ORAL HISTORY 2 TRANSCRIPT

DENNIS E. FIELDER
INTERVIEWED BY CAROL BUTLER
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BUTLER: Today is September 13, 2000. This oral history with Dennis Fielder is being conducted for the Johnson Space Center Oral History Project at the offices of the Signal Corporation. Carol Butler is the interviewer and is assisted by Tim Farrell and Sandra Johnson.

Thank you joining us again today.

FIEDLER: A pleasure.

BUTLER: Last time we talked a lot about your early days at NASA, a lot with the communications and your work in that area. We did talk some about your work in the advanced planning as well, future planning, but I wanted to go back first and ask you a couple of questions just on some of your thoughts on Apollo, even though you weren't specifically involved with some of the missions. I'm sure you followed them as they were going along. Actually, when did you first learn about the lunar mission studies and their first efforts toward getting involved in that?

FIEDLER: I was still at Langley [Research Center, Hampton Virginia], probably '61, '62, and I'm sure just after the President [John F. Kennedy] had made his grand announcement, and I was not privy to any of that work that was done before that at the time. Chuck [Charles W.]

Mathews pulled me aside one day and said, "We need to look at Apollo's ground support system." That's about the earliest I can recall. I don't even really remember what we did about it, other than I'm sure that got us involved in the Deep Space Network [DSN], which up until that time had been virtually dedicated to the unmanned exploration satellites. You're familiar with the Deep Space Network?

BUTLER: Yes, run from JPL [Jet Propulsion Laboratory, Pasadena, California]?

FIEDLER: Right. That became a major element of the network to support the lunar missions, but it had not yet been integrated into the manned spaceflight program at that time.

BUTLER: Were you involved in that whole integration process then?

FIEDLER: I believe so. Can't remember much of the details on that. That's about as early as I can recall getting involved in the Apollo Program. I was never hands-on on the Apollo Program. I was always downstream, upstream, in front of the Apollo Program, to some extent, which is the destiny of a person who's in the planning business, I guess. So I just followed along behind the activities.

BUTLER: How closely did you follow any of the missions, even though you weren't directly hands-on or directly involved?

FIEDLER: Just sitting in the back room of the control center, not always. Most of the major events I was elsewhere. I know you asked me where was I when we landed on the Moon, and to this day, I cannot recall that. It didn't register that significantly, I guess, although I can remember looking up at the Moon at that time, and it was a bit impressive.

BUTLER: Did you think back at all during that time as they were in the process of landing on the Moon and think back to just the few years previous when Kennedy had made the announcement to go and all the things that had been done in between?

FIEDLER: I don't recall. I don't really recall that in that context.

BUTLER: Just working on and doing your job then. It was all part of it.

FIEDLER: Something like that.

BUTLER: You said you don't recall specifically when they landed on the Moon. Do you recall anything surrounding the decision of Apollo 8 to go to the Moon?

FIEDLER: No, that was all done—I was not involved in that set of decision-making activities. I was probably wrestling with AAP [Apollo Applications Program] at that time and with the Marshall [Space Flight Center, Huntsville, Alabama] crowd, who were for the disabling, making the Skylab from a spent Saturn stage as opposed to launching a developed stage.

BUTLER: That's the wet workshop versus the dry workshop?

FIEDLER: Yes, that's the game.

BUTLER: Could you explain a little bit about that and some of the differences and some of the pros and cons of each approach and how that process came about?

FIEDLER: I only recall that the wet workshop, if that's the right way to describe it, was the focus of the Marshall approach to the program, the initial Marshall approach to the program. I would presume that one of the reasons it was their focus was in that direction because at that time there had been no visible end to the Apollo Program. It was scheduled to go through Apollo 24, 25, and there was no termination specifically built into the program at that time. So there was no, quote, "residual" hardware, okay?

To have done a dry workshop you would have had to pulled an up-rating entity and add to the production line and refurbished it, and the production line was all set up to keep Apollo being launched three times a year or whatever their rate was back in those days. So I'm sure their focus was reutilize, reuse, take advantage of the fact that it's up there. It doesn't take much extra energy to keep it in orbit, and you don't have to dedicate an in-line production unit to that end. So I believe that their logic was built into that kind of background.

It wasn't until probably it became very obvious that the production line was producing more hardware than was going to be used in the program, that thoughts started on utilizing the residual hardware for whatever programs could best utilize it. So I think that the dry workshop evolved out of the concept—not the concept, the awareness that there was going to be residual hardware in the programs.

The Skylab Program, as such, was all based on residual hardware left over after [Apollo] 17, or if you count down from 17 or forward from 17, there was eight or nine sets of flight hardware. The command modules and service modules all became the revisit spacecraft to Skylab.

Then on top of that, there was the Apollo-Soyuz [Test Project, ASTP] program, which was again a residual hardware program. So that's, I think, a little background as to the wet versus dry. I'm sure there were many, many other issues wrestled with, but I think probably from a planning viewpoint, regardless of whether there was residual hardware, the sheer concept of converting a wet workshop to a dry one in space was a bit more than we were going to wrestle with in the same time scale as Apollo. So, I think, probably from a planning viewpoint, the wet one was dismissed very early in our minds, but it usually took a little longer to dissuade Marshall, and it didn't take long, I'm sure, to do that either.

I think the residual hardware game, it was a very valuable pool of resources, some of which is still lying around in institutions, exhibits. That's about as much as I recall on wet-dry.

BUTLER: That's certainly a good description.

FIEDLER: Although there was a lot of work done, design work done. I remember drawings to the gazoo flowing through the system on how to convert that stage to a habitable stage.

BUTLER: It would certainly be a complex operation.

FIEDLER: Yes. Wasn't the way to go.

BUTLER: It seems to have worked out the way it did eventually. How was it that you did first become involved in Apollo Applications programming, and when you first became involved in it, was that planning for Skylab or was that even not that well-defined?

FIEDLER: Well, you've opened a little door. I wonder how much will come out. The Apollo Applications Program, I believe, was rooted in some kind of exercise to show that space programs could be economically beneficial. I recall getting involved in a lot of—I don't know if "research" is the right word, but exploration into what applications programs made money or could conceivably make money. NASA did not make money, but you wrestled with the social advantages or whatever.

It was at that point in time, I know we talked a lot to the life sciences people, and they were exploring these romantic things that an Earth observation satellite could detect specific plant life on the Earth's surface and that plant life was the habitat for a certain snail and that certain snail was a habitat for a certain virus of some kind, which turned out to be some dread disease in Africa somewhere. So the argument was that Earth applications programs in the life sciences direction could come up with all this world health-type information to this fairly interesting sequence of relationships between the color of the grass to the management of a major disease in an undeveloped country.

