

ORAL HISTORY 2 TRANSCRIPT

JOHN F. YARDLEY
INTERVIEWED BY SUMMER CHICK BERGEN
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BERGEN: This is an interview with John F. Yardley on June 30, 1998, in St. Louis, Missouri, interviewed by Summer Chick Bergen for the Johnson Space Center Oral History Project.

Let's talk about Shuttle today, and let's begin about 1969. You were working on, I guess, what they called Phase A of the Shuttle Program.

YARDLEY: The Phase As were kind of perfunctory. Phase B is a fairly significant one, involves teaming with various people and so on. So that went on until, gosh, I guess '71, we turned in Phase B reports.

BERGEN: McDonnell?

YARDLEY: Yes.

BERGEN: You were still working for McDonnell then?

YARDLEY: Yes, and we were teamed with Martin [Company] at the time, I think. I don't know who all did Rockwell. Dave Gowan [phonetic] did and a bunch of others. I was informally told by some of my friends that ours was the best Phase B, but then we screwed up on the real one, Phase C. I think I mentioned this yesterday. They didn't believe our teaming with our West Coast division was credible. Now, they didn't think we'd be credible; in other words, the relations weren't too good and everybody knew it. Douglas [Aircraft Company] was just dragging their feet then. They weren't really much of a help, but we got some help

from some of them, but the rank and file was not very enthused about it because we were going to be heading it out of St. Louis. So anyhow, that showed through on the real Phase C proposal, which is why we didn't win that, according to Bob Thompson, who went to work for me later, and the others in the review board.

The higher St. Louis activity that had done Mercury and Gemini was not the giant activity that they were going to have on the Shuttle, and Rockwell, with the Apollo background, well, I'd say they weren't too happy with the quality because they had some problems. They did have a big team. So I think that's what really did it. That's what they said did it. [Laughter] But I guess you know they came to me later and said, "Why don't you come to Washington and run this whole thing." They liked our stuff in Phase B and they liked our understanding of the whole thing at the top, but they didn't think it was sufficient in the broad sense.

BERGEN: So what did you do with McDonnell after you didn't get this position?

YARDLEY: Well, I went back to my day job. [Laughter] I was the general manager of the astronautics in St. Louis. We had the headquarters of the astronautics in Huntington Beach because they had a little more activity at the time, and we worked on the Skylab, setting that thing up, worked on the Harpoon missile. We went to the Navy and got a good start on the Tomahawk missiles and things like that, but not too much space.

BERGEN: So someone from NASA came to you and asked you to—

YARDLEY: Yes. The someones were the administrator, Jim [James C.] Fletcher, the deputy administrator, George [M.] Low, and Rocco [A.] Petrone. They twisted my arm to come to Washington and have dinner with them and put it to me. Actually, they sent out a guy who I

knew that was one of their headhunters, and he came to me with the guise that he was looking for somebody and who did I think would be good and all that stuff. I saw through him pretty easy. [Laughter] So that's how I got into it, and, you know, it was an easy decision, because, gosh, I took a salary cut from about—I don't remember the details, but \$85,000 a year plus promotions, to \$37,000 a year.

BERGEN: Wow.

YARDLEY: Which was the maximum pay at that time with the government channels.

BERGEN: So what could have caused you to take that kind of salary cut?

YARDLEY: Well, I wanted to do the job. They also had other problems. I mean, in order to be acceptable legally, I had a bunch of McDonnell stock, and McDonnell, of course, was still doing business with NASA, and so we finally worked that out, that I in my associate administrator job would delegate all interfaces with McDonnell-Douglas to my deputy, and that got cleared by the White House and stood up. So we got over that hurdle. It was a lot of fun, the program was a lot of fun. I enjoyed it, but it was kind of [unclear].

The other thing that bit me is in my retirement with McDonnell, gosh, I had thirty-some-odd years or so, twenty-five. The seven years I was at NASA was not counted. So that was a hit on my long-term retirement. The old man—they called him the old man—Mr. McDonnell, Sr., did make a change in rules for me in that they would give me a technical leave of absence, which would be satisfactory to the government, in which I could retain some benefits, past earned bonuses that hadn't been paid and things like this, and he passed a general rule that if employees went to work for the federal government, they would have this sort of a status. They had lawyers all working on it for the government. They would "have

their job back" when they came back if it was available or if another job was available, provided they did it within thirty days of termination with the government. By the time I came back, he was dead. Mr. Mac died in 1980, and I got back in '81, I guess. He was a great old guy, though. I think he was the best of the icons of the industry. Certainly, like Rockwell, we had a dozen of Mr. Mac's during our tenure.

