ORAL HISTORY TRANSCRIPT

JOHN F. YARDLEY
INTERVIEWED BY SUMMER CHICK BERGEN
ST. LOUIS, MISSOURI – 29 JUNE 1998

BERGEN: This is an interview with John F. Yardley on June 29, 1998, in St. Louis, Missouri, interviewed by Summer Chick Bergen for the Johnson Space Center Oral History Project.

Like I said, we're going to start at the beginning, and I'd like to start a long, long time ago when you were young and you were a child, because that was before the advent of the Space Age. When you were growing up, did you ever think that men would go into space?

YARDLEY: Well, of course, I was in the age of Buck Rogers and some other guy doing that, too, so I never really seriously thought about it, but I was in love with airplanes at the time. I built a lot of model airplanes and decided through that activity to get prepared in high school for an aeronautical engineering course in college.

BERGEN: And then you went and got your aeronautical engineering degree?

YARDLEY: Well, it wasn't quite that simple. The war started, you know, and when I got out of high school I was only sixteen, so I didn't get drafted right away. But everybody had lost their jobs. My dad was trying to get another job, so we didn't have enough money to go off to Harvard or anything like that, but I was able to get a scholarship to Washington University here locally, but they didn't have aeronautical engineering. I took mechanical. We were going four semesters a year. I mean, four semesters right straight through instead of two, blank, two.

BERGEN: Accelerated programs during the war.

YARDLEY: And so I finished the first two years in sixteen months, and in the meantime I joined the navel reserve, and they had a V-12 Program. I don't know if you ever heard of that, but that was their program to get engineers, principally aeronautical, but engineers, into the Navy, get a supply line going through the colleges, and so they would accept you into V-12 if you had good enough grades and so on. So they sent me to Iowa State in the middle of '43, and they had aeronautical engineering. So I switched over and did it that way. So I was lucky in that.

So I got out of there in '44, went up there in '43. It took two years, and I got out of there in '44. So I started college in '42, got out at '44. So that was my history there. Then I did things in the Navy like I went to school in Memphis [Tennessee] to learn about maintaining airplanes, and I went to Seattle [Washington] to learn maintenance in on-the-job training. We were taking care of Catalina PBYs at the time, and then the bomb went down about that time, '45.

Shortly after, they called me to Washington and put me in the Bureau of Aeronautics a year and a half. I got out in '46 and joined a little bitty aircraft company called McDonnell Aircraft. I had never heard of them. When I got to the Navy—see, Curtiss-Wright was in there when I left, and they went out of business, and Mac took that over from some little building he had. I got to know him a little bit when I was in the Bureau of Aeronautics because I had to come out here on field trips and look at their erection and maintenance handbooks for airplanes. I think they changed the name. But I got to know some of the handbook people. So when I was getting discharged from the Navy, I wrote them and said, "Who do I talk to to get a job out there?" So he set it up, and I went in and got hired then in '46. That's how I got started in that. I got hired two or three weeks before I got married. We've been married fifty-two years.

BERGEN: I'm just curious, did you try to get a job with McDonnell because it was in St. Louis, because you're from St. Louis?

YARDLEY: Yes, that's right, and I thought I'd start there and see what happened. McDonnell at that time was unknown. I'd go on a trip for McDonnell and tell them who I was with, and they'd say, "Who? Who? You mean the hamburger people?" [Laughter] As a matter of fact, Sandy, he was the chairman for a long time, the nephew of the founder. He was on an airplane one day, and this gal came up from up the aisle and said, "Well, I understand that you're the chairman of McDonald's."

He said, "Well, that's true."

She said, "Will you autograph this?" So he started signing it, and it's spelled differently. She said, "Oh, I meant McDonald hamburgers." [Laughter]

Actually, it didn't really become a nationally known company until the space business. We happened to be lucky enough to win the first manned space contract, the Mercury.

BERGEN: From the little research I've done, it seems like you all started working on that and you were in a special class for it?

YARDLEY: Yes, that was interesting. I went into McDonnell as a stress engineer, and I worked my way up to chief stress engineer after I was there twelve years—well, I did it after ten, but twelve years after we were [unclear] again, '57, and our chief engineer thought that there was going to be something to this whole thing, so he moved me from that job into advanced design, where they did airplanes, and now they were going to take on space, too, as their space chief designer. So that's how I got into the space business, and that was in '57.

All through '58—this is before NASA was born. They were born, really, mid-'58. But we were going around the country looking for people to do something about this, and we talked to guys like Max [Maxime A.] Faget, Chris [Christopher C.] Kraft [Jr.], and those guys before they were NASA and before we were bidding on anything. I don't know how we won it. I've heard stories that Grumman really wanted it and the Navy didn't want them to waste their time on that. Anyhow, that was how it got started.

I stayed in space, then, for another twenty years or so after that with the Mercury, Gemini, a little bit on Skylab, not all that much, and the Shuttle.

BERGEN: So you were working in this special group before NASA.

YARDLEY: As a matter of fact, the first thing we worked on was Dyna-Soar [Project].

BERGEN: Oh, really, the Air Force project.

