they're still—(chuckles)—short of ideas. It's not easy to see how you protect a president and leave him available in a public way, in an obviously public way, but the phrase that goes up until its nauseating and in an election year, the "American people"... (Chuckles). But, you know, you have to: A) protect him, and B) expose him.

And so the interesting thing that developed then was for a couple of weeks, everything went along fine. We didn't discover anything. We didn't have any good ideas, or any great ideas. I guess some ideas did develop. But we

weren't bothered by anybody. It didn't leak out. But then somehow or other, in about three or four weeks time, the Bureau of the Budget learned about it. You had to spend money and even though it was out of the Secretary's office, it still was subject to BOB controls, et cetera. They had some alert person over there. My guess is what happened was some bright young person in BOB said, "Look, if I know those ARPA boys, they're up to something, because how could they let a thing like this go by and not be?" Because that's what everybody in ARPA was saying. I suspect that somebody in the Bureau of the Budget must have said that, and so he raised the question in the Secretary's office and the Secretary had to admit that there was this thing going on.

So, okay. What happens, then? Harold was called into Kermit Gordon's office. Kermit Gordon was Director for the budget. Outranked Harold in the federal system. And so he called Harold in. Harold took me along and we went over to Kermit Gordon's office, explained to him what we were doing and why. He could see why very easily. But he said over and over again, if Lyndon Johnson ever caught wind of this thing, that not only Sproull, but Brown, but McNamara, but Gordon would—(chuckles)—have their heads chopped off. I was expendable. I was no problem, but Kermit Gordon was thinking of his own head, sure. Very able guy. We never had any other problem with him.

But, anyway, he listened to what I said about the program and in particular the things we were doing to keep it quiet. And so finally, I think Harold asked, I don't think I asked. I think Harold said, "Well, Kermit" (I wasn't on a first name basis to Gordon, and he was). "Kermit, what do we do?"

Gordon sighed a little bit and says, "Well, I think there're only two things possible. One is we shut up the shop this afternoon, not tomorrow, but this afternoon. Or, the other is we go over his head. I suggest we go over his head."

Well, you know, I lost not only a breath, but a whole, close to a lungful of breath. We're going over the head of the President of the United States? But we did. We kept the project going. It never got out, I don't think. And Johnson got reelected. As far as I know he never caught wind of the project.

Now, it would be nice to say that we developed some brilliant approach that protects the president perfectly and keeps him well exposed but I don't think I can say that, but you'll have to admit it's an interesting story.

I: Fascinating.
Sproull: STAR was the only thing that is an absolutely new program and that "reorienting information processing." Everything else was done within the confines of the individual projects already going.

I: Most of the projects were from the President's office, or from the Secretary's office. Is that correct?
Sproull: You know I'm not at all clear how the original ones started. I thought that York, and later Harold, must have been the authors of most of them. York was heavily involved with the President's Science Advisory Committee and its President's Advisor's office. The projects weren't leftovers from the big-booster

days, which was missile defense. I think they mainly came out of York's office and out of the OST, Office of Science and Technology.

But I think Harold must have generated some of them. You know, I never really asked that question.

I: When it came time to leave DARPA, did you reflect?
Sproull: Sure. I've been reflecting ever since, but you've heard a lot of my reflections already.

Harold had said that he wanted to appoint me for at least two years and I said, "Well, I'd be willing to consider it for, at most, two years." So, we settled on two years. I had already agreed and decided to go back to Cornell and had gone on leave from there for two years. Actually, I was really not on leave the second year because Cornell gives only one-year leaves. But it was sort of understood that I was going to come back.

So, I remember Harold said he was envious that I knew what I wanted to do. I wanted to be going to university administration. He hadn't really made up his mind what he wanted to do. And as you know he did some interesting things afterwards.

But I did a lot of reflection on ARPA later on, much later when I became president at Rochester. A lot of the things I learned at ARPA I could apply, management techniques, if you will, but nevertheless I learned mostly about people and how to learn about people. And of course I later became Chairman of the Defense Science Board and so I kept an interesting life in Defense things for several years afterwards.

But the three years I was the Cornell Vice President, I was in the Pentagon and in the AEC at least, oh, once a month. More likely several times.

I: I was wondering what it was like to be at ARPA right on the edge of science.
Sproull: It was on the edge of applied science. It wasn't on the edge of that kind of science that upsets the apple cart, the thing that people get Nobel Prizes for, it wasn't on the edge of that kind of science. That's not only 6.1 — is that terminology still?

But it's sort of 6.0. It's more 6.1 than 6.0. ARPA was mostly 6.2, advanced development, and that's what it's good at: taking stimulating, good scientists to develop things that then become new developments, and then developing them. But I think ARPA is all the way connected all the way down to what I call 6.0. It doesn't support. It reads the literature and it talks to the people.