Boeing was the other really staunch organization. Of course, now they've merged, and I hope they can get along better than they did with Douglas. [Laughter] So we got it all worked out, and it worked okay. We didn't have any problems. Nobody was raising the red flag, "Hey, this guy can't do this because," blah, blah.

The Congress, I got along well with the Congress, too, mainly because I told them the truth all the time. I mean, they were tough, some of them. The House wasn't bad. We had Bill Nelson for most of that. On the Appropriations side of the Senate, old [William] Proxmire used to give us a bunch of lectures and stuff. Eddie Boland [phonetic] was the head of the House Appropriations Committee, and he had some good questions. He'd start out, "Mr. Yardley, last year when you were up here you said you were going to have so many hours on the engine. What happened?," that kind of thing. But he was a great guy. He came to my retirement party and all that. So we got along pretty good.

Okay. Where were we? I was digressing.

BERGEN: So you got everything worked out with McDonnell, and you came to work, went to Washington and went to work for NASA.

YARDLEY: Moved my whole family. At the time it was five, I guess, kids, all five kids. The oldest was going to college, so she didn't come. The second oldest was already married, but she was having trouble with her husband, so we had her and her two little kids for a while. But we found a nice house. One good thing is we bought this house. Seven years later we

sold it for over twice what we paid, which was just the way that the Washington housing market was. So that helped a little bit to defray some of the other problems.

[When I left Washington, I rejoined McDonnell as president of the McDonnell Douglas Astronautics Co. The next major bid was on the Space Station and we won one of the major elements.]

BERGEN: So when you came to Washington in your new role, what were your responsibilities?

YARDLEY: Well, they were very broad. The three guys that I had dinner with are the three guys above me in the agency. I had known George Low ever since the merger. He was one of the Mercury guys for NASA. Fletcher I did not know. He was a card-carrying Mormon, and a really great guy. He lived it. There was other Mormons that didn't. They had a senator from Utah that used to ride our airplanes back and forth, and he drank like a fish, you know, which Mormons aren't supposed to do.

The job really was to coordinate and direct the whole operation, wherever it might be, and it was all over the country, and it's kind of a hard thing to get a handle on. Now, there's a lot of good people working—Bob [Robert F.] Thompson, for instance. You probably know Bob. He was the Shuttle guy at Johnson [Space Center], and Johnson had the charter of being not only the orbiter people, but the systems integration people. Marshall [Space Flight Center] had all the propulsion stuff, the main engines, the solid motors, and that sort of thing, and Kennedy had the launch readiness and checkout.

We had some problems with different things. Johnson we didn't have much problems with. [Christopher C.] Kraft [Jr.] was very active in it, a good friend of mine from way back, from the merger. He was one of the first guys I ever met. Faget didn't get into it much. I'm not sure why. He was still there. I understand he's having problems now. Johnson was kind

of strong-willed, and so they had to lean on him now and then. Thompson, [unclear], "Marshall isn't really coming right. Why don't you give me their funds, and I'll take care of everything." [Laughter] But it all came out.

So we did have to make some changes at the Cape. I forget who it was that was there at the time, but it was a general, I think, an Air Force general. He was retiring from that. So we put Lee Sherr [phonetic] down there. "We," I mean [Alan M.] Lovelace asked me if it was okay with me. Lovelace at that time had moved in.

Shortly after I got there Petrone quit and went to run a garbage company, you know, reclaiming environmentally important type of activity. Then George Low, who was the number-two man, he left for Rensselaer, to be chancellor of Rensselaer Polytechnic, so there's Fletcher without any of these guys. He checked to see if I wanted to be the deputy administrator, and I said, "No, I don't want that job. I'm happy with my job." So he put Al Lovelace in there. Al was the associate administrator for science, extremely good guy. I didn't know Al very well, but he was very good, and he knew Sherr and thought he'd be pretty good, and I didn't know much about him, but I said okay. He'd run Edwards, I think, for a while. But that didn't work out. He just wasn't cutting it, and I finally fired him, and we put in Dick Smith, who was one of the Marshall top engineers for years, a non-German, and he'd been up in my shop as a deputy administrator for maybe a year, and he did a fantastically good job down there.