YARDLEY: The Air Force had an idea on Dyna-Soar. We worked on that and made a proposal, which didn't win, and I'm glad, because it never amounted to anything, and a lot of people wasted a lot of time and weren't, therefore, as competitive in the Mercury thing because they'd been working on it. But we lost it fast enough to get back into the right thing.

BERGEN: So what did you think when you heard about Sputnik?

YARDLEY: Well, before that we were involved, "we" being the overall industry, through the AIAA [American Institute of Aeronautics and Astronautics] and other things on this—what did we call that thing—our satellite that we were going to put up, our country's satellite. I said, "Why are we messing with that thing?" [Laughter] But now I would have a different

perspective. I thought Sputnik would spur people into wanting to do something in this area, which it certainly did, particularly when [President] John [F.] Kennedy got in, but things were already rolling when John Kennedy got in. We were two-thirds of the way done on a design and things like that, but we had lots of hoops to go through. Kennedy had this guy—what was his name—his science advisor, and I guess we can look that up somewhere, and he didn't think we ought to go. He was dead against it. Vannevar Bush was dead against it. I imagine that guy's name is in—this is the Gemini book, and I've got the Mercury book upstairs. It's in that book. I'd like to forget him. Wiesner. That was it. Jerome Wiesner was the science guy.

So we had lots of reviews and things. President Kennedy was in by the time we went, and he heard the whole story. I'm pretty sure he was it. [unclear] was the first administrator, and then Jim [James E.] Webb, who was absolutely the most fantastic administrator we ever had. He convinced the President. I remember—this is a little aside—Jim Webb had been on the McDonnell board, but I'd never heard of him, and he'd been the head of the DOD [Department of Defense], I think, or equivalent—no, the Bureau of the Budget. So I didn't know him. When his name was announced, and I was working at the Cape [Canaveral] at the time, Shorty [John A.] Powers—I don't know if you ever heard of Shorty; he was the PR [Public Relations] guy—he said, "Hey, I understand this guy's from McDonnell's board. Tell me a little about him."

"I don't know a thing about him."

But he really did turn out to be a great guy. Everybody thought, first impression, he was mostly a big talker and not a doer, but that's not true. Somebody said, "Listening to him is like drinking from a fire hydrant." [Laughter] But I think he was a pretty great guy.

I got sidetracked there. Where were we?

BERGEN: We're still talking about Mercury. When you started in this program designing this Mercury spacecraft, people had never designed a spacecraft before, you'd always designed airplanes, and the Mercury spacecraft was very different from an airplane.

YARDLEY: Well, Max Faget has to get credit for the shape and all that stuff. He'd done a lot of work, and he's the one who recommended in the literature that we don't try to put wings on this thing, that we make a conical entry vehicle, and all we had to do was get the right heat shield. Max has always oversimplified, of course. [Laughter] He always thought you could do everything for one-tenth of what it cost. But he was a bright guy. So that part of it is sort of a given. "We'll take this cone angle," and blah, blah. Got a picture of it somewhere. That's Gemini, Mercury down below.

Anyhow, once you had that, then you had to figure out how to make it small, how to get the people in, how to keep the people alive with life support and all these different things, but we used mostly equipment that was available, airplane equipment. Most of it, and they'd work pretty good, except we found out during the last Mercury flight, [L.] Gordon Cooper's [Jr.] long flight—everybody else had made it a maximum of four and a half hours, and he made a thirty-six-hour, or thereabouts, flight, and everything started getting wet because the humidity was soaking in, and the equipment was not humidity-proof and that. So that taught us something real importance. In Gemini we went to protected equipment that wouldn't have that problem, because the water gets into the electronics and makes it intermittent.

BERGEN: Aside from the humidity factor, what were some other things that you had to kind of learn when you were designing the spacecraft that you didn't have to really worry about in aircraft?

YARDLEY: Well, let me take another example, the internal atmospheric controls of the spacecraft. I like to call them spacecraft instead of capsules, but we called them capsules in those days. It reminds me of people dropping something in the ground, cover it up, and come back in fifty years.

But we had to keep the pressure down, the differential pressure from the inside to the outside, something like 5 psi [pounds per square inch]. It normally [unclear] fifteen, and if you took that up into orbit, you'd have more stress on everything, it would be heavier, and so on. So what we did was we designed for five, and we put a suit circuit in that was always pure oxygen, and the rest of the cabin at launch was air, [unclear]. As I recall now—you can check the details of that, but I'm pretty sure that's it—we put our test engineer, who was really a test pilot, Bert [Gilbert B.] North, who was the twin brother of the North that worked for NASA—a

BERGEN: Warren.

YARDLEY: Warren and Bert were brothers, twin brothers. So he was flying this mission, and after about two or three hours he passed out. What happened is, there were some leaks between the suit circuit and the cabin that let that nitrogen get in, and you don't use up the nitrogen; you use up the oxygen. But you didn't draw oxygen into the suit circuit if the pressure got kept up with nitrogen. So pretty soon there was too little oxygen and too much nitrogen, and he passed out. So we said, "Oh, we can't have that," and that's for sure, we can't, so we went to a system where we took off—see, this was the nitrogen as you're going up and in the cabin before it all leaked out and went down.

