ORAL HISTORY 10 TRANSCRIPT

GLYNN S. LUNNEY
INTERVIEWED BY CAROL BUTLER
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BUTLER: Today is March 9, 2000. This oral history with Glynn Lunney is being conducted for the Johnson Space Center Oral History Project, in the offices of the Signal Corporation. Carol Butler is the interviewer and is assisted by Kevin Rusnak and Jason Abbey.

Thank you for joining us again.

LUNNEY: You're welcome, Carol. It's a pleasure to be here as always.

BUTLER: Thank you. Before we've talked up through when you had retired at NASA, and if you tell us now about what you went and did after that. You did stay involved with the space program.

LUNNEY: Yes, it may be that I could draw some differences between how it was at NASA and how it was in industry and that might be helpful to somebody or another.

BUTLER: Absolutely.

LUNNEY: It was interesting when it became time for me to move. It would be easy to go through kind of an intellectual exercise about how I arrived at that decision, but I had the feeling that it was more like so many other things and so many other times in my life, it was a little bit more of an emotional thing, in the sense that I had been doing the Shuttle program manager job for four years by that time, by the time I left, and, frankly, it felt like I was just going to continue to do it indefinitely into the future. There wasn't anything in the way of a

prospect to change that. When I look back on my career, I had generally changed jobs, moved on, every three or four years, at least in some significant way changed my responsibilities, usually made them larger.

So I guess I found myself with my internal clock going off, saying, "Glynn, it's time to move and to do something different." By that time I had probably gotten a little flatter on the learning curve in terms of the NASA system, because I was doing something that I had been doing for quite a while and I had a lot of experience in it, so it wasn't like there was a great deal of learning going on, although it was still a very challenging job and a great challenging task, but it wasn't like I was learning many new things.

I had looked around the rest of the NASA, I mean, mentally, at least, in my mind. I'd been to [NASA] Headquarters [Washington, DC], and I didn't see anything there that I aspired to go do, and I didn't see anything at the other [NASA] Centers that I especially wanted to do. So it just had the feeling like I had done all that I could do within my career potential within NASA. It didn't look like I was going to get to be the center director here [at Johnson Space Center in Houston, Texas], which is something that I had aspired to, and it didn't work out. So I had the feeling that I was sort of getting to the point where it was, I don't want to say a dead-end, because it was not, but a little bit of a sense of that.

So the bell went off, as it had in previous times in my career, kind of inside of my head telling me that it was time to do something different. Actually, probably by the time I did quit being the Shuttle program manager, I don't think I realized how tired I was getting in the job. I mean, it's a real wearing kind of a job. I don't know the statistics are, but I expect probably since that time most people don't stay in that job more than four years. Probably four years is a little bit on the high side. I don't recall exactly, but it seems like people change out after a while. And I think it's because it wears people out. I mean, they don't even know it probably at the time, but it does wear them out, because it's kind of on your mind constantly.

But it was difficult to come to a decision to change and leave the government, for example. I'd worked for them, of course, since I was a young boy in the co-op [cooperative education program] in college, and I loved it. I mean, I just had every opportunity in the world. So in that respect it was also very emotional in terms of thinking that I was going to leave this, but I was still fairly young, forty-eight or so, and I recognized that I had a lot of career in front of me. I didn't see the learning opportunity so much anymore inside of NASA that I had always experienced before. That probably wasn't correct, but that was just the way I felt about it at the time.

So a combination of things like that, mostly internal clock happening, got me to the point where I thought that it would be time to do something different. There were some opportunities at NASA and NASA wanted me to do some things, but they didn't fit me right, at least I didn't feel like they fit at the time. Then I had an opportunity to consider doing something in industry, and I ended up deciding when I left NASA that I would go to work for Rockwell [Aerospace, now Rockwell International Corporation] out in California.

At the time I was viewing that as pretty much of a complete break with what I had done in the past. All my past experience had been in human space flight, and I was going to go work at a division at Rockwell that was building unmanned satellites. They were building the GPS, the Global Positioning Navigation Satellites Network that we have up there today.

So I was going into a completely new field, relatively new field, it was still space work, but it was unmanned satellites as opposed to the manned stuff. When we left Houston, I left with the idea that we were really leaving and I wasn't going to be back in human space flight in any way. So it was quite a change.

There were two things, probably two things that [were] happening to me at the same time. One is, I was making a change from government to industry, and there are differences, most of which I had to learn, some the hard way, some were obvious. I was also moving from jobs that I had always had that were basically very tied into the program, program

management kind of jobs, which are a little different than—the program manager job here at the center is a different job than the center director. The center director job is a little bit more like a general manager or president of a company, like a satellite company or any other kind of company, satellite-building company. So I was making two transitions, one from government to industry, and one from program management to more general management of a business unit, which is the way Rockwell talked about things. So I probably didn't realize at the time how big both of those steps would be, but I was off doing them and learning as I went.

I guess I would make kind of a comment at this point, and that is that I have always been somewhat surprised in my career that there is so little preparation for people to take the next step to a bigger job. There's sort of a feeling that you learn by watching and by experience, which is valid. It's valid. I had great leaders in front of me the whole time, especially in the case of Dr. [Christopher C.] Kraft, Chris Kraft, so it was easy for me to see what he did, or at least see the outward signs of what he did and to try to emulate that.

But even so, I think especially when you move from government to industry or you move from program management to general management of a business unit, there's a lot of things that you have to think about differently and your whole agenda starts taking on a different flavor. Within Rockwell I didn't see any way in which they really trained people to make that step. In my case I was the Executive…VP, which is like a deputy to the president for about six months when he retired, and then I got that job. So I had six months of sort of on-the-job training, and maybe they viewed that as sufficient.

I always felt, though, that there [were] steps that I took that I could have profited from some more, I don't mean formal training, but some more description of what are the expectations that people would have of me in a new job, and what are the difficulties or the problem areas that people see, what are the things to watch out for and so on. Sort of like a discussion, perhaps, that an experienced uncle might give you when you're moving into a

new position. I just felt that that didn't happen to me except somewhat accidentally and somewhat by virtue of my asking people a lot of questions.

That's probably true in NASA and industry, and it's not a knock on Rockwell in particular, because I have observed that happens everywhere that I've been, and probably a lot of other places, too. But it is surprising that people don't do at least even a couple hours' discussion of expectations and so on and what to watch out for. It would be helpful. So anyway, I was off making those changes.

Now, you hear a lot of people comment on bringing a business to government and there's a lot of good in that idea, but the government operation is very different from a corporate operation in the following way. I mean, we have a large executive department in Washington, DC with a lot of different outfits. I don't mean just NASA Headquarters, I mean all the other people that are involved in these things. We have a lot of legislative players, the staffs, certainly the members, but the staffs, the committees, subcommittees and so on, then the GAO [Government Affairs Office] and the CBO [Congressional Budget Office] and a whole bunch of people who perform various kinds of analyses for the congressional committees.

Then in Washington you also have a sort of a set of public inputs that come to the agencies. For example, when something is written in the *Washington Post* that is either critical of or aimed at one of the agencies in Washington, I can guarantee you that the whole senior staff of that agency is doing cartwheels for hours while they are figuring out how to respond to this *Washington Post* article.

So there's a great deal of top-down-driven questions, probes, looking for alternatives and so on, justifications, rationales, why did this happen, why did that happen, and I contrast that with corporations where as you go up the line in a corporate let's get to the chairman of the board, he basically is dealing with his board of directors. He's dealing to some extent with Wall Street and he's dealing with his shareholders, but those are all in much more

structured ways. My impression is that they're not everyday twenty-five questions like often occurs in Washington, DC.

So the corporate structure becomes almost, this is not entirely fair, but it's less receptive or receives fewer inputs or probes or barbs from the outside than does the Washington government process. So the government process gets very top-down Washington headquarters, Washington, DC, top-down-driven kind of set of questions and required responses, and that's not quite so true in the case of corporations. They, of course, have to deal with their business position, they have to continue to be profitable, they have to continue to grow, etc, etc., but it's not like they're getting a constant everyday probing by hundreds of people who are very well informed and have a very good understanding of their business, and are being critical of it in the sense that oversight requires people to be critical, which is what a lot of people in Washington, both in the executive branch and the legislative branch, see that their jobs entail.

So there's a great deal more interaction and many more inputs coming to the front office, like the administrator of NASA [Headquarters], from outside, than there would be to a chairman of the board in a large corporation. Generally true. I mean, in some cases certain companies get in certain positions where there's a lot of input to the chairman, but that's probably a little on the abnormal side rather than regular day-to-day business.

The other thing I noticed very strongly was the way in which, if I could describe—let me make an analogy of the center, the JSC [Johnson Space Center] center to a division, or a business unit in a large corporation. In the center's case, again, because of what I described in the first place and for other reasons, there's a great deal of interaction with Washington headquarters on a day-to-day detailed kind of a basis, which I grew up with and never thought very much about.