So we started exploring all that, not in great technical depth, but just a collection of one-liners with a little exploration that said all these good things are of some benefit and you get them from Earth observations programs.

We had a parallel group that said, "Well, you don't have to do that from space. You could do that on the ground once you know how to do it." But most of the time we came up with the observation that you could do something from space that was beneficial, and then this other group came up and said, "Well, you could do that from the ground." But if you could do it from the ground, it was immediately available. You didn't have to launch an Earth observation satellite. So there were spinoffs from that intellectual exercise that said some of the stuff you didn't have to fly. You could do it from airplanes, don't have to have a satellite to do that. So we were left with a few things that were space-related that were of some benefit.

The Geological Survey business was another major thing. The Earth-mapping was another thing. It's difficult to do with a few sweeps. The early AAP program was just based on that kind of assessment, and how much of that actually got built into the AAP program in a technical sense, in a hardware sense, I'm not sure. [R.] Bryan Erb can probably tell you all about that. If you've had him in the interview, well, it was his world in those days. Earth inventories, forestry, all sorts of wonderful things, the Earth observation scientists, technologists, were coming up with, that Earth observations could lend to the program.

We were only involved, I was only involved in that because it was a set of arguments for the program, not that I was in the Earth applications business. But it was a sort of an early attempt to put the whole values together, which were good value subjects. But I cannot remember what years that was. It was pretty early in the program. The life sciences people were quite active in that, the physicians in the life sciences program.

BUTLER: At what point then did it begin to evolve to be Skylab, and how far into that were you? Did you stay focused on the Skylab idea?

FIEDLER: I don't remember. Doesn't ring a bell.

BUTLER: Okay. That's fine. It's certainly several years back and there was a lot going on, so we don't expect you to remember everything in full detail.

When you were beginning to look at it being Skylab, what were some of the other key issues? You talked about the wet workshop versus dry workshop and tying in some of the Earth observations work. Were there other issues you looked at at all, like dealing with the long-duration flights or how any of that would be different from Apollo and Mercury and Gemini?

FIEDLER: It just doesn't ring a bell. I know my problem is, I'm always ahead of the programs, or was ahead of the programs. None of that comes back to me. It probably will later on.

BUTLER: That's fine. You mentioned some of the other applications that you had been involved with, such as some of the satellites and even getting into solar energy, satellites of some of the other programs you'd been involved with. Were there others, too, that came along during this time frame that you were working on for applications or were those pretty much the primary—

FIEDLER: Rephrase the question.

BUTLER: Okay. Basically, what were some of the other areas of applications that you explored besides like the Earth satellites? You had talked before about some communications satellites and solar energy satellites. Were there any other areas of focus for the Apollo applications?

FIEDLER: We talked about solar energy? Apollo Applications Program, AAP, was, you know, pretty well defined. There wasn't too much exploratory research involved in it. It was all well thought-out applications. Solar energy conversion or acquisition or use in space or prospective use on the ground from space was mostly paperwork exercises, paperwork exploration.

In this month's *Popular Science*, there's an article on a propulsion system based on solar energy focused onto liquid hydrogen as the propellant, as an advanced propulsion system, which is the first time I've seen solar energy employed in any objective way in an advanced study. But that's because it's in the lay press. It may well have been going through the hallowed halls of the agency for some time. In fact, I'm sure there's a whole group who wrestle with solar applications as a subject.

We played with it in the advanced concepts sense. It's a huge resource, and sometime in the future it will obviously be the way to go as a principal source of energy for whatever reason. I mean, it's a horsepower per square yard, for want of a better term. You can very rapidly get all sorts of major energies from relatively small arrays of solar collectors if you can get 100 percent conversion. But even at 10 percent you're doing very well.

So on a terrestrial basis, never mind the space program, solar energy, the conversion of solar energy to something useful on the ground is obviously the way to go. Just think how painful it was to go outside the door the last three or four weeks. Yes, an enormous resource that's untapped, at least in this general area. There are places that work it.

There was an energy exercise, and I can't remember the name of it. It was an effort that was done in concert with the Department of Energy, DOE? We had one of those once, didn't we?

BUTLER: Yes.

FIEDLER: And it was essentially what did NASA know about converting resources in the energy business. They did a domestic exercise on a shopping center to convert an energy-efficient shopping center, which meant all sorts of energy conversion systems and solar arrays. What is the name of the guy who did that? Bob [Robert O.] Piland was involved in it at some point in time. But NASA lent its wisdom to that and mostly in the solar conversion, energy conversion business.

We did some studies on the concepts of use of solar energy in space, converting it in some form to transfer it down to the ground, but we talked about that before, didn't we.

BUTLER: Where would the ideas come from that you would study in the advance planning? Would they come from people in your own group, or would they come from outside sources, and how would you decide which ones to look at and which ones to examine?

FIEDLER: Well, there was a contingent of people throughout the agency who got involved in this kind of thinking, and they would meet fairly regularly at each other's institutions, in a fairly open forum. There would sometimes be a focus. Sometimes it was a future space station of some kind. As soon as you started building that city in space, which was usually the concept behind most scientific objectives, particularly the university crowds, who were always building these huge, circular rotating stations that had populations of thousands in it, but it didn't really matter. It was dimensions that gave you more parameters to wrestle with. But all these things got tossed around. Nothing was unacceptable at that point in time. But sometimes you wrestled with just mechanisms to expand your thought train. You could just write words and a list of nouns that relate to different sciences or technologies and then just started matching them together and see if you could get some sensible parameter out of it.

For maybe an example, if I can think of it, and it was in an acoustics textbook from the fifties or sixties back then, and a guy had written, just written down all the applications and technologies associated with sound, and by combining the words—there was sound, recording, okay, speech recording, and then it was speech-to-sound, sound-to-writing, okay. This was almost before digital machinery. But the guy just sat down and wrote these words down and said, "You can't do that." You can't go directly from sound to the written word back in the sixties. You can hardly do it now. [Laughter] But it is well within the technology bounds. But just by combining those simple words together, you come out and wrestle with, "Hey, that doesn't exist," or "That's not possible, that's not practical," but you just toss that kind of game around. It's just like a scrabble game, and it just simulates thought. That's all it really does, but it's one mechanism.

Other people seem to come up with these unbelievable ideas from nowhere. But most of it was just round-the-table discussions like that. The scientific community tend to focus into—not all of it, by any means—but they tend to focus on a very narrow technological spectrum, but in great depth. They'll come out of the woodwork with some scheme that seems impossible to you, but they'll sit there and argue the physics for it and the applications for it, so you beg off and try and do some engineering in the same direction.