The fix, we thought, was to put pure oxygen in the test on the ground. It took off with 15 psi pure oxygen, so any leakage was going to be in the right direction, and it was a very small capsule, and nobody was really worried about fire there. As a matter of fact, I made

some back-of-the-envelope calculations that said it would burn itself out in a few seconds because there just wasn't that much oxygen in there.

BERGEN: Just because of the small size?

YARDLEY: Yes. But that particular thing worked fine on Mercury and we did it on Gemini. I worked fine on Gemini. They did it on Apollo, and they got burned up. So we felt kind of bad about picking that solution. There might be other solutions. You can do an awful lot with regulators and everything, but those things are all subject to malfunction so you don't want to use them. So that actually bit us a little bit before we got through on Apollo, and they fixed that, but it was after that fire. So that was one of the problems that we had.

The Mercury didn't have too many. This all sounds crazy, but the transistor was in a very new stage of development. Big circuits, large circuits and things like that weren't even thought of. The transistors, we'd put them in on some of the relay panels, but not all. We used relays for a lot of them, which are old standard mechanical [unclear]. There was enough that we had a lot of intermittence in the testing, ground testing and we had to take these relay boxes off and shook them to see what was going on. They had solder balls inside the closed cans of the transistors. So we had to replace all those. You know, they should worry about that in airplanes, too—I'm sure they would—but there just wasn't enough known about it, so they hadn't spotted all those problems.

There's many, many others that we had. The first flight we made unmanned, you know, it wasn't a complete spacecraft, but it was the production of the frame and balancing inside fell apart on top of the Atlas at 30,000 feet or something like that. That was an interesting day. Walt [Walter C.] Williams—I don't know if you knew Walt or not—he was kind of a crusty guy, you know, "Do this, do that," but he was the guy who called the shots on that launch. It was raining cats and dogs, and we said, "Why in the world is he going to go

with that?" They did it anyhow, but we don't think that had any bearing on it. It was the vibration that fatigued the Atlas ring. There was a big argument between us and NASA on the one side and the Air Force and [unclear] on the other as to whose fault was this. And so what they decided is to thicken up the skin on the Atlas side, and it was going to take a year or so. Everybody moaned.

Bob Gilruth came in. At that time I was down at the Cape. He came in and said, "There's something we can do to get the flight off center than waiting for a year?" So we hypothesized. He said, "I came over because you're a [unclear] man, and you figure this problem out." So we did. I came up with what we called a bellyband to put around that joint, and it would reinforce the skin on the Atlas so it wouldn't do that, and it worked. Oh, boy. Everybody was mad at us, and the Air Force guys were madder than hell. They said, "Well, you're just stiffening the spacecraft." We said, "So, okay, we'll stiffen the spacecraft and you stiffen the … [booster skin later].

I don't know if you know Phil [Philip E.] Culbertson, or not. He was my counterpart on the Atlas. I was project engineer for the contractor and he was project engineer for their part of the contract. Still, every time I see him, says, "Bellybands. Bah, humbug." [Laughter] He's a great guy, though. He lives down at the Cape now, just moved into a new house. Unfortunately his wife is in the hospital or nursing home with Alzheimer's. But he just did me a big favor. We have a condo down at Cape Canaveral, too. We spend about four months a year on the beach. We'd been to New Zealand about ten years ago, and I got this sweatshirt, just a nice fabric and everything, just what I wanted. It had a big "New Zealand" on it, with colors on it. It was about worn out. He was going to New Zealand, so I gave him a picture of ours. He said, "I'll get you one," so I gave him a picture. He went off and got that. He said, "I went to fifteen places before I found it." He actually worked for me in Washington. He was one of my assistant administrators, deputy associate or something like that. I can't think what were NASA's titles.

I don't know if you want all this stuff I'm saying or not. You just cut anything out you want.

BERGEN: That's fine. This is your interview. You can say whatever you feel needs to be said and recorded in history. This is your chance.

I did want to talk about one more thing with respect to the Mercury spacecraft. In the Russian spacecraft, basically, everything was automated. The pilot didn't do much of anything. But you designed or helped design the Mercury spacecraft a little differently.

YARDLEY: Well, the pilots would not hear of that kind of design approach. Never! We had lots of pilots, like the one—what was that guy's name—that broke the sonic barrier.

BERGEN: [Charles E. "Chuck"] Yeager.

YARDLEY: Yeager. He said, "I wouldn't ride in that thing. It's like getting inside a can and getting shot out of it." But actually, the way we designed it was, it could be automatic, you know, the bare bones things, but it didn't have to be, and we would fly it with the man actually doing it. The men had override on anything. We had to do that, because some of the flight plans had unmanned flights that they had to work. They had monkey flights, a couple of monkey flights. Of course, you get the monkeys inside their own capsule, except we had a banana peel or something if he moved the lever right. But we always had a philosophy that the pilots would do it, but on the Mercury it was more could but didn't have to, which was a prudent thing to do because we didn't know what was going to happen, whether they were going to keel over with something or other, some space disease. But all the rest of them, the men could do it.