But when I got to the corporate environment, it was much more delegated than that, at least in Rockwell, and I expect it's true in other places. They expected you to run your

business well and stay out of trouble. They expected you to meet your numbers, your financial numbers. Then they expected you to have a plan to grow your business. As long as you did those things and did them reasonably well, then there wasn't a lot of probing or questioning or whatever about the day-to-day happenings. Now, if you had an accident or a fire in your plant or something, there, of course, would be required reporting and so on, but it wasn't like they were coming down to solve your problem, whatever it was.

The general mode of operation was, "This is your ship, you are the captain of it. We'll give you some policies, but you're the captain of the ship, you run it, and you make it successful. If you don't, you eventually are replaced." But that's sort of the way it ran.

The interface between a division business unit and corporate in contrast with the center to NASA headquarters was greatly different, much more delegated. Frankly, I really liked it. It was a new mode of operation for me compared to what I'd been used to, so I enjoyed it very much and had a good time with it.

I would say another thing about that environment that I was in. When I think about NASA—let's just take NASA as one of many federal agencies. NASA is not very peer-sensitive. In other words, if you said to NASA as an agency, "What other agencies are peer to you?" I'm not sure they would even relate to the question in that they don't kind of think of things that way. I mean, the DOD [Department of Defense] does some things that are similar to what NASA does in terms of space, but DOD is so much larger that it's not really a comparison. So they're kind of unique and they think of themselves that way, and that's fine.

What I observed when I went to Rockwell is the Rockwell culture and attitude was they were one of many corporations both in the United States and in other countries who were in fairly fierce competition for business and financial success. As a matter of fact, I was very, very impressed at the number of the meetings that I went to, especially on the front end of my experience with Rockwell, because it was new to me. I went to these fairly full-up corporate-wide meetings where the people who were running automotive businesses, or

factories within automotive, or electronics, or other kind of commercial businesses, these folks would come in and talk about what they were doing to make themselves competitive and to be successful. As you listen to them you had the sense that you were listening to a bunch of people who were actually at war. I mean, they were actually at war with their competition and were doing their very best to figure out how to better run their own factories, how to better make their own products, how to better deliver the service to their customer, and in the end how to be successful and stay in business and be financially successful. You really had a sense that people were in an absolute combat situation in terms of struggle for survival of these companies.

Layered on top of that was another thing that Rockwell did very well in that they had, at these same conferences, they would have speakers from outside come in. They had the best people in the United States in what I would call the guru class. The gurus were the people who kind of observed what's going on and then make a lot of recommendations to large corporations. At the time, the theme of the guru class was that the Japanese are going to run the American businesses out of business, run American industry out of business. This is what I meant by the combat environment that most of these folks operated in, because they were experiencing that. They were getting beat on quality, they were getting beat on price.

So you had the sense that things were really tough, and I saw what people were doing to make their businesses competitive and successful, and it was very, very intense. I mean, very intense. In each of their own factories, in each of their own organizations, they were engaging their work force in ways far beyond anything that they had done earlier, even before it was something of a boss-to-worker kind of a relationship. In this case they were dealing with more as a boss and worker are a team, trying to do the best they can to be competitive.

This was in the middle eighties, and I think this change was pervading this whole sense of "We are in a battle for survival and we've got to change a lot of things to end up

being successful and to come out of this okay" was going on across American industry. I mean, it was quite impressive to me. The gurus that came in and talked kept bringing this message, "The Japanese are doing this, the Japanese are doing that," etc., and they would have all these statistics about what they were doing and paint this picture of America gradually losing its competitive edge against our foreign competition, mostly the Japanese, but in some cases the Europeans.

I would have to say that this is about fifteen years later now, and in the nineties the country has experienced a dramatic improvement in our overall economic posture, and I think that has come from a variety of reasons. One, though, was the attitude, the turnaround in attitude of American business. Probably up until the late seventies, American industry was living off the post World War II set of conditions where America was the primary, and for a while, the only surviving industrial nation, so we just kind of sold our stuff with ease, and it wasn't until the seventies that that really began to be challenged. By the time the eighties came around, American industry was in a major response to that challenge.

I think I told you this before, it amuses me to watch so many people, especially politicians, take so much credit for the economic success that the country's enjoying, and I would grant you that they have probably not done some things that have helped that. I mean, I think mostly they can screw it up as opposed to help it. So by not doing some things they've probably helped.

But I mean, I watched and from where I was sitting I could see that I was looking at five guys from a factory representing maybe a thousand people at that factory, and you saw groups of five in these meetings from all these different factories, and we were just one company. So all these other companies, and it was very, very intense, people struggling very hard to be good at what they were doing and to be financially successful, compete on quality and price, and still stay in business.

So it was quite an impressive thing for me, and it was a shakeup. I had not experienced any such comparable competitive threat when I was at NASA on anything like this kind of a scale or at this level of threat. That is, threat of survival of a corporation, and even to some degree the gurus would paint a picture that would have you believe that American industry itself was at risk at the time. So a lot of people really did a lot an awful lot of things and a lot of good work to turn that around.

Then I think in the nineties we added to that the information technology that was just beginning to really come of age to be put to practical use. That, I think, was an added benefit for American industry coming into the nineties, and now throughout the decade that has also added a great deal to our competitive strength.

But anyway, it was quite an impressive thing to watch. It was also impressive to think about it from a NASA point of view, where there really isn't a comparable sense of threat that was occurring in the industry in such a very major way, in such a very gut-level way at the time.

Well, let's see. What else? The other thing about it is in NASA there are a lot of givens. What I mean by that, a lot of benefits for employees, pay scale system, etc. All these things are kind of handed down from somewhere in Washington and a lot of the retirement plan or the Social Security and they worked that and 401(k)s, it's all kind of a given.

In industry much more of that is invented as you go along. I mean, each division has its own system. They're generally similar across the divisions, but not identical. So there are variations locally across them. You had the feeling that there was much more control and decision-making on the human resource benefit kind of things that apply to employees, and, for that matter, on personnel. I always had the sense that I had more freedom to move people than I did when I was in the government. Maybe that was in the mind, but, I mean, I really did feel like I had more freedom to do that, and a couple of times I had to, and it went through the system okay.

But there's another set of things that go with it, too, in terms of being on the industry side. There's a lot of compliance audits. The government gets compliance audits, but they don't carry with them the same threat that an audit does on the industry side. When the government is auditing an industrial contractor, I mean, he's really got to pass muster and the threat is that if he doesn't he will be penalized in any one of a number of ways, starting with his fee and eventually up to and including terminating the contract if something was bad and continued and were not fixed. So there are a lot of things that you experience, and the government side experiences audits, but it does not carry with it the same threat of what the consequences will be if you don't come out of it squeaky clean, as you have on the industry side.

So the audits, the compliance, and so on, of which there are numerous sorts of things that you have to comply with, probably beyond what anybody would recognize, and all those things have to be done well and handled well and so on, or if you do screw something up, then you have to have a recovery plan and so on. Sometimes you get in trouble even if nothing is wrong, but simply because someone complains.

In the world we live in today, there's a lot of discrimination complaints, either age or race or gender, whatever. Again, sometimes they have validity and there's something real there, and sometimes it's something, you know, someone just not happy and therefore grousing about it. But it, nevertheless, results in just as much work in terms of having responded to it as you would have for any other kind of a non-compliance.

So there's a lot of those kinds of things and it surprised me the numbers of things that I had to deal with that had significant consequences to them if we didn't do them well. It was far beyond what I was used to dealing with on the government side.

I would say that as an example of that, right after I got to Rockwell, within a few months, Rockwell was barred by the government from competing for or being awarded any contracts. This bar lasted about six months. It derived from six people in another place

there, I think up in Dallas[Texas] six people time-charging improperly. So the lesson was, how many dollars could possibly be represented by six people not charging right for a few months? It's not a lot of dollars, but, nevertheless, the principle was, if you do something wrong like that, then consequences can be very severe. Because here was this whole corporation held up in terms of being awarded any contracts for six months or whatever it was because of the actions of just a handful.

It was very clear in Rockwell, and I expect in every other corporation, that the big corporations like that have absolutely nothing to gain, they have everything to lose by people doing something illegal or unethical. It's a lesson that in many cases I always felt like the government folks didn't quite understand… They tended in some cases to be suspicious of the motivations of corporations, when in truth the corporations were far more driven to be pure than the government could ever imagine. I mean, it just wasn't worth it to them for some little thing over here to get a big penalty and your name in the paper and God knows what other consequences might come with it. So the consequences are out of all proportion to the—can be out of all proportion to the event and any dollar value that anybody could imagine that would be so-called beneficial coming out of this time-charging or whatever.

So over and over again, the lesson was drummed into people's head that, "It's absolutely not worth doing anything, we absolutely don't want people doing anything illegal or unethical. Stop it. Don't hear about it. Don't let it even start. It's just not the way we're going to do business."