We didn't really have any more troubles. Marshall was always kind a standoffish organization officially. When [Werner] von Braun was running it, it wasn't too bad. You could go in and sit down and talk to Werner for an hour and this kind of stuff, but Bill—let me think. What's his name, the guy who was running it all the time? He was kind of standoffish and close-mouthed and close to the vest, his cards close to the vest, and I kind of had to run around him a little bit to get things done. Most of the guys he had on the projects, the tank guy, Jim what's-his-name. I'm terrible with names. Then George—actually, George

Hardy was on the solid and Jim was on the tanks, and J. R. Thompson, who was outstanding, was on the engine. He and Rocketdyne worked hand in glove, as I mentioned yesterday. Their only problem was they were continually improving themselves into trouble.

I'll tell you a little funny story. I finally said, "J. R., I want you to—" he was out there at Rockwell—"I want you to give me a call at eight o'clock our time every morning," which was five his time. [Laughter] So he'd go out and he'd get a pay phone and call me. He'd say, "Gee, it's cold in here."

I'd say, "Why is it cold?"

He'd say, "Well, I've only got my underwear on." [Laughter]

They agreed that the way we wanted to go would make it work better, faster, sooner, but they sure would like to try these other things to improve it. So I said, "After we get it qualified for 104, you guys can play your games."

We had cooperation from most of the other centers that just had peripheral—like Langley, [unclear], and, of course, Edwards ran our test flight on the B-29 separation and all that out there. I was sitting next to Barry Goldwater out there. He was watching it, and we were watching before the thing. Carl Sagan was there and a bunch of people like that. But he said, "Who's that guy over there with the pointy ears?" It was this guy on "Star Trek" that had the big ears, you know. He was there. [Leonard Nimoy] So we had a lot of fun. But we would never have the chance to do all that otherwise.

Let's see. What else?

BERGEN: Why don't we talk a little bit about the NASA-Air Force relationship.

YARDLEY: The Air Force was not enthusiastic about the Shuttle, because what they saw is the possibility of taking all their launch vehicle development away. Their one big customer was the CIA [Central Intelligence Agency], and they were not very happy. They didn't worry

about the things the Air Force worried about. They worried about "Here's another bunch of civilians getting into our work that can't keep a secret." [Laughter] So between those two, we had some problems. As a matter of fact, everybody was going to go in and do it grudgingly until the *Challenger* happened. They said, "See? We can't put our payloads on that." So it gave them a convenient out, and I don't think they're doing anything. They were planning on launching their whole GPS [Global Positioning System] system, now the Shuttle, on little third stages, which are called payload assist modules, PAMs, done by the West Coast McDonnell. Instead of the delta upper stage, they modified it so it would go in the cargo bay and do it, and it worked fine, but it was primarily for commercial customers and things like that.

When the government, whoever that was, it was not NASA, could concluded in the flight, the *Challenger* flight investigation, that they shouldn't have any of these commercial payloads and they shouldn't have all this diversion, and that's what was giving us problems. Well, that's not what was giving us problems. Before that, we had to get these commercials lined up and the Air Force lined up so that the Congress would say it was worthwhile doing. But it's the normal in-fighting business. They weren't going to stop it then, and they did. The Congress, to their glory, gave us a replacement order, which was a couple billion dollars for the *Challenger*. So once we were that far along, they weren't going to stop it. On the other hand, why should we risk these very expensive machines on these nickel-and-dime satellites? Well, it'll come back. It'll change.

What else? What else would you like in that general vein?

BERGEN: I just wanted your viewpoints on that. I was wondering if you could maybe talk about some of the problems that Shuttle had before the *Challenger* accident, the development and production.