Lots of those folks used to show up to these meetings. They weren't even interested in the fact that you were in an advanced space program. They just wanted somewhere to voice their thought about whether these ideas had any merit in your direction. If it didn't, they disappeared and went off and found some other mentor or font.

NASA was pretty good at allowing that kind of interchange to go on. To my mind, they allowed it to go on. It certainly did go on, and it was kind of interesting to see the scientific communities and the university communities and the engineering communities all sitting around the same table putting ideas down. I think NASA used to probably bound these concepts with dimensions like putting a size to something or a cost to something to sort of provide some focus to the discussion. I'll think of the names of some of the people involved in a minute. They're still in the game.

BUTLER: How well did these groups from universities and from the science world and engineering and NASA come together and work together? Was the relationship pretty good?

FIEDLER: When the group was small, they did okay, because they all tended to give each other equal time. But when it got large, you got sort of political consensus flowing in the system. Sometimes they just didn't want to be bounded by pragmatics. The engineering side of the crowd used to put anchors on the ideas sometimes. Well, they didn't want that. So sometimes you were dismissed summarily from the discussions, like, "Don't fence us in." [Laughter]

I think every agency, every center in the agency, supported these things, and I'm sure they still do. I'm sure there's an advanced group over there somewhere, doing stuff like this. In fact, they're the people doing the manned Mars program studies, although I wrestle with that sometimes.

BUTLER: About whether it should be done?

FIEDLER: Well, I know I've said this in a previous thing about it takes a week to get to the Moon, and you spent a week there and a week to get back. It's nice roundtrip. The system seems to work very well in those general dimensions. It takes two years to get to Mars, and you've got to stay there for a block of time before the return part comes back, and it takes another two years to come back. I just had never really thought that the hardware, the software, nor the human endurance is really set up for that kind of program. And until you can make Mars a three-week trip, okay, and you can adjust your stay time accordingly, and another three weeks to get back, you're stressing the whole system in terms of endurance now.

To get from here to Mars and back in three weeks means essentially you've got to thrust half way, accelerate half way, turn around and decelerate the other half. You have to expend energy all the time, and you get close to the speed of light somewhere in the middle. But you're getting your travel times down to what I think are reasonable, two years just to get there. That's why everybody in the science fiction world has this stasis business where you sleep all the time. I really think the Mars program, they'll probably pursue it to some ultimate end. But transit times are the things I think are the biggest burden the programs have to bear.

We did studies of nuclear transportation, nuclear stages, which have all the usual problems. But assuming you can solve the problems, the environmental problems associated with a nuclear stage, it has that kind of energy. You can thrust it a half G halfway, turn around and decelerate at half G. So you've got almost a gravity environment, so you're not wrestling with all the physiological problems you get with that kind of environment. But you have to expend an enormous amount of energy, but given a nuclear kind of concept, you can do that.

Nuclear stages have all sorts of environmental problems, local and otherwise, so you have to put lots of mass in the shielding and other good things. So there's lots of problems to solve with that kind of thing. So we played those kind of games and, for my money, in those days the manned Mars missions were put on the shelf. Until you can get adequate energy involved in the program, we ought to stay with their two-week, three-week time. There's plenty of time to do with that as you're slowly coming about now with the Space Station. So while I think Mars exploration is a great thing to do, I think it's the profits of the unmanned satellite program world or the robotic world for the time being. Long answer to a short question.

BUTLER: No, that's fine. That's fine. It's a good answer. As you were doing a lot of these studies, how much of them were mostly just paper-oriented, and how much did you do or arrange for various tests to get some of the data to support them? Did you do much of that, or like human studies or any of those type of—

FIEDLER: No. Most of those studies that I was associated with were paperwork or software exercises. Some of the universities were running parallel R&D programs in some of these directions. But the advanced studies, depending on how far into the future they go, they don't get a lot of funding. A lot of it's done because of the intellectual challenge of those things. Small groups sit on the side lines and do that kind of thing, but for awhile NASA—and probably still does—put seed money into this game, which is mostly in the form of travel and supporting the appropriate documentation and publications and stuff like that. It's a communications program, really. However, there was one—I don't remember it well. No. Not coming.

BUTLER: Okay. Going back, jumping back to Skylab briefly, did you have any initial thoughts about the Skylab itself? We did talk some about space station in general last time, but just the idea of having a space station up there and how long it should be there dealing with some of these human issues on the long-duration flight?

FIEDLER: Well, it was the first time they put anybody up there longer than whatever the length of the lunar mission was. So that was a great excitement for the physiological information. I know I was enthusiastic about the fact that they were going to do that program and that they did it. I think they visited three times. But it was somebody else's program at that point in time. It was hardware and people and operations and all that good world. We were an advanced frame for all that, at that time.

BUTLER: At some point in the planning for Skylab, you did have a little bit of involvement in proposing some names for some of the missions. I don't know if you recall that at all. Some of those are quite entertaining choices [referring to documentation].

FIEDLER: Good heavens. Is that right?

BUTLER: We came across that when we were doing some of our research.

FIEDLER: What were the names of the three missions?

BUTLER: All we've ever found is that they called them just Skylab. They called the first unmanned launch Skylab 1 and then the manned ones, Skylab 2, 3, and 4 and never had any specific names applied to them.

FIEDLER: Good heavens. I don't remember any of that.

BUTLER: No? I was going to ask if you had any favorites off of that list.

FIEDLER: [Laughter] Abraham, Martin, and John. Wasn't that a song in the sixties?

BUTLER: Abraham Lincoln and Martin Luther King [Jr.] and John [F.] Kennedy.

FIEDLER: No, there was a song in the era that was "Abraham, Martin, and John."

BUTLER: Yes.

FIEDLER: "The Three Graces." Wow. That would have been a good set. "The Three Fates."

BUTLER: Yes, I thought that one was kind of interesting.

FIEDLER: I know I used to play these games every now and again, but I don't remember this. In fact, in there [referring to documentation] you mentioned the business about a memo proposing to build something out of spent stages.

BUTLER: Yes, we did run across that as well. I don't have that one handy, where you talked about using spent stages of the Apollo missions to build this space station. Actually, later on, probably after you had already left the office, there were some studies about using the external tanks off the Shuttle, boosting them into orbit and using those—are you familiar with those as well? I wonder what some of your thought would be on those.

FIEDLER: Well, it was just shortly after I'd actually started with NASA with the business about using the spent stages. It's simply because you can do so many things with just tubes, okay, and they were there. The last stage actually went into orbit, but rapidly decayed back down. It didn't go very far. It wasn't really a very intensive exercise, as I recall. Everybody was so busy trying to get things done back in those days, so that memo didn't go very far.