However, it wasn't until we got to the Shuttle that we did the first flight without men. … I remember that argument that we had, Kraft and myself, … the administrator … George [M.] Low, and [several others;] we talked about it and why we should and why we shouldn't, and it cost billions to do that, and you'd just take your engineering and your manufacturing to build a special vehicle, which wouldn't be much good after you got there anyhow, and we wanted to concentrate on making it work as it should and letting the people decide in it what they were going to do. We had triple redundancy on almost everything so pieces of boxes going out isn't going to get to you. But the guys choosing what they wanted to know, what they wanted to do, was the thing to do. Of course, we did have a Shuttle problem in the *Challenger*, but it wasn't due to not having an automated pilot in there. That's another story, though.

BERGEN: When you were moved to the position of launch manager during the Mercury Program, what were your responsibilities?

YARDLEY: Why in the hell did they do a thing like that? Well, you know, our president, the McDonnell president at the time was Dave [David S.] Lewis. He later became chairman. He called me in and said, "Well, I'd like you to go down to Florida for six months or so and be launch manager."

I said, "Dave, I don't have any experience like this."

He says, "Nobody else has got experience in flying these things." [Laughter]

So I went down for six months and stayed four years. I remember arguing with the IRS guy after a year. He said, "You can't have this per diem, ten dollars a day, any longer than six months." I said, "Well, the company keeps changing its mind." So we revealed some number, but it wasn't as much as it should have been. He thought it was too much.

So that's what I did, and it was a new ball game. Nobody could say it wasn't. All the flight business was new, how you launched them, what kind of mission control you had, what Kennedy did versus what [Lyndon B.] Johnson did, and the whole ball of wax.

BERGEN: So you were launch manager for the Mercury Program.

YARDLEY: For McDonnell.

BERGEN: For McDonnell.

YARDLEY: NASA was the boss, and they had their guys as chief [unclear], our guys are supplying most of the answers.

BERGEN: So what you basically supervised was a lot of the check-out for the launch?

YARDLEY: Well, one of the biggest things that we did at the Cape was rebuild spacecraft. There are all sorts of changes come through all the time, and we have to incorporate them at the Cape. So that took a lot of our time. The rest of it was in helping NASA plan the flight plan and the countdowns and writing the procedures for doing that for NASA and that sort of thing and contributing the people to do it. We always had somebody over there who was the number-two guy, the NASA launch—what did they call it? [Unclear]. But basically they had the responsibility, and, of course, they did the whole thing, and they did a lot of the—well, in the Cape they didn't do as much as they did at Johnson [Space Center]. Johnson did all the software and all that stuff and all the overall systems stuff. Of course, we had some people helping there, too. We had a big bunch, maybe a thousand people at Johnson at the time doing that.

BERGEN: So when McDonnell got the Gemini contract, you were moved to the position of Gemini technical director?

YARDLEY: Yes. That wasn't at the same time.

BERGEN: That was after?

YARDLEY: The Gemini was an interesting thing. NASA had assigned Jim [James A.] Chamberlin to be their program manager. Chuck [Charles W.] Mathews was it for a while, but he was needed on the Mercury. Chamberlin did a lot to say, "Hey, we need this vehicle. We need this Gemini vehicle." He became Mercury manager, and he started working at Gemini, and he pretty well sold everybody that the programs were going nowhere unless we had a vehicle that would do a lot more than Mercury, as a stepping stone to Apollo, which had already been started. See, it's not well known that the Apollo Program contract was placed before the Gemini contract was placed.

I was still at the Cape. This was '64. No. I went back in '64, and they had been doing a preliminary design, but most of the tough work was like—and technical director was the name they gave the position, and I was working in the engineering, all engineering, and all of the launch operations, all the test operations, [unclear] test operations, when I wasn't driving in rivets. [Laughter]

BERGEN: McDonnell was in a unique position, looking back, because you had the Mercury contract and then you had the Gemini contract. So you were able to build on what you learned from Mercury.

YARDLEY: We weren't really a contender on Apollo, because they wanted the Gemini built in the time frame, see, and we weren't big enough to do that. So with the Shuttle we screwed up, I guess. The problem there was we had recently merged with Douglas, and they were pissed at us. "What do you mean, letting little old McDonnell take over Douglas?" was kind of their attitude then. We tried to put a team together with the two pieces, and the best we could do was not credible, from NASA's point of view, it would seem. And so instead of taking a team, they took me. Now, a couple years later they came by to get George Low and Jim [James C.] Fletcher and Rocco [A.] Petrone, twisted my arm to come up to Washington, because I'd lived in Washington before, at the Bureau and stuff.

It was a hell of a fun job on the Shuttle, but I had to uproot the family. We had two kids in St. Louis, and then we went to Florida for that other job. We had two more. So we had five at the time, and we had to move them all to Washington. Some of them were too old to move. We didn't have any more in Washington, but two of our youngest did go to schools in Washington. They weren't too red-hot. That town was in turmoil in those days.

So, yes, go ahead with your question now.

BERGEN: In the Gemini Program you got to incorporate what you learned from Mercury. What were some of the things that McDonnell learned from Mercury that you were able to take and apply to Gemini?