YARDLEY: Yes. The major problems in the development were the heat protection, [unclear], the main engines, and the other things were sort of not that far from what we had done before. They were new parts, but, for instance, we were using hydraulic controls on this, and we weren't using them, but the airplanes used them for a long time. We had to make them special for [unclear] and everything else. We had turbines running in the hydraulic system up to 70,000 rpm or something, that scared the hell out of everybody, but they didn't break, and they had occasions to contain them. Everybody in all systems had some problems. They weren't insurmountable. But the big ones were the tile and the main engine, because we kept blowing up engines, as I've already mentioned.

The tile, there was something like 25,000 tiles or something, individual. Lockheed made these tiles, each made to dimensions, tight dimensions by machine so they'd fit the curvature, the outside and inside stuff, and they'd fit the other things. It was a star-spangled mess just to be able to make them and get them on. But to take them off and redo them was really too bad. However, it did work out, but we had a heck of a time.

Down at the Cape, we decided—actually it was Chris Kraft and I, we both agreed we had enough problems with these things. The problem was they weren't going to stay on, maybe. Rockwell had used certain criteria to design them and stick them on there, and it was a suspicious criterion, so we started testing them, and, I don't know, 20 percent of them fell off under test loads that were not any bigger than the flight loads. So what we did—it was a hell of a decision, but we did—we took off 25,000 tiles, re-treated the tiles and re-put them on and proof tested all of them at the Cape. [Laughter] And we did it in one of the new orbiter processing facilities, and they hired a bunch of local people and taught them how to do this, and they had people working on those tiles—and the bookkeeping on whether the tile had been tested or was off or on was a nightmare, but it all worked. And after the first flight there wasn't a single tile gone. There were maybe a couple of dings in tiles where maybe something hit them, but it didn't bother them. So that was probably the number-one problem,

and it probably cost us six months. I'm just guessing. On the other hand, everybody else was playing catch-up: "Whew. Hope those tiles give me time to get my thing fixed." [Laughter] So that was, I'd say, the main problem.

The main engine. I've already mentioned those two were the main ones, but as we found out later, one of the problems was the solid rocket motors. All those things you glue together have uncertainties about them. The solid motors, the propellants [unclear] cast in there and glues itself to the side. What had happened, as I mentioned yesterday, if you left it horizontal instead of vertical, the weight of this propellant, which was heavy, would try to flatten the thing out, and it would pull the structure with it, and it was a slow process, and once you'd tilt it back up, it wouldn't go back up right away. It'd take a month, maybe, to go back to its normal thing, and that was a problem. We really didn't solve the problem in terms of that. We just weren't following our own rules. We had written the rules that you have to have those things sitting upright for so many weeks before you install them, and they didn't do that. Of course, you had the temperature thing that everybody latched on, and [unclear] trying to prove it was the temperature, it wasn't their fault and all that. Actually, the design was okay if it was handled right, but it really needed to have a little more security so that if it's not handled right, it still doesn't do a [unclear]. So they made some changes there that were worthwhile and good.

Let's see. What else? The landing situation never gave us any problems. We had a parachute landing we put on. We had the three-mile runway at the Cape. I can't really think of any big problems. Any system has got some problems that you have to solve during the design and development phase, the control system and the jets, that sort of thing. The software was always a nightmare because it's so complex, but Johnson did a great job on it. They did all the software, and I guess they had help from contractors, but I can't recall a single case when that [unclear].

BERGEN: You mentioned yesterday that during Gemini you had some problems in developing the landing gear for the Gemini spacecraft, but had technology developed to a better environment state for Shuttle?

YARDLEY: No. Technology on landing gears was fine. The problem with the Gemini thing was that there wasn't any good space to put it [in], so you had to stretch it up and make it twist a couple times to get it out and all that kind of stuff. It was just not a good application for it, but the Shuttle was more like an airplane, and it just had the doors open and the landing gear come out just like it would on an airplane. I think maybe they had some special tires and brakes that would take higher temperatures and that kind of thing.

BERGEN: How was your relationship with the contractor for Shuttle?

YARDLEY: Well, it turned out pretty good. "The contractor." There wasn't any "the contractor." Rockwell was the major contractor. I didn't have any problems with Kaslow [phonetic]. I'd been competing with them for many years. They had some good people. I'd say, in the engine department, the guy that was running the main engine there was an outstanding guy, [Dominique]—I was going to say Zucchini, but that's not right. It sounds like zucchini. I can't remember it exactly. But poor [Dominique] died a couple years after flying. He was a young guy, a lot younger than I am. But he and J. R. together did a magnificent job.