I expect that is true in all of industry. It just isn't worth the pain. Yet the government doesn't ever really seem to recognize that that's really the environment that exists out there. I've seem a lot of instances where the government people take a rather suspicious and almost a small-minded attitude towards what they perceive to be a corporation's interest in this kind of an area or their motivation in this kind of area. They got it wrong for the most part.

Let's see. A couple of other things I want to tell you. I want to tell you about the reward system. Within NASA and within the government in general, you know, I don't know exactly what it's like today, it's probably not too much different, but I was there, it got to the point where the pay for a division chief was almost equal to the pay for everybody else in the structure above the division chief was almost the same. The division chief would get to a certain level of pay, and then the differentials between what the division chief got and the next level and the center director and the associate administrators, and, for that matter, the administrator at NASA, it was fairly narrow. I mean, the word we used was "compression." I mean, all the top jobs, five levels of jobs, could get squished together and the pay between them was not very significant.

The interesting thing in industry is that was exactly the opposite. Division chief and below, the pay was probably comparable industry to government, more or less, but above that level is where the reward system really started to become significant and at each level up it was significantly improved over the level below that. So in industry it was a different motivation operative for people competing to be successful. There was an additional motivation—excuse me—than there is in the government. In the government it's pride of doing what you can do and what you want to do very well, and that's still operative on the industry side, but there's a substantial change in the reward system on the positive side.

As a matter of fact, it was interesting for me when I went into Rockwell because I could feel my peers, guys at the same level, beginning to size me up as a competitor in this competition for promotion above, at the division and above level. So it's quite an interesting thing. Very different. I understand why the government system is the way it is way as it flows down from the President and the congressional salaries and so on, I understand all that, but it's markedly different in industry.

The other thing I would say about it is, in many respects in government the scope of work that people deal with at various levels can be much broader than it is on the industry

side. I mean, you can get to certain levels in the government where a person's dealing with a fairly large scope of activity. In general, in general, you don't see quite that large scope at comparable levels in industry. You might see them at much higher levels, but you don't see them at comparable levels.

BUTLER: Did it take you long to get used to all these differences?

LUNNEY: No. See, I'm rattling them off now, but I was sort of experiencing them and internalizing them as I went along, and some I could be explicit about and some I just sort of picked up, you know, it was just sort a feeling you had as you went along. So it was kind of like a learning thing, and it was very steep. I mean, I felt like that I was learning quite a bit. I mean, this whole thing about the competitive environment that American industry faced and what people were doing to respond to it in terms of building organizations was fifteen years ahead of anything that the government has attempted to do. The government has a number of other restrictions on things when they try to do things, I know.

Rockwell was blessed in that not only did it have a large aerospace component, which was government business, but they had this commercial set of businesses equally large, and that's where you could see this real struggle for survival going on, and it was quite a lesson for us in the government part of life, government contracting part of life, to bring those lessons, as best we could, over to what we were doing. Quite a different thing.

The other thing that's different is growth of a unit, like the center here. I'm not talking about the future. I mean new projects and so on. There isn't really a formal structured process by which new projects come along in NASA, big new projects. I mean, they're fairly rare. Programs come along like every decade or two, right, but they're kind of slow to come along. There's a number of in-between stuff that occurs, but at JSC, which is most of my

experience, and I think that's probably not so true in other government agencies, but I think the new programs are more frequent than every ten or twelve years.

But then what the role of this center, Johnson Space Center, versus other centers gets to be decided in some way that's not terribly clear to the outside world or even to the other people in the centers. It's sort of an internal political, somewhat shrouded kind of a discussion, and out of those discussions come, okay, the Johnson Center's going to do this and Kennedy's [Kennedy Space Center, Cape Canaveral, Florida] going to do that and Marshall's [Marshall Space Flight Center, Huntsville, Alabama] going to do that. It's not a very clear process. It's not a visible process. It may be clear to people doing it, but it's invisible to the people on the outside.

I contrast that with what goes on in industry because certainly in the parts of industry that deal with government contracts, the process for competing for new work is very clear. As a matter of fact, it was really an eye-opener for me to go and experience what people had to do by way of proposals in response to RFPs, requests for proposals, that the government puts out. The effort that people put into responding to those proposals is absolutely immense. I mean, it's just beyond anything the people on the government side could really relate to.

I mean, I think they intellectually can say, yes, some of them can say, "Yes, I believe I understand what you for that," but emotionally, I mean, the level of commitment and the hours that people have to work and so on is just staggering. I mean, writing proposals, this is nothing, it's not unexpected for people to be there from dawn until midnight, midnight at night, go home and sleep for a couple hours and come back, I mean, and do that week after week after week, because the growth, the continued future success of the business unit depends on people winning these new contracts, and they're very competitive.

As a matter of fact, to some degree the government—I don't have a suggestion to make, because it's hard to deal with, but in many cases the government drives things on cost

to such a level that the whole thing becomes, I don't mean to say this harshly, but it becomes a bit of a farce, because people bid prices that work just cannot be done for, and the government never seems to know how to respond it except to cheer and applaud that this is so wonderful when everybody who does the work knows it's not going to really be that way when they get there. So they end up with these really hassling contracts that are set up to create hassles. They create failure on the part of both the government and industry, because nobody can deliver on the contract as it was bid and as the government applauds when it signs and so on.

I don't have a suggestion for what to do about that, but the government in many respects sets itself up for failure, because NASA, if it signs a contract to do something for X bucks, and then has to go back up to Washington or to the [Capitol] Hill and say, "I can't do it for X, I need 2X to do this job," they're just as embarrassed as the industry team that did it.

In the case of industry, probably you've already removed two or three program managers by that time and maybe a general manager for bidding such a dumb thing. But everybody gets embarrassed about it one way or another, and somehow, although I haven't thought about it very much, there ought to be a better way to do that that doesn't set both sides of the field up for failure. Because the government managers are set up for failure and the industry managers are set up for failure. Anyway, that's what happens. So it was another interesting thing.

How we doing? I'm doing okay. There's another interesting thing that happened. I went to work at this division where we were making the navigation satellite, GPS, but in addition to that, we had a number of people who were working on surveillance satellites, that is, satellites that could be used to detect missile launches, like boost surveillance, they called it. This was in 1985, and it was after President [Ronald R.] Reagan had announced what he called the Strategic Defense Initiative and what the press called Star Wars, with the idea being we would build a shield and protect the continent from any incoming ICBMs

[intercontinental ballistic missiles] and nuclear weapons primarily from the Soviet Union at the time.

Now, even to those of us—and I got involved in it because at the division people were doing some of this surveillance work and the surveillance satellite was a piece of this much larger concept called strategic defense, but Rockwell, at the corporate level, had a set of very smart people who had done a lot of this kind of stuff for a while, and they were a real resource to the government for thinking through a lot of these scenarios and analyzing technologies and imagining solutions and so on and so on.

Most of it dealt with the fact that it's a pretty staggering scale to try to imagine doing something like that and doing it successfully enough so that you defeat most of the missiles coming in. I mean, it's a staggering technical problem. But, I mean, people were working on a lot of things. I only worked in this area for just a brief period of time on only a slice of the picture, but I was quite impressed with the scale of what would have to be done. It was probably several times bigger than Apollo [Program].

I was also impressed with the willingness that President Reagan had to say, "I'm going to do that." I mean, he wasn't like he was out studying the thing or anything, it was like he was intending to do that. He didn't know how and he didn't know whether Congress would approve it, but he was intending to do it, and he had a great deal of confidence in the ability of American industry.

In years since, you can look back on that and I think it really did have some effect on our competitors in the Cold War. I had participated in the race to the Moon part of the Cold War, the human space flight part of the Cold War, and that turned out, we won that in 1969 when the other guys sort of withdrew from the field. So here I was again in another aspect of the Cold War, and it was interesting to see all the different activities that were under way. It was still, frankly, a little incoherent in the sense that it wasn't clear how all this stuff could ever come together and be a system that would do this, but people were exploring all these

technologies. Rather than incoherent, I guess it would be better to say it was at an exploratory stage, where people were trying to explore all these ideas and there would be champions for some idea and sometimes the champions would get more carried away than the idea deserved and then sometimes the ideas would fall apart of their own weight.

But it was interesting to see how much went on in the government, certainly in the Air Force in this case, the Department of Defense, but also in the industry to accomplish, or to try to accomplish the goals that had been set by President Reagan. And I believe that that had a significant effect on the ultimate disintegration of the Soviet Union and its war machine as the Soviets came to grips, when [Soviet Premiere Mikhail] Gorbachev got in office, I think, came to grips with where are we going, and are we getting ahead, or are we getting behind, and how is this going to end up, and what are our options. I think they must have had some conversations like that, and they had to have been fairly discouraged.