Was Skylab a sister of Apollo? I remember I had a book of Greek mythology sitting on the desk, and a lot of this stuff comes from not my in-depth knowledge of Greek mythology, but they always give it the names of the gods, whatever the gods are, right? [Laughter]

BUTLER: Absolutely.

FIEDLER: And most of the project names were being given Greek names at that point in time. How about that? Sneezy, Dopey, and Doc. [Laughter]

BUTLER: I think that shows some of the spirit, too, that surrounded, seems like NASA as a whole. Even though there was always the job to be done, and—

FIEDLER: You didn't find the memo about crossing the International Date Line?

BUTLER: I didn't run across it, but it may be there.

FIEDLER: I vaguely recall writing one about the International Date Line.

BUTLER: For the Skylab?

FIEDLER: No, it was something to do with the fact that people were traveling all over the world back then, and the Apollo and the Mercury crossed the International Date Line. As you cross the International Date Line, you lose a day or gain a way, whichever way it is.

BUTLER: True.

FIEDLER: So if you do that nine times in twelve hours, then— [Laughter]

BUTLER: That's a good point. That's a very good point. Things could get very confused that way.

FIEDLER: Well, yes, it was an interesting exercise if you didn't realize that while you're crossing the International Date Line and pick up a day, while you're traveling the rest of the orbit, you're losing a day, so you lose the same day you pick up as you cross, but nobody really tells you that. [Laughter] But it's something about coming back to where you were before you left.

BUTLER: It's one of those concepts of orbital mechanics coming into play there.

FIEDLER: Perhaps this is a digression. Did you go to Dr. [Robert R.] Gilruth's memorial service at the center?

BUTLER: I did.

FIEDLER: Do you remember the story that Max [Maxime A.] Faget told about crossing the International Date Line and "taking all day"? [Laughter]

BUTLER: Yes.

FIEDLER: There you go. That's the kind of thing we used to play with.

BUTLER: Yes, that's a pretty good one.

FIEDLER: How neat. Do we know who K.A. is? And who A.V.L. is [referring to same document]?

BUTLER: Not immediately offhand, but we can check. The phone books would be good, or the org charts.

FIEDLER: E.R.

BUTLER: We can certainly get you a copy of that and we can locate who those people might have been.

FIEDLER: When did Skylab fly?

BUTLER: Skylab was in '73. The first launch went up in May, and then the last one came down—

FIEDLER: And this is '71.

BUTLER: Yes.

FIEDLER: Two years' lead time. Was this out of the blue, or was this called? [Laughter]

BUTLER: That I don't know. We just found it in the files. I think it says at the bottom which particular files it might have been. I'm guessing the Skylab chronological files maybe.

FIEDLER: I can't really read that.

BUTLER: I think we have another copy of it.

FIEDLER: A.V.L. Who is A.V.L.? You gave me a list of places I worked for. Here we go. Is this out of what I said, or did you actually get this from other sources?

BUTLER: This actually we got from a variety of sources, including we did go through some of the files over in the history collection and they've got like official NASA bios, and then also out of the phone books is how we get some of that, is by looking in to see—

FIEDLER: Somewhere in a vault in a box I did a timeline of all the places I have worked for, all the number of people that have worked for me and how much money I was making. Because there was a lot of motion between the Flight Operations Directorate and the Engineering Directorate about who did planning in a directly responsible way, because as soon as the planning process becomes large enough to involve more than one person, it becomes an institutional element and politics suddenly become an issue, because you're now talking about a number of people and a supervisor and a new grade and all sorts of other issues.

We moved to E&D under Max Faget for a while. Then we got moved out of that whenever John [D.] Hodge created the Program Planning Office. When was that? Program Planning Office, John Hodge, it was a separate entity. Who did it report to?

BUTLER: I know we could check on that, because we talked with John Hodge, so I'm sure we'd have some research pulled on that that we could find that date.

FIEDLER: It looks like it's '71, '72, somewhere like that, because I know I went up on Chris [Christopher C.] Kraft's staff, Flight Operations Directorate. That must have been '66, '68—Program Planning, Advanced Mission Program [Office], APO. Okay, 1968, that was APO.

That was John Hodges' program planning office, which is where the memo came from in 1971. So we must have been involved in setting it up at that point in time. No, I think that was probably just a distraction of the moment. [Laughter]

BUTLER: Probably. We just thought it was interesting.

FIEDLER: Yes. There must be some remarkable things in the archives.

BUTLER: There are. There's a lot of interesting information there, some of which are a little human interest like this, and others that have got more technical information to them. It's pretty good.

FIEDLER: John Hodges' Advanced Missions Program Office had three units to it, and Andre [J.] Meyer [Jr.]—there's a name out of the blue—Andre Meyer ran one of those units. I believe Andre Meyer was the guy who was most involved in the definition of these near-term programs. My unit was probably involved in the longer-term programs, in a planning program sense, but we always used to meet in John's staff meetings, and we all discussed each other's business. That's where that kind of thing came from. John would know the name of the other lad. Ray—no, Berglund—[Rene A.] Berglund?

BUTLER: Bill [William B.] Bergen?

FIEDLER: Here's where you have to have some telephone books.

BUTLER: We can pull some of those here after we're done and flip through them and see if the names come to mind.

Speaking of different people that you worked with, were there certain individuals—

FIEDLER: Rene Berglund. There you go.

BUTLER: Were there some of these people through your career at NASA that had a big influence on you or your career that you'd like to mention?

FIEDLER: Certainly the initial crowd we ran into in Langley, which was Chuck [Charles W.] Mathews and the Chris Krafts and the Max Fagets and the original crew, the original twenty or thirty people that were created to form the Space Task Force, because there was a lot of exposure for it, because they always used to have these grand meetings where everybody and their brother showed up. In fact, it was the entire Space Task Group. Guys would get up and tell the rest of them what they knew.

John P. Mayer, who has long since passed away, but he was the, for want of a better word, the mathematician, the trajectory man, the orbital mechanics guy. He got up in front of the crowd one day and went through the orbital mechanics of Earth orbit, okay, very fundamental stuff, and it was all new to us, not new, but it was a revelation to realize that there was these simple equations that kept the whole program together.