Now, in the structures part of Rockwell's thing, I think they had a screw-up that caused [the tile rework]—if they had done that properly, we wouldn't have had that problem. They would have discovered, "Well, we've got to do things with [the tiles]," way ahead of time. So that was a weak spot. Of course, the aerodynamics and the design, basic design, was pretty good, but those tiles were a mess. They were lightweight and good insulators, and

I don't think, in all the flights they've had, which is twenty-five, thirty, forty, maybe even more than that—I can't keep track anymore—I don't think they've ever had a tile come off.

We actually had, for the first flight, big arguments. We had a bunch of scientists, of course, telling us what to do all the time, and this one guy insisted—he was a very well-known guy—that we develop this little “hand car” for the pilot to get out and a kit to put tiles back on on the first flight. We had already agreed, and I'd already agreed, for the little manned maneuvering unit, but that was for normal things, and this wasn't any way to do that. We did have a way to do it if you wanted to crawl around. We didn't want to use it. It was a last resort kind of thing.

So, Hans Mark at that time—I don't know if you know Hans Mark. I believe he was the deputy administrator. I'm not really sure. He was either that or he was in charge of the spooky CIA stuff. He had been deputy, our number-two man in the Air Force. He was very interested in it, and he said, "I think we could work something out. We're going to have spooky ships up there while you're up there, so we can get a photograph to see if you've got a problem before you let these guys go out on a rope basis to fix them," and having to go out, whether you fix it or not, just because you don't know if it's okay is not—and even so, there's nothing that would happen to those things. They're not in a bad environment for launch. If they're going to come off, it's that they're going to get hot and vibrate during entry.

So they took pictures for us. They were a few miles away, and they had [unclear] and didn't see any problems, and I don't think [unclear]. That's not classified. What is this, '98, and that was '81. So, seventeen years. It must be unclassified.

Okay. Go ahead. What's your next question?

BERGEN: We talked about some of the problems that you had during Shuttle. What are some of the accomplishments that you had?

YARDLEY: Well, I don't know that I had any, personally. I kept getting the money. I kept getting the guys off of these engineering fun things that slow things down, like on the engine. Of course, being an extra stress man, I found out about this couple of tiles pulling free. It stirred me up, and that helped get the whole thing started. I don't know. I just gave everybody a lot of trouble, you know. [Laughter] I'd have meetings about once a month of most of the same people working in Washington, and they had grief and all, and they used to they used to nickname me "Old Ironpants" or something like that, "Iron Bladder" or something. We'd sit there all day, you know, crossing our legs and all. But they were good. I would be a tough, a little tough, because I asked some straightforward questions, and if they hemmed and hawed, I knew they didn't really know. I think a lot of people didn't like that, but they went home and did their homework, and the program was better off, and actually they'd admit it was better off later on. But I don't know how many of them liked me and don't like me. But that's what happened.

Okay. What else?

BERGEN: Why don't we talk a little bit more about your interaction with the Congress. That was a big part of your job, wasn't it?

YARDLEY: Well, it was a fair part. I kind of got to know the key people pretty well. The key staffers are important, like in the House Appropriations Committee. Eddie Boland was the chairman. He had a right-hand man that was his staff man, whose name escapes me right now. But, you know, he'd call me up and say, "How are you doing?" I'd say, "I don't know. Why don't we go out to lunch and we'll find out. I'll tell you what I know." I used to go out to lunch with him maybe every couple of months and keep him informed. You know, I wouldn't twist his arm or like that, it was just a question of he felt that he was getting the straight skinny, and he felt that we were interested in keeping him informed, and that's all he

really needed. What they hate are these people that are doing this and not telling them anything, and they suspect all kinds of problems. So they didn't really give us any problems.

Bill Nelson was a friend of ours, and before Bill, Don Fuqua was the guy. They were all for space, and they were just the Space Committee, whereas Eddie Boland was the total Appropriations Committee. So they were all good friends of ours, and they all came to my retirement party and so on, so I felt pretty good about that. And we never did stonewall them. We always told them the truth, and sometimes it was painful, but it paid off to do that.