They didn't know what we could do. They knew how difficult it was. But on the other hand, we had done the Apollo thing. So there was reason for them to suspect that if we really committed ourselves to this thing, we were liable to do it, or 95 percent, and, in effect, just wipe out the investment that they had made in ICBMs, in both land-based and submarine weapons over the years.

So it was an interesting time for me, an interesting experience to see the thinking that was going on in the country. I must admit that I was not a terribly big contributor to that thinking at the time, because it was kind of a new field of thought for me, but it was quite impressive that what had been going on and what had been going on in the government and what had been going on in industry, and how industry, at least within Rockwell, and that was comparable to other places, how they organized themselves into producing teams of people who could do very good work on various slices of this problem, none of which added up to a whole great big system.

Today we're still far short of [President] Reagan's view of what a shield would be, but they're dealing with sort of local defense systems, they're dealing with theater defense systems, and they're dealing with a national missile defense system, which they are actively testing the pieces of today. Again, it's still a very difficult problem, more difficult as you try to protect more territory from more incomings. But, nevertheless, people are making progress on it, and in the future I think we will have to find some way to deploy some scale of those kinds of things as a defensive system. I think sooner or later we will. I think it's inevitable. They will be the descendants of what started with President Reagan's speech in 1984. I caught a slice of that. I probably was in the area where that was going on for a couple of years. It was an interesting time for me.

Let's see. I was at Seal Beach, [California] where we worked on the GPS satellite. Then I went up to help in Downey [Downey Engineering] where one of the work packages for Space Station Freedom, Space Station at the time, I don't think it had the name Freedom, was being put together.

I'll tell you an interesting story about that, and it applies to NASA and it applies to industry, and that is that especially when you're at the position where you're responsible for the direction of things, you have to be careful about the environment and whether it changes on you. What I mean by that is, there were four work packages for Space Station, and this was being competed. I think there were four, but let's say there were four, because I'm going to talk about work package four. These were being competed for the Space Station. All that was against the backdrop of Rockwell being the Space Shuttle big contractor. They had won the bid, so they were the big development contractor. So here were a bunch of industry teams competing for these four packages of work for Space Station.

Now, through a combination of circumstances that I don't know exactly what they all were, Rocketdyne, which was a sister division to the division at Downey that I went to help the Space Station guys with, Rocketdyne ended up getting work package four assigned sole-

source. I mean, they ended up having the technology, I guess, that the other companies couldn't quite compete with or something, but for whatever reason, NASA decided they were going to award work package four, one-fourth of work on Space Station, to Rocketdyne.

So in my opinion, that represented a fairly significant environmental shift from where it was before, because now we in Downey, or the team in Downey, I hadn't gotten there until the last month, the team in Downey was now faced with, now, what are the odds that NASA's going to award us work package two and give half of the Space Station work to Rockwell's corporation when Rockwell also has work package four and the Space Shuttle.

The impact of that shift never caused, that I could see, a rethink of the strategy for work package two by Rockwell at the time. They were competing with McDonnell-Douglas [Corporation] at Huntington Beach, [California] and as near as I could tell, the proposals just ran the course. The Rockwell and the McDonnell proposal ran the course that they were on without a significant rethink of the impact of this. The only way that Downey, another Rockwell entity unit, could have won another work package would have been to have significantly underpriced all the other competitors. In truth, Downey priced the thing more realistically, and McDonnell-Douglas priced the thing a little bit on the crazy side, which they and NASA struggled with for a number of years to get right. They priced it very low.

But it was interesting to see this, and I got to the Space Station proposal very late. I think I saw it in the last couple of weeks before it went in, so I wasn't involved in any of those strategic discussions. But I don't think they ever rethought how are we now going to win, when one Rockwell business unit already has one-quarter of the Space Station work. How are we going to convince NASA politically to give another chunk of the work to a Rockwell unit? It wasn't apparent to me that there was any rethink of that kind of question when the whole environment had shifted on them.

As a matter of fact, that happens in every business in a lot of different ways and in government organizations and it's interesting how sometimes blind people are to these big

environmental shifts and they don't stop to recognize that it has happened and it should have some influence on whatever it is they're doing and somebody's responsible for thinking that through. They need to know that that's their job.

Let's see. What else? So I went up there and the Downey outfit lost the work package two on Space Station. I spent about a year in a business development job, and Sy Rubinstein was the president of the division. Rocco [A.] Petrone left by that time. There was some pushing around that went on to make that happen, but, nevertheless, [Rocco] left and Sy was the division president and I was running the business development unit.

But I have to tell you that that was unsatisfying for me. Matter of fact, I did it for about a year, and I was getting to the point where I wasn't going to stay doing that much longer. I just didn't like it. It didn't fit. I mean, the work was okay, but it just wasn't anything I wanted to do for any sustained period of time. I was actually getting to the point where I was saying to myself, "I'm not going to continue to do this much longer. I'm going to go do something different."

About that time, a series of events occurred with changes of personnel and the fellow who was running the local Houston operation, Bob Minor [phonetic], went back to run Downey and that opened this job up. Sam Iacobellis, who was in charge of all the aerospace at the time, asked me—he didn't ask me, he told me. It was interesting, he told me, he didn't ask, to go down and run the operation in Houston. That was three and a half years or so after I had left and it was—I mean, it was interesting, it was a return to Houston, it was a return to human space flight, it was a return to a lot of people that I had known and worked with a long time. So especially since I had this other somewhat unhappiness with the job I had been assigned back there, and knowing that I eventually was going to have to change that, either somebody was going to change it or I was going to change it, it turned out that came along at the right time.

So I was in charge of what was called the Rockwell Space Operations Company, RSOC for short. They were doing all of the operations support, not all, a lot of the operations, flight operations support for the center [JSC]. Then there was another part of the unit that was like an extension of Downey called Rockwell Houston Operations. It was an extension of Downey in terms of their engineering orbiter contract and cargo integration contract for JSC and the program office, and it was a different contract than was the big operations contract. On RSOC we had probably in the order of 3,000 people, and on Rockwell Houston Operations' side we had about 300 people. So they were significantly different in terms of size.

So I spent most of my time working on the Houston Rockwell Space Operations part supporting mission operations directorate, MOD, here in Houston, which, by the way, is where I'd started back in the old control center days. So I was now back after leaving it back in 1970 or so, here I was in 1990 back in a support role as a contractor to what my whole organization was, which had changed a lot by that time, and many different players, although a number of people that I, of course, had worked with over the years.

So that was fairly a good move, and it was nice for me and it was something I enjoyed, because I was then again, I was the president of the outfit here, I was somewhat my own boss, somewhat more in charge of my own destiny. My boss, Bob Minor, was back in California. I reported to him within the Rockwell chain of command. He was running Downey. He had been here, was sympathetic to it, so he gave me a relatively free hand and things went reasonably well and we had a good time.

In the next couple of years, though, especially because of my job here in Houston, I was able to go over to the center and not only visit with the primary customer that we had for space operations, which was MOD, but I visited with all the other directorates and the program office and just to see what people were. I knew a lot of the people, so I could just talk with them about how things were.

There was this growing sense inside of NASA that something needed to change on the Shuttle program. They didn't know what, but they were increasingly unhappy with the way that the work was distributed amongst the centers and the way the work was distributed amongst the contractors. Outside review teams came in and generally criticized NASA for having a kind of strung-out, complicated-looking organization for actually running the Shuttle program. NASA didn't exactly know what it wanted to do, but it had this sense that something needed to change.

I always had the feeling I was looking at a pressure gauge on a boiler. In terms of how much NASA wanted things to change, the pressure would go up. I just had the feeling that when I got here this gauge was comfortably in the green and everybody was happy, and then as I watched it for three or four years, there was a sense of the gauge flipping over into the red zone where NASA really wanted something to be done. They didn't know what it was they wanted, they just wanted something to be done. They were wanting the industry, Rockwell or Lockheed [Martin Corporation] or both or whatever, to come in with some proposals for them. Neither corporation was forthcoming in terms of any proposal.

I, in the job I had here in Houston, kept reporting this pressure gauge analogy about the attitude and emotion here at JSC is that Downey should do something, they should come in with some kind of proposal to help the government deal with this unrest, the growing unrest that they had with how the program was being managed.

In fairness to Downey, since the government didn't know what it wanted or how it wanted anything changed, or the most changes you could imagine would involve stepping all over somebody else's toes, it wasn't all that terribly easy to come up with something real clever that everybody could salute. Anything you came up with would infringe upon someone in the system, either another NASA center or Lockheed Martin or somebody else. So it was kind of awkward, but the little gauge just kept getting redder and redder in terms of the feeling that something needed to be done. As a matter of fact, it was getting to the point

where the government was beginning to threaten to compete the whole thing, that is, the work that Downey did, the engineering support, and the work that contractor Lockheed did at the Cape [Cape Canaveral, Florida] where they did the processing of the orbiter.