I don't remember doing a dog-and-pony show on anything in particular, but probably no more than describing a network, as I did before, a cartwheel with spokes and that good stuff. But all of those people registered. You spent the rest of your career not necessarily directly involved with these people, but interrelated with those folks. Johnny Mayer wound up being the Director of the Mission Planning and Analysis Division, which was one of the divisions in the Flight Operations Directorate, and his people did all of the orbital mechanics works for all the programs involved in manned spaceflight. We used to work with him pretty closely because they were the people who generated the requirement for the data transfer to make those calculations possible and the software and the computers and all that good stuff. Good group, as I recall, and they're still there. They're still the same. But those people stayed in and out of the same program all the time. John Hodge, I probably spent most of my career in and out with, except for the time he went to the Department of Transportation. Even then, we closed the loop a couple of times.

Probably for the last half of the career, Joe [Joseph P.] Loftus, he and I crossed each other's paths a lot until I eventually wound up working for him, sort of. One of us had to be in charge. [Laughter] But he and I spent a lot of time together in the advanced programs world.

We talked about—did we talk about—when we were talking about the network, talking about the solar arrays, solar flare alert network, Solar Particle Alert Network, SPAN? Have I talked about that?

BUTLER: I don't recall that, no.

FIEDLER: Some of the scientific community, particularly the solar scientists, people interested in the sun and all the things it does, realized that we had a network which essentially had communications on a twenty-four-hour basis, back to some central thing, and they were interested in observing the sun on a continuous basis with telescope and conversion equipment. I was in the position to be able to at least introduce the concept that we could put some of these telescopes at some of these remote sites, because they weren't a great burden. The equipment was provided by another agency or another entity. They could do all the installation, and all we had to on the sides was just operate it, point it and operate it. Then it had its own steerage and so forth.

So I was persuaded by the scientific community to add this to the requirements for the network, so on several of the stations they put this solar particle observation system called SPAN, and it became a twenty-four-hour observation of the solar energy spectrum, which became part of the information that was used to predict solar flares, which was hazardous. The radiation levels were hazardous to flight crews if they weren't appropriately protected or we launched at the wrong time. The lunar transfer mission, the guys could do things that would lessen their exposure to radiation. So that got us in that kind of observation program.

Then another lad showed up and started talking about orbital debris. This was before anybody ever worried about that stuff, but for some reason he had been doing a count, some statistical tabulation of the number of objects that had already been launched and the way they broke down into particles or bits and pieces, and he did some wonderful mathematics that showed ultimately all these pieces started to collide with each other, all the orbital paths interfered with each other, and they would generate more and more debris, until you have this impasse, worst story.

So we started to wave this little flag in the operations environment and said, "Should we be monitoring space debris?" This lad worked with another headquarters agency and worked with the Department of Defense, who operated the satellite—not the satellite, the radar systems, the high-frequency radar systems, FPS-16s and higher, I believe. But they could observe small particles in orbit down to ten meters in diameter or length. So they started tabulating this stuff, and then after a while, it became possible to predict whether there was a potential impact between a specific object you're interested and this cloud of debris.

For a long time it was essentially an internal exercise, until it became fairly obvious there was some significance to this subject. It was around that time that Joe Loftus got involved in a principal way in looking into that issue. By that time, it had become a pseudo-operational entity, that we put enough data on the table to say that it's something that you want to worry about, if not now, certainly in the future, because you keep putting that stuff up there and it stays there.

The initial issue would was with the geosynchronous satellite system, which is a limited resource. It's just one particular orbital pass around the Earth at a certain altitude on the equator. The distance between satellites was based on what angle you could—what resolution you could separate them with the ground antennas, because you had to have a high-gain antenna with a very narrow beam just to look at that one satellite, because it was using the same frequency as the next one. So if you looked at both of them, you were in trouble. So the real estate became very valuable. It used to be four degrees apart for the old low-frequency satellites. Then it got down to about a degree or a half a degree apart for the high-frequency satellites.

BUTLER: That's pretty close.

FIEDLER: Well, that's right, and there's a pretty healthy population. At four degrees, it turns out to be, I don't know, eighteen slots at that particular set of frequencies. But then you could reuse those slots or the slots in between at another different set of frequencies. So after a while the population's getting enormous, and the satellites in those day were good for a couple of years. Then their batteries would crap out or the solar arrays would deteriorate, or they'd become technologically redundant, but they were physically still there. So they started to become their own debris.

So then a scheme was resolved that you would pump these satellites up to a higher altitude once they were used or no longer functional. So that became another characteristic of orbital debris, was the populations that the geosynchronous satellites, which is the orbit in the equatorial plane, then there's a geostationary—wait a minute, got it the other way around—the geostationary satellites are the ones in the geosynchronous, in the equatorial plane. Geostationary, the satellite has a fixed ground location on the Earth. You can put your antenna there, the fixed antenna looks at that point, and you don't have to change the antenna position. Goes around with the Earth and does not vary.

But the geosynchronous ones just happen to be twenty-four hour orbits, but they could be at any inclination, and they paint different tracks on the Earth. The geosynchronous ones have all sorts of energy when they cross the equator. Two of them can cross at opposite directions, pass each other up. But, still, it makes more room for satellites. You can actually change the altitude slightly so they slowly drift. They're not exactly twenty-four-hour orbits. But all these things are this cloud of satellites of geostationary and geosynchronous orbits.

They’re all twenty-four-hour. No, that’s not really true. The geostationary ones are twenty-four-hour. So they synchronize with the Earth rotation.

Many of the others that are inclined are also twenty-four hours, but there are some where they're forty-eight hours. They’re just out of another altitude incriment. Some are at random just. But this encompasses all the geosatellites, GPS satellite system. The systems that are being slowly implemented for worldwide cellular phone access are not at synchronous altitudes; they’re at lower orbital altitudes.

But anyway, Joe Loftus became the seer, the overseer for all of the orbital debris work, and I just went foraging after space stations and things. Until this day, I believe Joe Loftus is still the guru agency-wide for orbital debris issues. It long became an international issue. It is now part of the United Nations' structure for orbital debris. It’s a managed resource in Earth orbit, as Earth space is a managed resource, and orbital debris is a principal characteristic in it.

At one point in time, satellites and other devices, launch vehicles, were being blown up, had a charge in them to destroy them to get the larger piece out of the way. But when you did that, you just generated a much higher number of particles, some of which had much higher energy, velocity, so they were put in a much longer-term orbit than otherwise would have been the case. So all of those practices have become regulated now. There’s very little that is destroyed in orbit by an explosion because of the propagation of debris. So the name of the game is to try and de-orbit these things as quickly as possible or manage their orbit in controlled sense.

Joe does that to this day, I believe. He is still there, much to my surprise, but good for him. He and I have been closely associated for probably the last fifteen years I was with

NASA, and every now and again we get together and swap war stories. Can't remember the name of the lad who actually did the original research that got the orbital debris story, but he was the principal scientist on the subject at NASA and here at JSC for quite some time. I know he got well recognized for it, but I don't think he got all the credit that he was due.