I can't think if any special congressional thing other than testifying and knowing, understanding what their real interests were. If something came up and if it wasn't time to test it or anything, contacting the staff guy and saying, "Hey, we've got a problem here and we thought you ought to know it. We think it's under control, but just so you know." And we didn't have a lot of trouble. I guess we did okay.

We always had a few problems. The [unmanned space] community, aerospace engineers and scientists—well, like, say, Carl Sagan, [advocated] unmanned [satellites] and so on [but were not too] successful in that. Of course, he's passed on, too, you know, Carl Sagan. He was a young guy. He probably wouldn't be more than fifty-five now. But they didn't give us a whole lot of problems. They would always be bad-mouthing us behind our back. [Laughter] [unclear], too. They said, "If we spent the money you're spending, we'd give you all kinds of [unclear]." However, the real thing is that the American people aren't as interested in remote things as they are with men doing these things, because they can relate to men, and it's hard for them to relate to these boxes of transistors. I think it's becoming more acceptable, because, you know, this little guy, this little rover that's going around on Mars unmanned is doing a great job. So they're coming along.

BERGEN: Do you think the industry could do anything about public perception more than what they've done?

YARDLEY: Well, I don't know. It's immediately recognized as self-serving, what they say. What we actually were doing after I got back, in '81, some of my guys at Mac had been working on a promising pharmaceutical [unclear] done in space. It can only be done in space. We spent about 30 million dollars on that, and it got [unclear] of us, and everybody was all for it and which we actually flew. We got a company astronaut out of that, Charlie Walker. I don't know if you've heard about Charlie. He still works for Mac, and he's in the marketing office in Washington. He went up three times with this system to prove it worked.

We also proved that you didn't need all that training that Johnson had been—see, they started out—this was kind of the business that this guy would have to go in for a year, a year and a half of training. Well, they finally agreed to ninety days on what is the Shuttle and what's your role and how you do these things and stuff. Unfortunately, another company—see, this is what happens when you get out of your own field—another pharmaceutical company—we were teamed with Johnson & Johnson. You'd think that that would be fine, but it turns out the Johnson & Johnson dumped us because another company was doing this without having to go in space, in a different process of genetic engineering. So they aced us, and the danger for aerospace people to try to do this was because you don't really understand the other pieces of this. This somebody else's kind of business, if you understand.

The first thing I asked them when I got back from Washington is, I said, "Okay, now. What makes you think that somebody else is going to do this while you're doing this cheaper and better with different technology?" Well, Jim [James T.] Rose—I don't know if you know Jim Rose—he was the guy at the time and a good friend of mine, he said, "We have this three-man committee around the whole loop. Every couple months we meet and we tell them where we are and ask them if there's anything going on." Well, if there was something going on, I don't think he's got to tell them, if they're on the other side.

So anyhow, we quit. AMGEN is the company that was—[a genetic] engineering company. I don't know how they've done... Jim Rose, in fact, left then after [our plan] fell apart, and went to Washington as associate administrator for commercial activity on the Shuttle, and they set up centers around the country and did a lot of things, but none of it really took. Nobody was really going to spend much of their own money doing this kind of thing.

We did one thing, I think, though, that we argue with each other about whose idea this was. It's called "Getaway Special." That's the nickname. And what it was is, we had offered colleges and people like this, researchers, space on the Shuttle—it started a big [unclear]—for experiments for \$10,000 a flight, which was way below the cost. But it was extra space. We had that much space and everything, and it wasn't enough weight. I think it couldn't weigh over 500 pounds. But we had a cargo capacity of 65,000 pounds. You're never going to have it loaded just right so that you can't take one of these, and we actually had three or four of them at a time in space. The schools all loved it and so on. This was probably the best way to get things done in space rather than on the ground, because these guys would understand it and they would adapt it. [unclear] not really equipped to do that. That stuff is still going on, as far as I know, and it's very successful.

What else?

BERGEN: Can we talk a little bit about *Challenger*? We talked yesterday about basically the cause of the accident. Can we talk today about the repercussions of it?