During this period, by the way, Kennedy [Space Center] and their Lockheed contractor were rather often at odds with Johnson Space Center and its contractor, Rockwell in Downey. There was a fair bit of bad blood that had developed by this time, because they each managed to find fault with each other. If you were in either organization, you could always see the wisdom of your organization's position, but from the outside it looked like a contest where one organization was constantly criticizing the other, finding fault with it in some way. It took the flavor of what was happening to the orbiter, because Rockwell, of course, had built it and Lockheed was processing it. So if Rockwell sent a modification, the modification was never right. If Lockheed did something at the Cape to install something, well, they broke something else and those guys didn't know how to install anything right. So this was sort of constant.

This was just adding fuel to this sense that NASA was developing that something needed to be done, because NASA didn't want to have to deal with this constant contest that was going on between the two big contractors, although in some cases it was kind of provoked and sponsored by the local government managers one way and another. So it was awkward all around.

So into this void, or this mess, gradually—and I don't know exactly who started it and talked about it first—Chris Kraft for years tried to get Rockwell to step up… He was a consultant to Rockwell here in this time period. For years he tried to get Rockwell to come in and propose to take over the whole shuttle system for the government.

Oh, I know one of the things that happened. So in response to this growing sense that something needed to be done, [NASA Administrator Daniel] Dan Goldin created a special team, which is a typical approach to one of these things, to take it outside the hands of all the

people who aren't coming to any resolution, and he asked Chris Kraft to run it. Chris didn't want to do it, but Chris eventually ran it. The question was, how should we organize to run the Shuttle program?

So Chris went off with a bunch of senior well-known, well-respected people, and came back with a report that said you ought to consolidate this thing considerably more and move in the direction of turning it over to a contractor as much as you possibly can. That was acceptable. That was fairly acceptable within NASA and it still carried the possibility that then the whole thing would be competed and Lockheed or Rockwell would either win it or be out.

Somewhere, and it might have been in Chris's report, I don't recall now, but there was certainly a sentiment that people wanted to retain the Rockwell heritage and the Rockwell set of people and so on that had gone into building the system, and certainly at the Cape they wanted to retain the Lockheed people with their sense of having operated it and processed it so well over those years. So out of all that came this idea that maybe Rockwell and Lockheed ought to get together and do something.

It was interesting because—I can't recount for you all the things that happened there, but one of the key ingredients for making this happen was that it began to be dealt with at a level above the level of the work being done. It was done above the level of Downey, it was done above the level of the Lockheed guys at the Cape. It began to be handled by Kent Black, who was a chief operating officer, which is like next to the president, within Rockwell, and a fellow named Peter Teets in Lockheed. So they began to meet to explore whether anything could be done in some joint fashion that would address this problem that NASA was having, and provide a solution that would have the characteristics to match what the Chris Kraft report to Goldin had outlined.

If you had left it to the units at the level of which they had been competing with each other and finding fault with each other, I don't think anything would have come from it, but it

got escalated and was then done at a level significantly above that, so that all of the bad blood thing was not on the table, and what was on the table was the going forward part of it. That is, the customer needs something to be done, we need to do something to get the Shuttle program to…control costs. For a while Kent had an internal Rockwell activity before he got together with Lockheed, and as did Lockheed, and they were presenting competing visions to Washington, D.C., as to what this thing might be.

I must say I can't remember exactly what the trigger was for getting Lockheed and Rockwell together, but whatever triggered it, and maybe I'll think of it or maybe somebody else can tell you, it was then done at a level that was above the level of the previous problem, so all that went aside and was objective. Plus the people involved in it wanted to get a good solution for the government, they wanted the Shuttle program to be successful, they wanted to continue to be involved in it, both corporations wanted to continue to be involved in it, and they wanted to find some way to arrive at a business solution that would satisfy the needs of the customer.

So as a result of that, Kent and Peter Teets began to talk in terms of perhaps some sort of a joint venture or some kind of an organization between Rockwell and Lockheed that would permit this to happen. It was at that time that I was involved through my boss in Downey, kind of one layer removed from where these discussions were going on, but I was asked my advice a number of times. You know, my advice was, look, the government wants to keep Rockwell Downey, wants to keep Lockheed. If they compete it, one of those two parties is going to be out, there's going to be hard feelings on the part of either center who loses their contractor. You're going to lose some talent along the way. If we structure this thing right, the business position would be as good as it is today, or maybe better for each of the contractors in the future, and if they don't like that, then they're running an all-or-nothing risk. They could either double the amount of business that they would get out of this thing,

or they could end up with zero. So the question is, do you want to keep the loaf you've got or do you want two loaves with the risk of having nothing at all when you get done with it?

So I said I think it would be best, especially since on the government side they have a sense that they want to retain the contractor that they have had serving each center, I think it would be best if we could find a way to put these organizations together somehow. And gradually that began to be the theme that worked.

Interestingly enough, we had several levels of progression, I guess you would call it, in terms of how this thing that became known as USA, United Space Alliance, which is a joint venture of—it's actually a limited liability corporation of Lockheed and [Rockwell]—jointly owned by Lockheed and Rockwell at the time, now Boeing [Company], at first it was conceived of as a 200-person company, kind of like a big program office that would manage the exact same efforts that were going on everywhere in the system today. The problem with that is, it didn't look like it was solving anything, it was creating another entity in the middle that still had all the same bureaucracies to deal with and probably the same competition then between the Lockheed at the Cape and Downey Engineering out in California.

We then began to talk about making it significantly bigger and then is when probably the thing that made this easier to happen was that we began to talk in terms of putting all of the Houston people, the Houston operations support people, the RSOC people from Rockwell, into this new entity. Then Lockheed would put an equivalent amount of the operation in the Cape.

To make those two organizations, to make those two the sizes, the scales about the same, if you put all of RSOC into it you would have only put about three-fifths of the Lockheed at the Cape. So then we'd had three-fifths of Lockheed in the deal and two-fifths that still worked on Shuttle processing outside the deal that we had to have some other arrangement.

So that got kind of complicated, so we finally got to the point where we put all of the Lockheed at the Cape, we put in all the Houston operation, the whole RSOC operation, and we put in all the logistics operations that Rockwell had at the Cape. That was a rough balance in terms of size, assets that we were putting in, fee that we were making on those respective contracts, and it was close to a 50-50 match, which is what people were striving for.

That's about the way it transpired, although I've given you a rather quick summary, and it really took several months of trying different things, trying different ideas, and then beating them out and then taking them and airing with them with either internally the corporations, or airing them with the customer, [JSC Center Director] George [W. S.] Abbey in this case. Gradually we got to something that was acceptable to all the parties, both to Rockwell at the time, Lockheed, and to JSC, and then to Dan Goldin and company inside of NASA.

It was a major stroke to have very large-scoped players like Kent Black and Peter Teets involved in this and setting it up, because they were at a level in the organization and had been around long enough to where they didn't have sort of petty agendas for any of this stuff. I mean, they just wanted to get something that was going to be successful and do well for the NASA customer. I think both of the men were genuinely motivated to do that, and they weren't saddled with any of the baggage of problems between competing—competition problems that had been going on between the two units, Lockheed and the Cape, and here.

The unit we put in from Rockwell, which was the Houston operations, didn't really have a problem with the Lockheed guys at the Cape. That problem existed West Coast to East Coast, Downey to Florida. We were kind of separated completely from it, and served our local customer, and in a sense mission operations is a little bit like launch operations at the Cape. So in a sense we had similar kinds of things. We do kind of different kinds of work, but conceptually we were both operations support contractors and we didn't have this

previous baggage or any of the problems that went with that, so we got involved in it. I was sort of one of the major players here from the Houston side, and we started to put this thing together, and the players that came together didn't have any of this, with each other, they didn't have any of this baggage problem with each other, fortunately.

Downey ended up becoming a subcontractor to what became known as the United Space Alliance, and we went through a process of negotiating a contract. For a while NASA had to deal with the possibility that this might be a competition, but NASA didn't really want it to be an open competition where this joint venture team of Rockwell and Lockheed would compete with other people. Other people came up and showed up, but it was more of a strategic positioning that they were doing because basically what they wanted to be sure was that their business was protected and they wouldn't get swept up in this. So they were pretending to want to compete and so on, but all they really wanted to do was to protect the business that they had.

So as that unfolded, it was easier for NASA to deal with, and then they got to the point where they could sole-source this work with USA, United Space Alliance. There were several major steps in that as we went along. I didn't write it down and try to recall exactly to this discussion, but this was announced sometime in '95, and then we had some organizational discussions, organizational announcements of Kent Black as being the guy who was going to come and lead it. He was so interested in it and he was at a juncture in his career where rather than continue where he was with Rockwell in the hierarchy, he wanted to come do this for a couple of years, because he basically lives here in Texas, above Dallas and so on.