YARDLEY: Well, the things that worked good in Mercury we did, but we had to improve a lot of them, like the humidity capability, the electronics. The transistors were far better or getting into integrated circuits, and so that was all [unclear], fuel cells was brand new. Apollo was developing, and we were, too. Ours were different from theirs, but we went through a lot of development there, learned a lot from problems in flight tests and so on.

Let's see, what else did we have? Well, we piddled around with the landing gear for a long time. I'm glad we threw that thing out.

BERGEN: The paraglider?

YARDLEY: Yes. Well, the Gemini had to have a landing gear, too, a retractable landing gear and all that stuff but with the paraglider. It was just too much to tackle. We didn't really need it with the schemes that we had, landing on water, and we got the whole Navy out, but that's not a very practical operational thing for the long haul, but that's not what we were doing. We were building a vehicle to learn how to do things in the future. And, of course, the Shuttle doesn't land in water. The Shuttle's got landing gear, and it doesn't have a lot of those problems, but that paraglider, I'm sure glad they bypassed that.

Let's see, what else? All the systems were improved. The RCS system, I believe we had hydrogen peroxide on Mercury. Here we had the bipropellant hydrozine, I believe, and something, nitrogen tetroxide. It was a bipropellant. It had a more sophisticated system. McDonnell did do the pods for the Shuttle, the RCS [Reaction Control System] pods, but they didn't do the engines, because that was somebody else's job. Also, McDonnell did the stretchers for the solid rocket booster, that is, not the structures that they put the propellant in, but the things that bolted onto that and supported it on the pad and all that sort of thing.

Gemini. What else in Gemini? Oh, we had some interesting things happen in Gemini, like in the rendezvous business, you know, I guess the first real rendezvous that we were attempting with Walt [Walter M. "Wally"] Shirra [Jr.], on flight number six, and the Agena went in, and they were sitting around with long faces, because it would have taken them six or eight months to weave this back into the fabric of the program and get new Aeginas and all. So my boss, Walt [Walter F.] Burke, who was the vice president of Space

Trust, asked me, he says, "Do you think it would be possible for us to pick one of the Geminis to be a target?"

I said, "Well, it might be.." See, one of the problems would have to be move the booster off and put another booster on, you're ready to go in eight days, and, well, the capsule was the same. I shouldn't say that. [Frank] Borman, his guy went first. I shouldn't say "his guy." It's Jim [James A.] Lovell [Jr.]. Martin [Company] had checked out how you could switch boosters and all. So we took a look at our test procedures, and it looked like it was doable. We might have to make a few changes. So Walter was all enthused, so he grabbed me, and we went out to Houston that night to talk to Bob [Robert R.] Gilruth, and Bob is always a conservative guy. Do you know Bob Gilruth? He's got Alzheimer's now. He's somewhere. I don't think he's died yet. And we gave him the spiel about how it could be done. He said, "That's real interesting. Let me get some of our guys to look at it and I'll get back to you this afternoon. I'll have Kraft and a bunch of those guys look at it."

Meanwhile, Chuck Matthews, who was the program manager for NASA on Gemini, said, "Aw, that's just too dangerous. We can't do it like that. We won't know, won't have time to doublecheck everything."

Gilruth I would have thought would have grabbed onto that, but he didn't. He didn't sway. It didn't sway him.

So Kraft came in after a while and said, "Hey, we think that's great. We can change the control center over, and we can use the old Mercury control center for the second run," and blah, blah, blah. "No sweat. We've even got a name for it," he says, "Gemini 76." Which I'm sure you've heard that term.

BERGEN: I haven't heard that before.

YARDLEY: Well, it was the number seven spacecraft with Borman as the captain. Number six was [unclear]. Here's a picture of it. Right there's a picture of Gemini VII taken from Gemini VI or vice versa. Oh, here's a beautiful one Wally Schirra sent me. Here's Wally's capsule, I guess. Another picture of Frank's. Anyhow, it went to the President before we got it okayed to do it, who was Lyndon Johnson. It all worked and everybody was happy, and we rescued [unclear].

George [E.] Mueller, who was, for manned space flight, the associate minister at that time, said we had to finish by the end of the year, and we never would make it. We would have to drop out a bunch of flights. And, of course, the purpose for Gemini was to do things just like that rendezvous flight, can it get there or not? So that was a very exciting thing, and everybody was happy we did it after we did it, but there were still some naysayers before we did it. [Laughter]

BERGEN: What was the most challenging aspect of planning for that mission?

YARDLEY: Well, I would say it was mostly—well, there are several. Kraft wanted to do the mission after he looked at it. There were changes to make in those control centers so we had that. As far as the spacecraft is concerned, we didn't have to do anything to Wally's capsule, but we had to put a radar in Frank's to find him, so things like that, which were done pretty fast, because he was the first one up. He was going to go in seven, eight days.

The other problems were launch vehicle. The next time we got ready to go, Frank was already up. He'd been up seven days when Wally was getting ready to go. A booster cut off, and it cut off in such a way that if you followed the rules, they would have aborted with their Gemini and that's all she wrote. They were on the ground, of course, while [unclear] and got all their guys together, and they agonized over it, and they finally found a rag in the

pipe. Very embarrassing, and I don't know if that ever even came out in public, blocking the flow.