YARDLEY: I don't really know much about that, because, see, that happened when I was gone four years, and I was very intensely interested in why it happened, because it was my baby. But what happened, the repercussions I'm not too—well, I didn't even get a copy of the report, but the thing I can remember that was a repercussion is the fact that the "government," maybe Congress, maybe the Executive, maybe both, sort of made a rule that we were going to

stop flying these commercial payloads, and that was the opportunity then for the CIA to get their payloads off and the Air Force to go back in the booster business, so they were all happy with that. I think that was the main repercussion that I know of.

But it was probably good for the next period. We got a lot of flights in. I don't know how many total, but they will come back if they have—you know, I think it will change back after time whenever things are working great again. There is space available and we can recoup some of the cost by flying other people. I think it will come back, but it hasn't yet. I heard some talk about that recently—now, where was that—that they might lift that ban on flying other payloads. Not just other payloads, commercial, non-government payloads. They probably would let the Air Force do it, but the Air Force doesn't want to do it. They want to do their own thing. So I think it'll come back in time.

Everybody's off designing new ships to supersede the Shuttle and making claims that we made years ago, which they can't do, you know, all this stuff about, "We don't need to do any tests, we don't have to have these lengthy quality things." That isn't going to happen. We thought we'd get away with some of that, but we've been through it, and you just can't do it on these kinds of machines. So I don't know what's going to come of all that. NASA will probably fall in line, because they want to build another machine. They're always wanting to build another machine.

BERGEN: How do you feel about privatization of the Shuttle?

YARDLEY: Well, I don't know how to do it. Privatization—I don't think the Shuttle is in a position to be self-sustaining on an economic basis. There isn't the paid demand for it that would keep it going.

YARDLEY: So what it does, as a government machine, is it goes ahead and flies, and flies things that need flying, and it's doing a lot of good, but the government's paying for it. I don't think it would change.

Now, I don't know. Let's set that aside and say people would pay for it. How the government really [unclear], nobody is going to pay them 2 billion dollars for that order. You know, that's what it really costs, and all the facilities and everything else around that, I don't see it. So what the industry is working on is smaller vehicles and completely reusable and land like an airplane and all this stuff that we used to talk about pre-Shuttle. [Laughter] But it's a fiction until you get a lot better off than we are and a lot more experience. It's just a much more dangerous environment than just flying airplanes. You have a lot more things to worry about, so it gets more complicated, and I don't think it's going to happen for a few years. I think, if there's enough pressure and if they turn up enough markets, that it will pay the cost, we may see some smaller-type Shuttles. People think they've going to happen. There's some 10-million-dollar awards for the first person that flies his own [unclear]. Ten million dollars is a drop in a bucket to build these things. Now, if it was 10 billion, then you'd see really a lot of work going on.

BERGEN: You've seen so much happen in your career and even since your retirement. What has made the greatest impact on you that you've seen in the space industry?

YARDLEY: The greatest impact. I'd say the whole program, while it's had its bumps, like the Apollo fires and the Shuttle disasters, sitting here in both cases, it's the price of making progress, and what we're doing is important, and exactly how it's going to be in twenty to fifty years, I think it will probably change a lot. You know, if you look backward to see how much things came forward—the automobile—well, the airplane is a great example. The first

flight in 1903, crossed the ocean on a solo in 1927, and look what it's made. It is a major industry; it's not just a fun thing for people to do. It's hard to understand.

Actually, you could conceive, if you could technically do these types of jobs, the Shuttle sort of thing, those environments at a reasonable cost, you could have a transcontinental, you know, get from L.A. to Berlin in about an hour, a quarter to three quarters of an hour, a lot better than the supersonic transport, which never went anywhere. I thought that was kind of fun. I don't know if you've ever followed that, but the British and the French built this Concorde. Gosh, it must have been twenty-five years ago. We were doing it, Boeing was doing it under government contract, and President [Richard M.] Nixon said, "Let's cut that out. We don't need it." And it hasn't hurt us a bit. Our airplanes are still winning the markets. They're getting sold. The French and the English aren't doing that much harm to our system, and there are still five Concordees or something. It's great. I flew on it once, free, but that's another story I'll tell you.