I insisted that in the behavior of all of our people at ARPA that a contractor could come in, and no matter how hungry he was, or how even greedy he was, there was always something to be learned from him. And that was the kind of attitude and setting I liked to get going in ARPA. I think I did. We always could learn something from people in the field. We had such wide connections. That meant we were in connection with an awful lot of science and engineering.

I: Was it an exciting time?

Sproull: Yes. And, in fact, on the day when I was exploring the Pentagon and the Pentagon was exploring me, Ruina said, "You'll always read the newspapers differently after being the Director of—(chuckles)—ARPA. "

And it's certainly true. You read behind the policy questions into the technology questions and it does have, in a sense, some excitement to it. There's just no question about that.

Also, unfortunately, it has a bad side in that you always have kind of a disappointment, the things that you're not equal to, that you couldn't do something about. But it really is an exciting atmosphere. And I guess it's, as I mentioned before, somehow they've managed to maintain that for 50 years, which is really exciting.

I: Weren't there any projects in the Navy that involved risk that you were in. What did you mean? Was "risk" part of the excitement of ARPA?
Sproull: Well, yes. I felt that if there wasn't a risk involved in a project, it wasn't worth ARPA doing it. Of course it usually involved just wasting money. It didn't usually involve risk of people's lives or anything like that. But the risk is that you'd spend a few million dollars and get nothing out of it.

But ARPA had to do that or it wasn't on the frontier. But, I don't think we ever undertook anything that was a risk to life and limb if we knew about it. In fact, I don't think we ever had any casualties in my—including in Vietnam, although General York, who was not our man, but the man we dealt with over there, tried to get me killed a couple of—(chuckling)—times just by putting us into positions where were too close to operations for my safety. He would have gotten a medal for it, but I could hear my friends saying, "What a stupid thing he was doing."

I: What relationship did you have with Congress?
Sproull: Well, it was fascinating. I was worried about that more than anything else. I had testified as a civilian before Congress before and I knew that they treated outsiders with kid gloves, but the insiders who were spending money they treated very much more carefully.

But I had a first-rate assistant, Donald Hess, who was the Director of Program Management. He replaced Bolton. Bolton was good at his job but he was not the kind of person I wanted to have as a window to the contracting community. He always behaved adversely to the contractors. I wanted to be more sympathetic. Not giving them in any way anything but nevertheless seeing their problems as well as ours.

Anyway, Hess was a superb program manager. He always helped me by preparing the program book and going with me. He and I went together but nobody else. I think maybe Charlie went with me one time. He always wanted to go to—(chuckles)—Congress and I couldn't deny him at least one chance.

But the Armed Services Committee had an aid, Ralph Preston, who was superb. We dealt with him and George Mahon, the Chairman of the Committee, was also very friendly, really—how shall I say—polite and genteel Texan? I haven't been asked that, so I've got an answer that I think is correct, namely that

the best way of describing our relations with Congress is that you're giving a seminar in a subject that you're very familiar with but you're giving it to one of the grand, old men in the field, who is no longer involved with the field. So, you have to explain everything in more elementary terms to him. And that seems to me the atmosphere that pervaded my relations with Congress. I was scared to death but in the end I found them really very cordial.

We always got what we wanted and we were very careful, of course. And that's where Preston came in, to make sure that the language, as it was called, the language in the report didn't hamstring us which was a real issue coming before the Committee each time. What were they going to write in the report about telling ARPA to do or not to do?

And of course, we wanted the maximum freedom. And when we didn't get it, or when we had to change, for example, the IPT thing, we were very sure that we went up to Congress and dealt with them and made sure that we had their blessing. We wanted to transfer the 125 seismic stations to the Coast and Geodetic Survey. That would require several committees in Congress to approve of it and it wasn't done until very much later. I admire some nameless ARPA Director for getting it done because it's a very hard job, as you probably know.

And materials, we wanted to transfer the IDLs to the NSF and I started to do that but, again, it required several committees and it wasn't done but about three, maybe two, Directors later. But it was done and so ARPA managed to keep good relations with Congress at least several directors after I served.

I: The JASON. What is JASON?

Sproull: Well, JASON was a very interesting group of geniuses and semi-geniuses. The time I was involved, peripherally—I was never involved directly—it was young people, but it started with really the high priests in the business, people like Van Neuman and Bethe and so on. Many of them had made their reputation in the military during the war in the atomic bomb business.

It's a study group. Anyway, this group organized and selected a bunch of young people and then resigned within about a year or two after the start. So, JASON was formed by people you might call the high priests of physics and chemistry, mathematics, but then they quickly turned it over, quite appropriately, to young people which is where the ideas and real imagination's going to come. And so the JASONs did what they wanted to do, essentially, although they looked around and visited Navy laboratory and Army and Air Force laboratories. Talked, had briefings of military problems and so on, and then selected problems of their own, which they did mostly in summer sessions for two or three months in summer, although they usually had a winter meeting, but they did their work during the summers.