At any rate, that fit his personal desires, and when that was announced, I mean, it really was a downhill slide, because everybody in the system, both in the industry and on the customer side, had a great deal of respect for Kent Black, including Dan Goldin. It's hard to please all of these players with the selection, but in this case Kent was such a winner in terms

of selection and pleased all of the people who felt they had a stake in it, and impressed them, as a matter of fact, that it was easy from then on to get on now with this thing.

So eventually the contract got negotiated. That was tedious. Contract negotiations are always tedious. We started with the program authority to proceed in October of '96. Fiscal '97 was our first year of operation as USA. At first, the Houston operation I described and the Rockwell logistics depot and the Florida work came in, and then since that time we've added a few other things, not large ones. Downey is a subcontractor to this United Space Alliance entity, so they're still in the picture, but they have a different relationship with respect to the customer here at JSC. Now there's, in effect, a prime contractor, USA, where before Downey might have been considered a de facto prime or a pseudo prime or something, although Lockheed might have contested that, but that was Downey's role before, but now they're a subcontractor to USA.

The government is supposed, and has a schedule, NASA had a schedule to include the other parts of the Shuttle program, the tank and the rockets and the engines. We've added the software and the Boeing work that was done here for stowage, but the major elements like the [external] tanks, [booster] rockets, and [main] engines are still delaying. We have passed the time when the tank was supposed to come in and it got delayed for a variety of "We're not ready" kinds of reasons. Frankly, it feels like NASA is drifting away from the idea of a consolidated cost-incentivized contractor that's really going to run this. It feels a little bit like we're back to where we were, although we have consolidated at one level up from where we were.

It remains to be seen whether the three major projects which constitute a lot of the work that goes on at the Marshall Space Flight Center will come into USA. The first one that was supposed to come in the tank is still being delayed, and everybody says that, yes, they're going to come, but every time it comes down to putting one in to the USA contract, it's hard for the government to get around to doing that and they find a lot of reasons not to want to do

it exactly now, maybe later. So it will be interesting to see when it actually does fully consolidate with all the Shuttle elements in here.

I think one of the things that might cause that to happen quickly would be if NASA, as time goes by, can get this station on orbit and going and then might enjoy the assignment of a new start, a major new start from Washington Headquarters. I still think that's several years in the future, but when that happens, I think NASA's going to be looking for a way to turn more of its present work over to the industry so that they can release more people to work on the new stuff. That's one possibility for a trigger and initiative or set of pressures that would cause NASA to move in the direction of proceeding to full consolidation of this contract that they have with United Space Alliance.

But absence that, I think it's going to go slowly, and more slowly than people advertised. It's just the nature of the beast. I just don't think people are ready to do that. One of the men who pushed it awful hard was Dan Goldin, and by the time we really get around to the next consideration of things, Dan's been in the office up there eight years or better now, and that's longer than any other administrator, so sooner or later you're going to lose him as a pusher for this thing. Who knows, next fellow or woman that comes in may push it more, push it less, we don't know, or other circumstances may occur that would cause it to go faster or slower.

So right now it's where it is, the two big operations at Houston and Florida are in it, some other contracts are in it, flight software and the crew equipment stowage and stuff like that. The other big ones that come from the Marshall Space Flight Center are not in yet, and it kind of remains to be seen when and really how soon that NASA's willing to do that. It may take them a while to be willing to do that, and it has to do with NASA doesn't have other projects to run, so it's difficult for them to take the one or two big things they have and turn big portions of them over to industry and then they don't know quite what to do with themselves. I understand that, so we'll see what comes of that.

So all in all, the United Space Alliance, I mean, I think it has been a good thing. I think there was need to do further consolidation, there's need to move towards more consolidation in the future. I had the sense that it's kind of stalling out a little bit in terms of the original push to do it. When Kent was doing it, he sold, insisted on and sold, and everybody agreed within him that it should be a fairly well incentivized contract. By that I mean if the contractor can save money below what the contract is, then the government and industry share in that. The government gets two-thirds of it and the industry gets a third. It's kind of like that. It's called a share line.

Those kinds of contracts are generally highly praised at all conferences and so on, and in many government agencies are used, I believe, with varying degrees of success. NASA tends to praise it, but they tend not to like it in practice for some reason. So it still has the feel that NASA wants to run it, not so much like a completion for them, cost-incentivized contract. It still feels a little bit like NASA wants to run it like a level of effort contract, as have been the previous contracts that they have had, which is different from the spirit and the intent that people had at the beginning. Nevertheless, consolidation by itself will provide some benefits to the government and gives you a framework in which to put the rest of the Marshall projects as you decide, as you, NASA, decide you're ready to do that.

So we'll see how it plays out. I mean, it's still a work in progress, but a lot of progress has been made so far, and, frankly, it's working reasonably well, but there are always things that will happen and sometimes people have a tendency to blame something breaking on this new organization. But the truth is, generally they don't have anything to do with the fact that we have consolidated some stuff, it's the fact that things get broken every once in a while.

Some of the recent stuff with the wiring, for example, on the orbiter, is as much a function of age and wear and tear as it is anything else. The number of people trooping through the orbiter over twenty years and stepping on wires, or whatever, is absolute independent of the organizational contractual structures that might exist around the orbiter.

It's the same feet walking on the wires that causes the problem over a period of time. I say feet. Whatever's causing the damage over time. So wear and tear is kind of a thing that we're going to have deal with and we would be having it no matter how we were organized or contracted for it.

So I've continued to watch it, and I think there will be more consolidation in the future and there may be some series of events, either new starts or other sorts of things, that will cause the consolidation to move faster or slower, and it's sort of out of our hands, out of our hand, my hand, certainly now, but still out of the hands of the people at USA, and they'll just have to wait and see how quickly NASA wants to move.

So I worked a long time for NASA, thirty-some years. I mean, I had a wonderful time. If someone had asked me to write a book or write a chapter or write a something, a scenario for what my career could have been like at NASA, I mean, I just could not have imagined anything better than it was. I just could not have. Even looking back, I don't know what else I could have asked for.

Then having gone through all that and kind of run the race, so to speak, inside of NASA, it was getting a little bit like anything else I did after that had the feeling of moving laterally or something. It wasn't clear what the next door to open was going to be inside of NASA.

Then the idea of moving to industry was a new thought for me and difficult to come to grips with at first, difficult to imagine leaving an agency that you had grown up in, but in retrospect, it was the right decision for me to make at the time. When I made it, I got some advice from people that said, "Just don't look back. Just proceed on this path. You only get one in life, so proceed on this one and make the very best of it and don't second-guess." That was good advice and I certainly would have gone about it that way, I think, but I think it reinforced the way I would have done it. So I learned quite a bit.

As a matter of fact, it was quite an illuminating experience for me compared to the government setting I had been in to see what American industry was going through in the eighties. It was quite an eye-opening experience for me, and I was quite impressed at the level of vigor and fire with which people were attacking this problem of competition for survival. It was a no-kidding kind of an experience.

At any rate, then to see how things got done on the industry side, to see how some of the differences are between what drives the government operation compared to what drives the operation on the industry side, and what some of the differences are, it's been very enlightening. I always felt like coming back here for the last eight years or so of whatever it was of my career, I mean, I felt like I had been through a lot. I think people here at the center genuinely felt like I was trying to help them the whole time, which I was. I was always trying to find a solution that would be good for the program, good for the customer, because as the program succeeds, so would the contractors who were associated with it. So NASA's success is really success for the industry also. It was easy for me to think about it that way and to try to find ideas and concepts and so on that I could bring to my NASA colleagues for solutions to things. I enjoyed it.

So I found myself in kind of a unique position, having been both places. It was a very satisfying way to complete my career activity. It was kind of a magic trip. I mean, the whole thing was kind of a magic trip. I just could not have imagined a more wonderful, fun-filled scenario than the one that I had a chance to complete, and then a chance to visit on the industry side and learn a lot of things that I would never have had a chance to see or appreciate. So I think it kind of rounded out my experience within aerospace, having now worked both sides of the fence.

But through all of it, people in both government and industry, especially for the human space flight work, and I had only a few years of the other kind of work, genuinely love it. I mean, they genuinely love it. The people who come to it are attracted to the work,

they want to be part of it, and therefore they tend to be positive and they tend to be kind of can-do-ish. That has been a hallmark really, a characteristic, a predominant characteristic, of the whole group of people, both government and industry. Over the decades people have been very can-do about this. They're very dedicated to it. They take a great deal of pride in all the successes that the program has. They suffer when there are failures or problems in the program, suffer emotionally. They really committed themselves. They've committed themselves to it. It's a wonderful thing to see so many people, tens of thousands of people, joined in an enterprise and still carrying a lot of the same common goals, common sense of dedication, common sense of can-do. It's an admirable, noble enterprise, and a wonderful thing to watch in action. So for me, I've just been blessed by God to be able to see it from so many different angles and so many different jobs. I've loved it a lot, and I still do.

BUTLER: I can certainly understand why. Let's pause for a moment and change the tape, and then I just have a couple last questions, if that's all right.