I think if you have enough of this stuff going, it'll start to coalesce and you'll get a confidence and a cost picture which will be worth it. It'll be competitive. I'm sure it wasn't cost-competitive at [Charles] Lindbergh's level, or for twenty-five or thirty years after. I guess the first really commercial airplane was hauling passengers, maybe, in 1935. My first flight was 1945, in a DC-3. I was in Memphis getting trained as a Navy lieutenant, or ensign, I should say. My sister got married up here in St. Louis. I was down in Memphis, so I flew up on a weekend.

BERGEN: What direction would you like to see the space program head? We're talking about manned and unmanned.

YARDLEY: Well, I don't know. I personally think if you put it down in a dollars-and-cents point of view, you'd probably go for unmanned, but why would we fly unmanned airplanes?

Well, it isn't cheaper for that [unclear]. So once we get this down to the right volume and cost, I think that will be the winner, the manned spacecraft. So, like I say, well, it may take longer and the unmanned will be doing things cheaper. It'll win. Now, the unmanned people don't have the support that the public [unclear]. I'm afraid the manned support is getting a little less strong because it's getting so old hat. "Oh, there's another Shuttle going up?" So you've got to fight both those battles, but I think they'll both survive. I don't think you'll see either of them go off, and I doubt if we'll send the Shuttle to Mars. If we do, we won't get it back. But they will send these other things, and they can get them back, and they're doing some really interesting things which are innovative and cost-saving. Some of these smaller payloads and automated and picking up their own dirt instead of the astronauts picking it up off the moon.

BERGEN: How do you feel about the change in the space industry from solely American to the more international cooperation?

YARDLEY: Well, I think international cooperation is good, but you've got to be careful how you do it. Actually, that's been going a long time. The Shuttle Program was something called the Spacelab done by the Europeans, eleven European countries together. We had a man in Paris most of the time working that, and I went over a number of times to see him. But we had done it in a way which if it didn't happen, it wouldn't hurt us. In other words, it was an accessory instead of a mainstream piece. Now when they start out in the Space Station and they give the Russians the control center, they haven't got the money, you know, [unclear], so it's not a very smart way to go about it. Now, they have a better plan that they could do a smaller Space Station without them and have them add on the exercise gym and other things, and they'll probably wind up doing something like that. But, you know, we've had pretty good luck in the Spacelab, and it came out too complicated.

With the Russians, we had a flight, Apollo-Soyuz. It was under my aegis, and I went to Russia once. But that was a different breed of cat. We each had our own thing that could get up and down by themselves, and then they could join and go back and forth, and that wasn't too big a deal. Our astronauts, who were Deke [Donald K.] Slayton and Tom [Thomas P.] Stafford, learned a lot of Russian and vice versa. I think it was a good program all around. It didn't do anything economically, but it showed that there was the cooperation and that we could work together.

And, of course, with that background, they went into the docking set up for the Mir and the Shuttle, and I think that's been a successful program, in spite of the fact that they've had some problems. The Russian Mir have had some problems, and that's understandable. It's been up there two years. And we bring up a fresh, new spacecraft every time so we're not having the problems. But it's not very much in our benefit to undertake programs which have got stoppers on either side if the whole thing collapses. It's just not a good way to go.

BERGEN: I want to close out this interview with one question. You've done so much in the space program. What do you feel is your greatest contribution?

YARDLEY: I think it was managing the Shuttle. I used to think it was the Mercurys, but the Shuttle is a magnificent step forward, and they actually picked our design.

BERGEN: McDonnell's design.

YARDLEY: Which Dick Chamberlain, I told you, came up and helped us evolve that. What I'm talking about, there is a gross design—where the boosters go, you sit on a tank, and all this kind of stuff. And the one that they finalized is the one that we had picked. Everybody else picked something similar, so it's not any big deal, but I think that having the opportunity

to see the whole picture for seven years and stir the pot and make it work was not only fun, but important, and I'm happy I did it, even though I'm a little poorer. [Laughter]

All my bosses, they're—Rocco Petrone is not dead, but Lowe and Fletcher are, and Lovelace finally wound up as an administrator. I have a condominium in Florida, and I bumped into him in one of the restaurants down there a couple of years ago, and he said he was looking for one, so I told him to come over and take a look at ours. So right now he lives right underneath me, and we're good friends.

Okay. Does that give you anything that you can use?

BERGEN: It's great. Yes. Thank you very much.

[End of interview]