So they got it fixed, and instead of getting it off the seventh day, I think we got off the tenth day. Now, the reason that was important is, Borman's vehicle was only equipped to go fourteen days. His was a big experiment at fourteen days, two weeks. That's lunar time. And he was going to come home. He didn't have enough expendable or anything else. So it was a good thing that he made it by that time. It was made in the nick of time, but actually it wasn't NASA's problem—it was NASA's, but it wasn't their fault that the thing had a—it was the Titan—rather Martin.

BERGEN: Were you actually at the Cape during the Gemini VI when it had the shutdown?

YARDLEY: Well, I'm not sure. I was there the first flight that fired after that one, and I was sometimes at the Cape and sometimes I was at Houston. I was in one of the two places. I think I was t the Cape, though, when they did that. I probably wasn't at the Cape when Frank Borman went off, but I don't remember.

BERGEN: I was just wondering if anyone expected, when the launch shut down, did people expect to see those astronauts eject from that spacecraft?

YARDLEY: I don't know. Probably weren't that many people. See, Wally was the captain on that flight. He knew what it should feel like. It was really lifted off and falling over, and that's when they pulled their string. He didn't pull it, even though the thing said to pull it, and everyone was happy he didn't. [Laughter] But nobody chided him for not pulling it.

BERGEN: Well, if he'd pulled it, it would have ruined that spacecraft, correct?

YARDLEY: Yes. Not only that, but the ejection-seat operation of firing them out was a dangerous one in itself, because it wasn't very high altitude, and they had never really tried it with men. They had with dummies. Nobody wanted to do it. There wasn't any astronaut in the corps that wanted to do that. Now, it would be another thing if you were up a thousand feet. That wouldn't be too bad, but if you're only sixty feet or fifty feet or so off the ground, you're going to hit, and, you see, you're going out almost horizontal. Not really, but the capsule has the slope on its sides, and I believe they would go out—well, they might go out directly sideways. I thought they might be tipped up a little bit, and they might have been. They probably were, because they wanted to get a little altitude. I don't remember what the details of that were. That was another one in Gemini that we can talk about, that was a tough problem, getting it in, getting the weight and all that.

BERGEN: As Gemini was coming to an end, I believe they established this Gemini-Apollo executives group that you were a part of?

YARDLEY: No, I wasn't. They actually had an Apollo management group that they invited some Gemini senior—it was sort of like a broad board of directors. Walter Burke was on there. But they did invite me to give a talk, and it happened to be on the day of the fire. I finished my talk, and it burned up about an hour later. But what they wanted me to do was summarize the lessons learned in Gemini for the Apollo bunch, and I did that, gave my running hard talk on it and had slides and all that stuff.

BERGEN: What sort of issues did you bring up in that presentation?

YARDLEY: I don't have a real clear recollection of it, but the hatch was another one. But, of course, I don't know if I mentioned the hatch there. The hatch was one of the big problems in the Apollo fire, because they couldn't get it open. On Mercury, we had put a screwed-on hatch that had an explosive way to get it out quick, and Gus [Virgil I.] Grissom did that by mistake. He would never admit it, and of course he's gone now, but we ran every test in the world on that. So Apollo had put some sort of a hatch on that. I don't even know what kind it was, that the guys, it took them a lot of work and time to get it open. And what they did after the fire was, they went and got our design for the Gemini hatches and took them home and put those kind of hatches on it. Gemini's, you could open with one arm and they would lock open. You could get out in like thirty seconds. So that was another one I forgot to mention. That was after the fact. They didn't do that before the thing. Actually, the Apollo guys didn't want to consult us on anything. They weren't anxious to even talk to us. But afterward, you know, the hatch was one they did, and the system for keeping the cabin the right atmosphere is another one we worked with them on after the fire. It was supposed to be the helper to Apollo. It wasn't for any other reason. Gemini wasn't an end in itself, but nobody apparently took the initiative along the road that we would have regular meetings together to discuss anything. NASA, I'm sure, was doing that to some degree.

BERGEN: What do you think are some of the reasons why? Was it because of different contractors?

YARDLEY: Well, I think the contractors have an aversion to training too much, although we were subcontracted assigned to Rockwell on building the pods for the RCS. That wasn't because they wanted it. NASA said, "We have the best design for that, so you go get the contractor." I can't prove that, but I think that's probably it. So they weren't anxious to do that. Those people on the West Coast all have an attitude problem. They're so goddamned

much better than everybody else. [Laughter] I think that was part of it. But I think they're part of the same conglomerate that McDonnell is with now. The Rockwell space thing went to Boeing.

BERGEN: Boeing, yes. They've all just kind of grouped together.

YARDLEY: That's hard, even after you've merged, to get those people to all work together. They have allegiances and feelings and all that kind of stuff. What they ought to feel is, "Why don't we do the job so it works the best." I've found that if you quit worrying about what's going to go on tomorrow with somebody and go do whatever makes good sense, that you'll probably come out pretty good, whether it's using their data or your own data or whoever's.