LUNNEY: Okay. Sure. [Tape change.]

BUTLER: I think this is a good, just a contrast, since, like you said, you did see both sides and watched everything evolve.

LUNNEY: It does make me mad at the politicians, though, when they all take credit for the economy. [Laughter]

RUSNAK: Especially around election-time.

LUNNEY: Oh, yes.

RUSNAK: They're taking credit for everything good that's going on.

LUNNEY: They're breaking their elbows patting themselves on the back. But I guess that's the way is it. So what else would you like?

BUTLER: First, I'm going to ask Kevin if he has any questions, and then I'll follow-up with a couple.

RUSNAK: I did have one sort of a general question. You'd mentioned at the beginning that you basically grew up with the space program, you came in when you were very young and have been a part of it all your life. So I guess what I was wondering is, how did you personally change going through this as you entered it as a young man and grew with experience in time? And then how did the agency change going through that same sort of life cycle?

LUNNEY: Well, let's see. It might be hard, you know, it's hard for an individual to evaluate himself, especially as he goes along over decades. I know that when I first came to it, and probably the first years of my career, I probably expressed impatience more often and more vigorously and in a less controlled way than I learned to do later on.

The organization we were in, in flight ops [operations], in the early days was very competitive about ideas, so people would argue about their point of view and how to do something, and they would argue about it very strongly. I mean, it was passionate arguments about how to do things and so on and so on, and sometimes probably more passionate than we should have been perhaps a little bit more objective along the way.

So in the front end of my career, I mean, I was in this environment where we passionately argued about a lot of things and how to do them and so on and so on. It came together well, I mean, as a result of that, and the people who were involved in the work were passionate about the work, so I guess it wasn't too surprising that we argued about it passionately. But it was kind of a characteristic of perhaps youthfulness in my twenties.

I didn't learn until I got perhaps along into the program management work, and even there that continued to evolve for me, to be patient with people. I mean, I've had people today, Kevin, coming to me and say, "You know, Glynn, I used to watch you in 602," the conference room over there where I was, where the program management function, one of the conference rooms the program management was exercised in. People would come to me and say they were always amazed at my patience with dealing with things. That was not a given thing. I mean, I had to learn that.

I realized that, in general, people would come to those meetings and they had a message to convey. Sometimes engineers don't convey messages very clearly, it's a little muddled, if you know what I mean. So I found myself trying to be very patient in drawing out what the person's message would be, and I guess I sort of worked at that, so it probably showed that I was solicitous of the person, even if perhaps he wasn't being as articulate as he could be towards making his point. But I learned that you need to pay attention to people.

I also learned that I could be wrong. Early on, you sort of have this conviction that you're right all the time. As things went on later on I realized that I could make a mistake about judging things. I don't mean about technical matter, but for example, when the [European Space Agency's] Ariane [rocket] came along, I must admit that I misjudged the seriousness of that as a competing threat to the Space Shuttle system, and I didn't take it as seriously as I could. I'm not sure that I would have done anything differently, because we didn't have the degree of freedom that they did, being a government agency, but I know that I

could have taken it more seriously and that might have caused some difference in my behavior, or in my actions, than occurred, but I'm not sure of that.

But nevertheless, I found that as I went along, I was probably a little bit intemperate at times, and brash on the front end, and I tried to learn over periods of time to control those things and become more patient and more ready to recognize that there are lots of points of view, that mine wasn't always right, and that I should seek out, perhaps, even points of view that were different, to get them out on the table.

So maybe you can call that maturity, Kevin, or process of maturing, but I could consciously recognize within myself that that was happening and that I was doing it or dealing with it, and I could see myself transitioning from a degree of brashness on the front end, or whatever you—I don't want to overdo it. But I found myself becoming more patient and more willing to listen and more willing to take advice, or recognize that I could be wrong and so on as I went along in my career.

Towards the latter stages of the career, for example, when I was back here at RSOC, I had the sense that it was long past when what was going on or what we were doing had anything to do with building any credits for me, but rather if I had any role to play, it was in helping people who worked for me in the RSOC organization, help them get their job done and help the customer and them get along well together, and see other's points of view.

So I kind of had the feeling that I, at that stage of my life, I don't know where it happened to me, but I recognized that coming back here put me more in a position of trying to be, I don't want to say mentor exactly, but something more in that mold with respect to the people who were doing the work. I mean, I was not doing the work anymore; I was just providing an environment in which other people could do the work. So I was trying to make that environment as constructive as I possibly could for them.

So I felt myself going through that, and I guess if I thought about it for a while, maybe I could delineate for you sort of the passages of life, but those couple of things were

very real and I was aware of them as they were happening. I worked at trying to make them to happen so that I could begin to downplay some of the stuff of my own that might be getting in the way of my really getting to the right answer and try to extenuate the things that I thought would help me get me to the right answer on any given subject. So I know that I changed in that way and so on.

With respect to NASA, NASA also had a sense of brashness about it in the beginning. Certainly the sixties were a time of a very bold and a brash adventure. But like all organizations, over a period of time there are more trappings get added to it and more process and more this and more thats, so there's less room in an organization for brashness. It's not as easy to get away with it or to apply it successfully.

NASA has become a little bit more bureaucratic, people say, but part of it is the Shuttle program, for example, drives people to be procedure-oriented, process-oriented, repeat it the same way every time. So in a sense, the programs that they're running causes them to get into kind of a mode of doing things and then to repeat it very well. There's some innovation and some new stuff, but 90 percent of what the people do every day is a repeat, to some degree, a little change here and there, but it's kind of a repeat, a repetition, of what has been done before. So that kind of mitigates against a lot of innovation, a lot of off-the-wall things, and so on, and it tends to bring people back and keep them in a tight zone of "This is the way you do things." So the nature of what they're doing is such that it kind of constrains them to this repetition of a known process and getting a known outcome, since you want the same outcome every time, that is, you try to keep everything the same. It's like a recipe.

All agencies, any organization after thirty, forty years gets a variety of things that they salute and have to do and want to do and so on. Things tend not to get taken off, they just tend to get added, so there's an increasing number of things, or processes, that people go through that's more frustrating. I would say that for individuals when we came in, when we

came in, there was a sense that it's wide open, there's more work to do and bigger jobs to do than we've got people to do it, so we were always stretching ourselves to grow in these jobs.

I have watched young people come to RSOC, and our youngest son works over at the center, and they're all playing into an environment where it's all stacked up in front of them. For any given job or any given opportunity, there's five or ten or twenty other people who may be qualified for it. So you don't have the sense of it being wide open, you have the sense of it being stacked, which, by the way, is the same sense I had when I went to the NACA [National Advisory Council on Aeronautics] center in Lewis [Research Center] in Cleveland [Ohio] back in 1955, that it was stacked. After a little while, even at eighteen years old, I realized for me to be a section head in this place is going to take four guys dying. It's a crude way of putting it, but there were so many people who were good at what they did, that the only way a fellow could advance there would be if all the people in front of him somehow fell out of the way.

So that sense of things being stacked up is not a good one for people. You'd like people to feel that there's more openness to their future and to the opportunities that they have. I think a lot of young people at the center are probably a little caught. Maybe they don't even realize it because it's the only environment they have known, but people realize when things are stacked up, because they can see, and if they compete for a branch chief job or something, that there's a lot of people competing for it and they're good people. So it's stacked up. It's hard to break through, and the truth is that may be true in a lot of organizations. It wasn't true in NASA in the sixties, but in any mature organization I expect that's the condition that you would run into.

So I think what you have is a mature organization that has all the characteristics of a mature organization. When we started, I mean, we almost didn't have, you know, in some cases—I mean, our travel was we had these little books that were like checks that we could write, go anywhere in the world. It's like a TR [travel requisition] we'd travel all over the

place or something. A TR book, little green things. They were like government checks. Want to go to Bermuda? Just sign this thing and turn it in, you got an airplane ride to Bermuda. Travel orders? Hardly. I mean, they eventually caught up with us and starting having travel orders, but I mean, it was fairly wide open. That's what I mean by a sense of openness. I mean, we just did whatever we had to do, but gradually all that changes.

I think, to me, I guess that's the sad part to me with respect to the environment that the young people are in over there today, even if they don't recognize it, which, by the way, I think they do, and that is that the situation is stacked up for them and there's not as much opportunity for them to grow and do different things and figure things so that the sense of always expanding your learning is not the same as it was when I was there.

I expect that people kind of intuitively know that, and they feel a little bit more constrained, and therefore it's not as much fun, or as much reward for them as it would be the other way. But I don't know what you do about that. That's just a sign of a mature organization, and that's what NASA is today. That's the way it is, kind of, unless and until NASA gets a brand-new start and then there'll be a great bit of room for innovation and so on as to how you might execute that new start. That would certainly energize the right kind of juices for them, but until that, they're bound by this fairly heavily procedure and process-driven system that they have into a kind of a lifestyle of repetition so as not to have anything come out bad. I mean, they know what they do works, so they're going to try to continue to do it the same way.