But that's still a big issue, orbital debris. They don't always call it orbital debris anymore, but it's a very large and evident problem. I don't know how many windows they change on the Shuttle these days, for striking objects, but that's all part of the game, and there's always the issue about penetrating the wall of the Space Station and the design, structural design technology to withstand impact from high velocity.

Burt [Burton G.] Cour-Palais also used to work for me, but Burt Cour-Palais worked for principally the science communities at JSC. He got involved in the high-velocity gun program here at JSC and there were other high-velocity guns, and they would fire projectiles at orbital velocities, meteorites. They would launch aluminum spheres, BB-type-sized things at all sorts of different structure at these enormous velocities. I wish I could remember them now, but they were really fast, such that when the aluminum object hits the target, it just vaporizes, digs a huge hole in the inert mass as the target. But it gives them the data on how the energy's dispersed and how to design structures.

That's where they came up with the—what do they call it? It's a side of buffer. It's a sheet of aluminum on the outside of a structure, so that if it's the main structure of the main space station, pressure shell and so forth if it's inside, but there's this relatively thin lightweight external cover. So when this particle hits it, the particle vaporizes that area of the outer skin and itself and disperses it over a wider area. That wider dispersions hits the side of the spacecraft, but the spacecraft structures is enough to withstand the dispersion over that wider area. That come out of the gun work.

Essentially the gun simulates space debris. So it's quite a well-institutionalized subject. You don't hear much about it these days, but it's there. You have to have garbage trucks in the future to go sweep this stuff up.

BUTLER: Did you do any studies about possibly cleaning this in the future?

FIEDLER: Sure, but it all resolves itself down that it's "self-cleansing," quote, quote, quote, because it all decays, and it decays more rapidly as it comes close to the Earth. But some of the lifetimes are enormous. The geostationary satellites are up there for eons of time unless you physically go up there and de-orbit them. They'll probably have to do that one day, at least to make some sensible attempt to strip some of that hardware out of the way.

Geosynchronous and geostationary management is a full-time job, and the FCC, I believe, is now more or less in charge of the frequency assignments that go with satellites, and the frequency assignments really determine how far apart they can be, and the distance apart determines how crowded the orbit paths are. So every dish you see on a service station, where you go put your credit card in the gas meter, the gas nozzle, the tank, the, this—whenever you buy gas at the gas station and you put your credit card in there and you whip it out and that thing says—a few seconds later, you're pumping gas, right?

Well, on the top of the station is a satellite dish, all the way back to that company's main computer, and that satellite dish is pointing at one of the little satellites up there, and it's on this crowded path along with all the other satellites that all the other service stations are using and all the other department stores or anybody who's got a credit card system that will approve your credit card and the computer's not in that store. Lots of utility of that kind of stuff. Then all the trans-Atlantic communications paths always use that thing. Then the NASA satellite, the TDRSS [Tracking and Data Relay Satellite System] satellites, are out there.

So I guess that was part of the spinoff, I suppose, of the advanced studies work, was the solar radiation monitoring. Now, all that was stripped out of the network after they got much better at solar radiation forecasting. In fact, I really think there was a little complaint went on about how much we divested it, solar power monitoring, solar energy monitoring. But I think we did some foundation work in that whole area. The same was true of the space debris. We didn't invent it; we just organized it. [Laughter]

BUTLER: Organized at least some understanding of it.

FIEDLER: Yes, and if you want some more on it, you ought to talk to Joe [Loftus]. There's institutional elements all over the place now that relate to that subject, and it's well published. In fact, periodically Joe sends me the latest epic on orbital debris.

BUTLER: Certainly going to become quite an issue in future years, I'm sure.

FIEDLER: I think it's an issue now. You'll find it's an element of space station design, spacecraft design, because it's there. The shuttle is impacting it every time it goes up.

BUTLER: I think I read an article recently that one of the very first satellites, it may have even been *Explorer I*, is still up there and it's going to be for quite a few years to come.

FIEDLER: Yes. High-altitude, small, high-density satellites, they decay very slowly.

BUTLER: Need places like NORAD [North American Aerospace Defense Command] to help keep track of a lot of that.

FIEDLER: Yes, the original surveys that they do—and they still do it, I'm sure—just by the frequency of the radar equipment, would limit you to some resolution in terms of an arbitrary diameter. That was ten centimeters, which meant theoretically you would spot everything that was ten centimeters or above. But ten centimeters is a big chunk, and there was lots of that, okay. Then it gets exponentially higher as you go down looking for smaller particles, which are just equally as damaging. I know now they've been searching at the one- and two-centimeter range. Then the statistical exercises go on to fill in the gaps under that. So there's a lot of it. All man-made. No, not true. Lots of it man-made.

BUTLER: A large quantity of it.

FIEDLER: And man-made is the stuff that tends to stay in orbit. Most of the natural stuff, meteroids, etc., tend to penetrate, but there's lots of that, too.

BUTLER: Space isn't as empty as it seems.

FIEDLER: That's true.

BUTLER: Looking back over your career with NASA, what would you say was the biggest challenge for you?

FIEDLER: The only one I remember—challenge, challenge. Gosh. Public speaking. No doubt. [Laughter]

BUTLER: That is a big challenge.

FIEDLER: I was never good at that, initially, anyway. It did not come as part of my persona to do a lot of public speaking, not necessarily public, but, you know, professional presentations and that good stuff. That came the hard way. There was no other option. You had to get up, so you would grab your self-consciousness and just charge. It's always been a challenge. I come at it kind of naturally in this day and age just by association, but it's like stage fright, I guess, that kind of thing. Don't know what the source or the origin of that issue could be, but ultimately nobody even thought that you would have some reservation. Some weakness in your makeup perhaps is what it is. So you were just commissioned to go talk to this crowd, wherever they were. There was a lot of public speaking built into the business back in those days, and if you ever went on travel, invariably you got tagged to make a detour to go speak to this group, that group, or whatever.

One of the more interesting—but it's only a little side issue, side comment. Let's see, I've forgotten their name. The female side of Masonry. Who are the Masons? Women's Mason group.

JOHNSON: Eastern Star.

FIEDLER: Daughters of the Eastern Star. I got tagged to talk to the Daughters of the Eastern Star here in Houston. I had never heard of them before, okay. [Laughter] One of the contractors around here tagged me one day. Two days' notice. Would I come talk to the Daughters of the Eastern Star? Sure. It turned out to be their national convention.

BUTLER: Oh, my.

FIEDLER: And they chose the space program as the theme for their meeting. It was in—where was it in? A hotel that got torn down.

BUTLER: One down in Houston?