BERGEN: After the Apollo 1 fire, you were asked to be an advisor on the Apollo 204 Review Board. What did you do in that capacity?

YARDLEY: Well, let's see. This is the day after the speech. I got a call from George Mueller. He woke me up in the morning. So I went down and started working on it. I essentially did the things we're talking about, and I consulted with the hatch problem, the oxygen problem, and all these others. As a matter of fact, I got so I was working with Borman mostly. He was very interested in that and all that because he hoped to go to the moon.

I had to leave because I got sick. I actually had to go to the mental institution. It turns out that I'm a manic depressive… At that time they did not have good medications for that that they'd let you use as an outpatient. When I got out of the hospital—I went in for about three weeks—they gave me lithium in the hospital and said, "Well, I wish we could give you this [as an outpatient], but we can't because it's not approved." So I had problems, not major

problems, but some manic problems for four or five years there until they made it—I take lithium today just to avoid that.

It's been how many years? That was 1967 to '97—that's thirty-one years. But anyhow, I got out. We had gotten most of the work done, and Borman carried the ball, and it all got fixed. Wally, in his book, put out I had a nervous breakdown. That's not quite the same. When you're manic, you think you can beat the world.

BERGEN: That's true. They didn't know as much about things back then. But you weren't the only person that had problems after the fire. I mean, a lot of people had trouble dealing with that back then. Even though McDonnell wasn't involved directly in Apollo, what kind of affect did the fire have on other McDonnell employees?

YARDLEY: Well, our people—it wasn't very obvious that there was a big problem there. The people who knew the astronauts all felt pretty bad about it. I know I went to see Gus's widow, and Pat [White, Ed White's widow] …

BERGEN: Another astronaut?

YARDLEY: Yes.

BERGEN: White. Ed [Edward H.] White [II]?

YARDLEY: Ed White's the one, and Gus—who was the other guy?

BERGEN: Roger [B.] Chaffee.

YARDLEY: Yes. I didn't know Roger very well. I'm sure the people down at the Cape who knew those people. Our people at the factory didn't come into as intimate contact with them. They'd come out every six months for reviews or something like that. But everybody felt pretty bad. I don't know that anybody else went to the funny farm.

BERGEN: That was pretty traumatic for the industry as a whole.

YARDLEY: Yes, it was.

BERGEN: I guess it had some impact on that.

YARDLEY: So was the *Challenger*.

BERGEN: Right. I'm sure, industry-wide, it probably had a similar impact.

YARDLEY: Yes. The *Challenger* killed more people. It was far more cost than the Apollo they lost, but it was not the first time it happened. I mean, Apollo was the first. It was the first time in flight.

BERGEN: So McDonnell wasn't active in Apollo, but then they did some work in Skylab, and you were the—

YARDLEY: Well, Skylab was sort of an ad hoc, "what could we work out" deal, a temporary space station. Our cousins on the West Coast sold their S-IVB upper stage, modified would be the tank, and we sold Gemini equipment. We rearranged that airlock, and so we had a big piece of the tube. Martin was doing another piece of it. The only thing I really had much to

do with was, I went to Houston and sold them on some of the ideas we had, but I didn't stay with them much.

At that time, we were working on the Shuttle activity. I'm trying to get the time straight here. Skylab was—well, I guess it was before that. They had some missiles, and I had to [unclear] and things like that, you know, but it didn't take too much work. We had a few problems with it, but there weren't any major problems. The most major problem was on launch of Skylab were we had a wing came out and we lost the wing and the other one's cocked or some such thing. The guy that had done the project engineering work on that was a good friend of mine and a very capable guy. Press [Brooks] was the guy.

BERGEN: If we take kind of a step back and look at Mercury through Skylab and look at the relationships between McDonnell and what eventually became McDonnell-Douglas and NASA, what was that relationship like between those, and how did it maybe change across the programs as the programs changed?

YARDLEY: Well, I don't know that it was uniform with all the companies involved. In our case, we always worked with them. We didn't take everything they said without some discussion, but they knew that we would take what they were saying seriously and then give us a serious answer on what we thought about it. So we had a good relationship, really, I think, at least at my level with Faget and Gilruth and Kraft and Williams and all those guys.

During the Gemini flights, I used to go into the control center and sit by Kraft for a lot of the time because things were—like we had a fuel cell that didn't have its heater working well, could we go into flight or not. We cranked up a test in St. Louis, and other things we were doing and decided we could make it. So we made that decision and they went. So it was really a pretty good, I think, mutual working group. Nobody was hot to trot to run

everything, and everybody was trying to make it work. There were some obvious discussions and disputes on what would make it work the best.

BERGEN: What were some of those discussions or disputes about?

YARDLEY: Well, let's see. I'll give you one. When we made our proposals for Mercury, we knew Max wanted that tower sticking up on top, you know. See it over there next to Wally? He says, "Geez, that's a [unclear] thing. Can't we do better than this?" So we actually proposed a couple of pods on the back to boost this thing off for escape, and we showed him the [unclear], [unclear] really insisted we could do this. So after we won, I went down to Langley along with my contracts guy and met with Max and his contracts guy, and he said, "Well, I've got one thing I want you to change. I want to take that stuff off the side by the tower." [Laughter] There wasn't anything wrong with the tower, but it looked like such a kluge to me. It worked. We actually had it work, not intentionally, in flight. I guess that was the sixth or eighth or something—it was an Atlas. It was the second Atlas, unmanned, and the thing took off, and about at 1,000 feet the guidance wasn't moving on the Atlas, so they blew it off, and the parachutes opened, it came down and hit the beach right at the waterline. It cracked the heat shield, but everything else was fine, and we flew it the next month.