RUSNAK: That was all I had. That was very well put. Thank you.

BUTLER: Jason, did you have a question?

ABBEY: No.

BUTLER: Talking about NASA as a mature organization, how do you see the programs and the direction that it's going now and what do you think might be in the future for the manned space program?

LUNNEY: Well, I know that what the space cadets would like to happen, all of us, is that a major new exploration initiative be started that would involve going back to the Moon, perhaps, or perhaps on to Mars. I say perhaps in the sense that you could do either one or both of them together. I think what most people feel is that that's the next big challenge that would lie in front of the agency. The difficulty that NASA has is they will be operating in low Earth orbit with the Shuttle and Space Station, and the question is, for how long before this new thing happens?

My personal view is the "how long" may turn out to be a fairly long period of time. It might turn out to be another ten years, or twenty, or none, or zero, okay? So if it's zero, then the problem somewhat takes care of itself. If, however, the "how long" becomes ten or twenty years, then I think NASA needs to find a way to create as much positive value for the country from the Space Station/Shuttle enterprise as they possibly can. I really believe that they're not organized to do that. There isn't a set of people who think it's their job to create a set of activities to make the Space Station/Shuttle complex pay for itself.

If you look at this in industrial terms, we have a Shuttle that costs, let's say, 3 billion dollars a year to run. We have a station that's going to cost 2 billion dollars a year to run. In round numbers, it's going to cost 5 billion dollars a year to run. So we had a factory that we're running, it cost 5 billion dollars a year to run this factory. We've got to start concentrating on what are we making, what are we producing with this factory that has significant enough value to justify the 5-billion-dollars-a-year expenditure.

I don't see anybody who's thinking that way in NASA. I mean, I know the folks here at the center are dedicated to building and operating the Space Station, and they don't view it to be their job to create the activities that would make it worth the cost or at least approximately worth the cost. If they happen accidentally, that's fine, but I don't think they view it their job. It's not clear to me that anybody in NASA views it as his job, his or her job, to do that. I think that's the risk, NASA, if they go get a new start approved next year, then this risk goes away, because it will get washed out and they'll get out of this Space Station and let somebody else run it somehow and so on and so on.

However, if that doesn't happen and they're here and have to run it for ten or twenty years, sooner or later people are going to say, "Well, now, let me see. We're running this 5 billion-dollars-a-year factory. What are you guys making with it?" And there has to be some much more constructive and positive answer to that question. It's not a trivial question. Especially if you imagine that it's going to go on for ten or twenty years after we get the Space Station built.

So I think NASA doesn't have an organizational focus that has that as its main responsibility. The problem you have at the center is people's main responsibility is building and operating this thing. That's what they see as their main responsibility. They agree with me when I express thoughts like this. They'd like to spend some time on it, but they're all occupied with what they're doing. There's needs to be an organizational focus that really has this answering that question. Strongly, that has to be the focus of their organization of that outfit, and I don't see that that organization exists in NASA. I think it needs it.

BUTLER: It certainly would seem to.

LUNNEY: That's what I think. I think, by the way, successfully doing that helps to cause the longer-run thing to occur more easily. Failing to do it mitigates against people arriving at a

positive conclusion to give NASA another big thing to do, because if we don't make the Space Station successful, people will be asking, "Well, let's see. We spent all this money for this, and now you want to spend all that money for that. Tell me again why I should do that."

Now, if you go in and say, "Look what we've done. We've done blah, blah, blah, blah, and made this thing a marvelous success," the guy says, "Yes, you really did." So it would be easier for the approval process and the decision-makers in it to greet with a positive answer a NASA that had made Space Station in low Earth orbit very, very successful in terms of the product and services that it was delivering. So I think it's an absolute necessity, but it is not being dealt with that way that I can see or find inside of NASA.

I think that's a very glaring problem that is liable to compromise the very seeking of a new start that so many people in NASA are dedicated to have happen. They're going to be judged by how successful they are. They're very good at building and operating things, but there isn't a focus on creating a set of products and services that makes this enterprise pay for itself, or at least approximately pay for itself, not necessarily in one-for-one dollar terms, but value terms. People would have to perceive that it was producing value that was worth the operating costs, and nobody sees that in his or her job, and that's a real blind spot.

I've said to a lot of people and they all nod at me, but nothing ever happens. But I think in the end it may end up having to be addressed in order for NASA to be successful in getting approval for another major new start, especially a big expensive one, which they all are.

BUTLER: Hopefully if enough people like yourself express the idea and as people are working on it and maybe as the construction finishes, maybe then the focus can shift.

LUNNEY: Yes. Yes, I hope so. But somebody's going to have to take it as his job to make it work, to make it happen. It won't just appear.

BUTLER: Can't come by itself.

LUNNEY: It won't just come by itself.

BUTLER: Well, looking back over your whole career with the space program, what would you consider—and I know you've had many—your biggest challenge? And then in retrospect also your most significant accomplishment.

LUNNEY: Biggest challenge. Well, I mean, it's hard to pick one.

BUTLER: I can understand that.

LUNNEY: I mean, I could almost pick them in terms of jobs that I had. I mean, being a flight director in Apollo and Gemini was a major challenge. Running the Apollo-Soyuz [Test] Project with the Russians, Soviet Union at the time, was a big challenge. Then running the Shuttle program was a big challenge for me. So they were big challenges.

In terms of accomplishments, probably Apollo 13 was the best piece of work I ever did in my life. For eight or ten hours there, I earned thirty years of pay in ten hours. [Laughter] Listening to that tape like I did the other day of the press conference I held the next morning, I listened to all that, and I was thinking, boy—even today, I mean, I asked my wife if what I was saying was intelligible to a lay person as opposed to jargon-driven, and it was, she said. I picked up on that as I listened to it, and then I was deliberately attempting to convert engineering jargon terms into English-meaning kind of terms for people, which is something we picked up. So the single most significant achievement, I think, was that one shift I pulled on Apollo 13 when the thing blew up.

Probably the other one was just being able to be the leader of the Apollo-Soyuz with the Russian interface, the Soviet interface thing. The Shuttle was—there's not one thing I could pick on in those four years of the Shuttle program management, but it was everything that it took to put that together.

It's interesting the Shuttle program doesn't have the same focal point of individual accomplishment that I had with the Apollo, with Apollo 13, with flight control, as a career at the time and Apollo 13. But the Shuttle program had four years of just one exciting mission after another and dealing with a lot of things on the side, having to do with maturing the system and growing and improving the performance and build another launch site and so on. So it had a lot of things going on and it's hard to pick one thing out of all those activities that I could salute.

So if I had to pick one single piece of work I did, it would have to be the night of Apollo 13 as an individual accomplishment. It was not an individual thing, because there were a lot of people there on the team. The chance to do that thing with the Russians in 1975, middle of the Cold War, as a young man, was quite a thing and we pulled it off.

BUTLER: You certainly did. You certainly have had a lot of major accomplishments and a lot of challenges along the way that led to some interesting experiences for you.

LUNNEY: They did. They all did.

BUTLER: You mentioned earlier that, looking back, you probably wouldn't have changed much, wouldn't have done things much differently, but looking back, would you have imagined where your career would lead you?

LUNNEY: You mean—

BUTLER: From when you first started at Lewis.

LUNNEY: No. I mean, absolutely, I mean, even when we got involved, even when I got involved in the Mercury project, I mean, I had just not stopped to think about where it was going to lead. I mean, we had a couple of flights scheduled, orbital flights, four or five, for the Mercury project, and I must admit, I mean, it's a symptom of youth, perhaps, but I wasn't terribly engaged in thinking about what's going to happen after this. I mean, I just don't recall being very occupied with that. We were so involved in the doing of this exciting thing that we had called Project Mercury, that I didn't give very much thought to what was going to come after that.

Then the next major challenges over the next couple of decades of my life were just handed to us, I mean, the "Go to the Moon" from President [John F.] Kennedy, which then led us to Gemini and Apollo and all that, and then the Shuttle decision was made in the seventies, as was the decision to do the Apollo-Soyuz project. Then the Space Station decision. So those were all kind of decisions made by other people out of my hands, but that created a future that I have worked in for forty years. But on the front end I had no imaginings of anything like it turned out to be. Just absolutely none.

I mean, had I written down what happened and written it down in 1960, saying this is what's going to happen, we all would have laughed at it, saying it can't be like that. But that's the way it turned out. So I was lucky.

BUTLER: We are very lucky to have you come in and share so many of your thoughts and your experiences with us.

LUNNEY: Well, thank you, Carol. It's been fun doing it. I appreciate the opportunity.

BUTLER: It's been a lot of fun for us, too.

LUNNEY: Good.

BUTLER: Thank you.

LUNNEY: Good. It's good. Good.

BUTLER: I hope that your family will find it fun, as well, that they can share.

[End of interview]