FIEDLER: In Houston. The old classic hotel that—anyway, it was a huge ballroom.

JOHNSON: Has a Irish name. Shamrock, the Shamrock.

FIEDLER: Yes, the Shamrock. The Shamrock, that's it. It had a huge ballroom. So I showed up at the hotel reception area, and this guy called to me, and all of a sudden I was in this procession that marched through this huge—it was like a political convention. Anyway, they had this huge tier of people sitting up, VIP, two ranks. The floor was covered with all these wonderful circular tables, each one designated as a different country involved in the space program. I have never seen so much jewelry in my life. I mean, they were all beautiful people, but they really go all the way when they go for that kind of show. That was awesome, really awesome. They clapped at every word I said, and I don't think they heard any of it. [Laughter] It was just national pride, that's essentially what it was. We just talked about—and I had a movie clip on—it was just after the manned landing. Must have been, or at least I had a clip of the manned landing that was relatively short-term from that. That tends to stick in my mind. I don't think I was their best speaker by any means, but it was an awesome show.

BUTLER: I'm sure you did very well.

FIEDLER: But we did a lot of that. From the poor beginnings, it slowly became something you had to do. It was part of the work environment, to get out there and talk to the public. I'm still not good at it. There are people who are just marvelous, they're just wonderful orators, and you can sit and listen to them and you soak up all they have to say. I can't do that, but I can get the message across most of the time.

There were some other things that I can probably reflect on. I think I told you the one about my first job on the Space Task [Group] was to get the requirements for the network delivered to the people who were going to build the network, Barry Graves and his merry men over in the Instrumentation Support Division. It was all revolving around the wagon-wheel thing, okay, which we developed in more detail. I was the requirements guy. I would come back to the flight operations and they would say, “We’re going to do it this way, that way, and have to have this.”

So I’d go across to Barry Graves’ place and say, “We're going to have it like this."

And they’d say, “No, we can’t do it that way.”

I’d keep saying, “That’s the way it’s got to be because these people want it that way.” [Laughter]

I can remember coming back—I just wonder if some of those guys can remember—and there would be Chuck Mathews, Chris Kraft, and a couple of other guys. I’d say, “I feel like I am slowly being beaten into the ground with this hammer, like a nail. Every time I go over there, I make all these statements and requirements, and it’s hard, you know.”

But they said, “Well, just keep on going. It’ll come out right.”

So we kept on doing it, and it slowly came out right. I was the only guy doing that, and it probably is by no means of the magnitude that I tend to conceive it of being, but it had some substance at that time. All that really goes to show is how little attention was being given in that work by the operations people early in the program. But we’re talking the ’59, ’60 era of the program. Barry Graves and his merry men had got these contracts taken to build the network, so they wanted to get going. That I recall as being some kind of achievement, not a large one, but—I’ll have to think about that question.

BUTLER: Is there any one point in your career that you find as your pinnacle, your proudest achievement, or just the one memory that sticks out?

FIEDLER: No, it's funny, I don't have anything like that. One pinnacle. Well, I don't know. Meeting [Wernher] von Braun was probably a pretty unique experience. I had this experience when I was an apprentice in dealing with German skill. I think I mentioned that before. The Brits got their fair share of German engineers and scientists as part of the war loot, as did the Russians and the Americans. Some of them weren't very good at English. I, as an apprentice, that was my assignment, was to communicate between the German labs and the rest of the facility, manufacturing labs and so forth, which is where I first got introduced to the metric world, since that's all the language they talk in there.

This guy was brilliant. He was really a brilliant engineer. You naturally had a lot of respect for the way these guys think. And when you walked into von Braun's area, all that came back. He was obviously of that ilk and he had surrounded himself with a bunch of guys that were equally as skilled as that. Well, they were all part of his original team or a percentage of his original team. It was kind of neat to be sitting in that environment.

I know we gave him a lot of pitches, and it probably was back in that Skylab set of issues about where we thought the world was coming from. You can make all sorts of conclusions and observations and rationale off charts and pictures on the wall, and they, all of those guys, they would sit there, they would ask questions. They would never criticize what you had said in an objective manner. They never said, "That's stupid." [Laughter] I don't think we ever really put stupid stuff up, but sometimes people would think it was. But you never got that reaction from them. There was always some constructive kind of conclusion. Now, whether afterwards they all swapped stories about how stupid it was, that I don't know. But they were very respectful of anybody who stood up in front of them and came forth. That was pretty awesome in some respects.

Von Braun actually remembered my name for two or three sessions. I'm sure he forgot it rapidly after that. That was at the Marshall Space Flight Center, which was a fairly awesome place when you went through the construction facilities for the Saturn V, Saturn I and Saturn V. Saturn V was thirty-three feet in diameter. Was that right? That's pretty big. In that hangar on one of the hangar walls they had the diameter of the Nova, which was their next project, and that made the Saturn V look quite small. It was probably twice or three times the diameter, and that was their Mars mission concept. I think they actually did some work on the engines for that class of vehicle. Good people.

BUTLER: A lot of good people that had to come together to make it all possible.

FIEDLER: I'm trying to remember the guy at the Cape. I just don't remember the story anymore. One of the Germans at the Cape got deported for some war crimes. Remember that?

BUTLER: I think I have run across that.

FIEDLER: Yes, I ran across—it's either in von Braun—yes, von in Braun's autobiography or one of the autobiographies written against him. That story is drawn out, and I did get to meet him, never knowing. Until this day, I'm not really sure whether he was treated fairly in that process, and my memory's not good on this stuff without coming back and rereading it.

But all of the military machine that was working in Germany in '43, '44, '45, was tremendously supported by what you would now call slave labor. Theoretically, the Gestapo system was the slave labor management organization which apportioned resources to whoever required skilled or other labor. The resources that were used to nurture the rocket developments, which were kind of under von Braun's regime—V-1s, V-2s, V-2 dominantly—was a huge manufacturing. I mean, they were going to produce thousands of these vehicles in the remainder of what turned out to be the last two years for the war. So that got major production lines into place, and they used all this "slave labor," quote, quote. I call it slave labor. They had other names for it.

So you could have gone back to anybody who was—theoretically they say the people who managed the projects weren't really aware of the impositions put on these so-called slave labor guys. But how could they not be? Von Braun never got tagged for any of that. Neither did any of his immediate lieutenants. But this other lad did. I thought that was kind of strange, but who am I to make that judgment? I never got aware of that until in the last few years.