They're very interesting guys, many of whom got to the absolute peak of their profession. And nobody tried to manage them. From time to time, we would suggest things to them, and I remember during my watch particularly one suggestion I made that had to do with reentry physics. We had decided in ARPA to put out a contract for a good many million dollars, I've forgotten now how

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many, on some of the physics of what complicated process goes on when a ballistic missile reenters the atmosphere, because we wanted to be able to distinguish a warhead from decoys. That was the main business, really, of DEFENDER. And there was some problem connected with that that looked like a physics problem. We suggested it to JASON.

Two people, Freiman from Princeton and Salpeter from Cornell, said, "We would like to work on it." They worked on it during a summer, solved the problem with trivial additional expense and saved ARPA not only a good many millions of dollars, but probably two years' time.

That kind of stands out. And, obviously, there're not many such exciting, individual, describable projects. But that's kind of the essence of what JASON was trying to do.

The contract was actually held by IDA. We just gave IDA some money, and they did all of the logistics, et cetera, for the contract. Nobody told them what to do. We always put in front of them what we thought were interesting and stimulating questions; there were plenty for them to do.

They've gotten into trouble recently, I guess. I don't know. I guess there was a book bad-mouthing them. Isn't there?

But as far as I know: a) it's still going; b) it still has brilliant, young people; and c) it's still a good idea. But I don't know. I'm not in touch.

I: Did you feel like you left it in good hands? What is ARPA's future?
Sproull: Well, okay. Boy, that is, this first one's fairly easy. The second one's the hard one.

Yes, I thought I was in good hands. Herzfeld was ambitious. Probably still is. Wanted to be Director when I became Director. There was a little bit of a problem. You talk about management and that's one of the problems you have in managing.

But I thought he was doing all right with DEFENDER. I didn't think it was needed to spend anything like as much money as it was spending. But there were interesting and important questions being explored. And I left the nuclear test detection, which is the second-biggest project, in excellent hands. Frosch is one of the superb managers around. And Sutherland with IPT, which was in many ways my favorite program. So, yeah, I put my heart on my sleeve. I thought it was in excellent hands when I left it. Thought it was in better hands than when I arrived, but I'm probably wrong.

Now, the second question is what's the future? Well, I don't know. I think as long as, you know, a lot depends on whom the secretary gets as DDR&E. I don't think there is really a DDR&E anymore. It's a changed. It's a changed structure. But if the structure is still the same, namely that the ARPA director reports to one guy, who reports to the Secretary of Defense, then I think DARPA still has a pretty good future, actually, a great future.

There are still lots of problems out there that scientific work can be applied to. Unfortunately, the Homeland Security is a little like the AGILE project. It's hard to get a scientific tool in to work on it. It's more a retail thing rather than a wholesale project, like DEFENDER.

So, I'm sure that ARPA must be working on Homeland Security but they must also feel very frustrated not being able to get in and apply strong science and engineering. Because you can do some of that, obviously.

But you may not get at the heart of the question, which involves more questions of sociology and political science and so on. And the just necessary hard science.

But I think ARPA has a great future. I don't think these moves to make ARPA-like things, like ARPA. Some people promoted an ARPA-E for energy. I think that's a bad idea because I don't think the connection into the Department of Energy is at all the kind of connection that ARPA needs in order to be able to do its job, to do a job that's different from anybody else. As long as it does the same job as other people, why have it?

I: Why do we have ARPA?
Sproull: Well, that's a big question. The goals of industry are different from the goals of universities are different...You have to have somebody that has the defense of the country uppermost on their plate all the time, regardless of where you are in this 6.0 to 6.4, 6.5, I guess it goes, train. It's always still the idea you have uppermost in your mind the goal of defense of the country.

Nobody else has that. And there's nobody else that has the ability to cover that ground. ARPA can apply to the same project people from universities, from industry, from military, from national labs, which is a kind of a ghost and management sort of horizon.

So, I think there's a strong role for ARPA. The main thing is; my question is when you have retail warfare, such as in Iraq now, that's sort of the environment that ARPA had in Vietnam and you face the same kind of frustrations, namely trying to apply high technology into a low-technology environment, and you're getting some reason for doing anything at all...

ARPA, after my watch, when we were in the shooting war in Vietnam, did do some projects I was interested in and better not talk about because I'm afraid some of them are probably still classified. But I think that ARPA had a role to play, but we face the same frustrations and same limitations, restrictions in the Middle East that ARPA faced in AGILE. So, it must be frustrating to be a Director of ARPA now and not be able to do more for what is the central arena of conflict.

I: Anything else that you'd like to add?
Sproull: Well, I don't. I'll think of lots of things after you leave.