There's a bookstore called Colleen's Bookstore on Telephone Road near the airport, and her bookstore is almost entirely dedicated to Texas. Used books. Has quite a large space section in it. I think people dump their libraries, personal libraries, into Colleen's, because it's a place you can sell books. There's a place for it, and I found this autobiography in there on von Braun which I'd never seen before in any NASA library, and this particular story was threaded through a little part of that. So there's a reference for you. Go spend half an hour browsing through Colleen's bookstore.

BUTLER: That would be a great resource for us. We're always looking for more space books and things.

FIEDLER: Well, they don't have a large collection, but it's an oddball collection.

BUTLER: Sometimes that's where you find the most interesting things.

FIEDLER: There you go.

BUTLER: Well, looking back over your whole career, you started out in England, would you ever have imagined where your life would lead you, your career would lead you?

FIEDLER: No. You know, I never thought about it. It was never planned, okay. It was all a series of happenings. I think most people's lives are a series of happenings. Could you have conceivably planned to have done all the things that we've done, having been there first?

There are things that I've watched others do. Some people chase the nouveau, the new, the latest, okay. One of the lads that worked for me, Bill [William L.] Davidson, as a matter of a fact—there's a name that came whistling out—he stayed with the space program through I think probably Apollo and some of the advanced planning stuff. Then the Alaska pipeline came up. So the next thing I knew, he was off working the Alaska pipeline, which was in those days a major technological adventure in the pipeline business. He went up there for three years. Then he got involved in the—whatever it's called, the big circular energy—

BUTLER: Superconductor?

FIEDLER: Supercollider?

FARRELL: Superconducting supercollider.

FIEDLER: Here in Texas somewhere. He got involved in that to the extent at least they dug the tunnel, which is awesome to me that they had done it at the time, to go that far into the project before it was terminated. So he was on some track to keep up with whatever was the latest thing that was going. Then he got back and involved in the Shuttle Program. So he took a—it's, what did they call it—a sabbatical, away from the space program for a while.

In England, and I'm sure elsewhere, if you're apprenticed to some institution like an automobile company or a manufacturing company or even with the government, when you finally graduate and you become some kind of engineer, they like to kick you out and say, "Go get some experience somewhere else before you ever come back to work for us." In a sense, he had done that from his own viewpoint.

I think probably if you stay close to what's going on in the world, you could probably have all sorts of fun, jumping ship from here to there. It's never been my makeup to jump ship. I think I take harbor in some kind of continuous relationship with an institution. [Laughter] But NASA is a such a multifaceted institution, that you get a lot of transitions built into the way it plays. Just going from engineering to operations is a major change in lifestyle and profession. And as I mentioned once before, the planning business is a universal business. Everybody does it, to some extent, and a lot of people tend to regard it as some kind of superficial thing that it's like a vacation. Get out of the mainstream for a couple of weeks and go play with these guys in the future somewhere. But it does get you involved in all the other elements of the institution.

So the planning people turned out to be, or the people involved in that kind of business, got to know most of the agency, most of the field installations, the other centers, the other centers'—what do we call them? Support stations, Johnson looks after other locations outside. They're attached to Johnson. We got to all of those and most of the people involved in managing those, and the center directors always have a piece of that pie because it's a budget line item and [unclear] the future.

So they would like to believe that any plan that's being worked on has their institution represented in it somehow, like it's got an operations mission control center or it uses my facility or my tracking stations or whomever you're talking to. So the center director always has a kind of a focus towards this stuff, not that they were totally in concurrence with whatever the fundamental technology was, but that their institution was represented as well as any other institution in the plan itself, that they were part of it, that they were looking out for their own.

So we got to know most of the center directors and their staff. They would always show up to the final presentations as it rotated around to the institutions. It was like being an apprentice all over again. Apprentices got to go to every part of the organization that they worked in, because the institution likes to believe that they got some people who know their institution. Apprentices were always the right people to do that, because you could assign them there for a week, there for two months, here and there and everywhere. Rotate them through all the shops, rotate through all the labs, and they became somebody who could tell you what the institution consisted of. We were able to do that for NASA and to some extent for DOD and to some extent, for some of the other agencies that NASA interfaced with. So I think we were pretty good envoys in that regard. It's a very useful thing to be.

Slidell [Computer Complex, Louisiana] was one of the latest additions to the agency, which is one of the places that I never went to once, and that was only because the guy who became the director of Slidel for a while was one of the guys involved in the planning business. But that was good background, good background. I'd say it's more background than most people got in the agency. But I think it's something that most employees ought to somehow get a feel for this size and complexity of the agency we work for and the resources that are in there.

When you talk about there's 4,000 civil servants in Johnson and the odd 10,000 contractors, why, you can find an expert in anything in 10,000 people, not only in what NASA's business is, but any other business, too. And when you start wrestling with the fact that you've four or five of those kind of places across the country, there's no question that can go unanswered if you know where to find the right people. That became a domain of the planning crowd for a while. You were sort of a reference consultant for where the expertise laid in the contractors and in NASA. I'm sure there are people who can do that now.

It turns out to be that that's fundamentally true of any institution. Even if it's small, there are still people who've got unbelievable skills that aren't evident at the level you practice. That's something I miss. It was a secondary skill, if that's the right word for it, in the general institution game we played.

BUTLER: Well, you have certainly had some interesting experiences and worked with some interesting people.

FIEDLER: Yes, having started this whole business with you and realizing that it takes all sorts of triggers that made me remember these things, I started writing my own history, if that's the right word for it.

BUTLER: Good. Sure it is.

FIEDLER: And there are these target things keep cropping out and there are other things that spin off that. But the biggest trouble I have is putting them in chronological order. You know, I can roughly bracket them related the one to the other, but actually getting them in the right order takes all sorts of time and venture. Good it's in a word processor so you take a chunk of it and move it up and down in the sequence. But sometimes you wind up bracketing in a subject matter that you just collectively discuss for a lifetime in one place, and you can't spread it out because it's a discipline of some kind or a specific subject of some kind. But it's becoming an interesting exercise. There are still total blanks, like I don't remember that [referring to earlier document] at all.

BUTLER: Well, that's okay. That's something pretty small.

FIEDLER: Yes, but there's total blanks, but sometimes something triggers you and cracks it open a little and you can get inside it.

BUTLER: I'm sure as you do more or more of it and more of those triggers go off, it'll come back. Maybe as you, once you do get moved in, like you said, and are able to go through some of your boxes and papers, maybe that'll even bring some stuff back, too.

FIEDLER: Maybe, maybe.

BUTLER: Well, we wish all the luck with that and hope you have fun working on it.

FIEDLER: I'll keep you posted. I'll keep you posted.

BUTLER: Absolutely, and thank you so much for sharing this with us, and hopefully this does give you a good launching platform.

FIEDLER: There you go. Great.

[End of Interview]