BERGEN: Oh, really.

YARDLEY: Yes. Well, it wasn't a total loss. [Unclear], but we wouldn't normally schedule a flight like that. We did plenty of ground tests, you know, firing things off the—well, let's see. What was the final question you were asking? How did we get along? We did a lot of things together. There was one guy in NASA that came from Canada. They closed the aeronautical place up there. His name was Jim Chamberlin, and he took over Mercury before there was a

Gemini. Mathews had to get on to the flight operations. Jim was a very brilliant guy, but Jim couldn't communicate any better than a dog. [Laughter] That's overstating it, but [demonstrates Chamberlain's speech]. In the first place, you couldn't understand him, and if you could understand him, his reasoning and rationale was somewhat obtuse. You couldn't understand it. So, anyway, we [unclear], and I hired him after he left NASA to work with me on the Shuttle in the proposal. He's so bright, and he actually came up with the configurations they used, but I wasn't going to tell anybody. [Laughter] No, I wouldn't say that. He wasn't well thought of at NASA, I think primarily because of his lack of skills in communication. We could get along with him if we did these things of talking and understanding and take a lot of time to do it. Most of the NASA guys didn't want to do it.

Let's see. I lost my train of thought there. I've got it now. You said something about NASA people. Well, anyhow. We got along with him. I know what I was going to tell you. We used to play with them, too, as well as work. You could do that at the Cape. I had a house on a canal that led into the Banana River, and I had a ski boat, and a number of them used to ski with me, a number of the astronauts. George Low came over one day and wanted to ski and so on. Walter Burke, who was my boss, would come down every now and then, and he'd go skiing with me. He loved to ski, although he's seventeen years older than I am. At the time he was in his sixties. So, Jim Chamberlin was down, and Walter came in and said, "Hey, why don't we take Jim out skiing? He doesn't do much. Nobody ever pays any attention to him, so why don't we do that?"

"Fine."

So we went out on the Banana River, and we had Jim and the skis and Walter and myself. I was driving the boat. So Jim got over the side, and we told him how to put his skis on, and we tried about ten times and he'd plop off every time. So I said to Walter, I said, "Why don't you get in the water and put the skis on, and I'll take you for a circle around here and you can come back and show Jim how it's done, you know." Okay. So he did that. So

when we came back, Jim was gone. This was out on the north part of the Banana River, which is a big expanse, and we couldn't find him. We cruised back and forth, you know, in a little search pattern, looking out west, and the sun was about to drop over the horizon.

So I went and called the sheriff, and they sent a couple of patrol airplanes out. Meantime, I called Walt Williams because he was the number-two manager out at the Cape. So he and Shorty Powers came over to the boat ramp on the Banana River, and they were [unclear], told them the details, but I knew they were figuring out what they would tell the public when this guy was pulled up dead. "NASA Employee Drowned by Contractor." [Laughter] So we're all there with these long faces, and wondering what the hell we were going to do. It's dark, pitch dark out, and here comes old Jim walking up with the skis on his back after an hour and a half or two hours. He said, "How come you all left me?" [Laughter] Well, we hadn't. We told him, "Put your ski up in the air so we can see it." But we did all those nice things with those astronauts.

Well, there's other one that's interesting. Wally was an avid skier. Matter of fact, the family—well, Phyllis and I went down to Houston one time and he took us out, and we went water skiing with him. But we gave him some rides down there. He was back there, and I made a fairly sharp turn, and he couldn't get the skis corrected to not go into the bank, so he's going up the bank, and when he got close, why, he did a somersault and he rolled right in. It was unimproved land. It was ground with burrs and things sticking up and God only knows what. So he wasn't hurt. He had a few scratches. So when Walt Williams found out about that and he put out a decree, "No more water skiing for anybody within two months of their flights," or something like that. [Laughter]

There was some gal down at Cocoa Beach, a beautiful lady, she was a German, and she and her husband ran an eating place. So she had these parties. She was a great accordionist and a singer, so she used to invite all these guys over, so she'd have one of these

about parties once a month. She had most of the astronauts over there, and they had a big time.

Those last couple of years we had a house that had a fairly big back yard, and we used to have whoever wanted to come over, not necessarily the higher rankings, but the other rankings. So we had a full yard, water skiing every weekend. We used to call it the Yardley Yacht Club. [Laughter] When we left town, they gave us a big inner tube. I think I've got it in the back. Actually it's a life preserver-type thing, with "Yardley Yacht Club" on it. So there was a lot of fun in the whole thing. I don't know, maybe it's—you have to have a lot of fun if you're doing this dangerous stuff. You know sometime it's not going to work.

So, what else?

BERGEN: Is there anything you want to discuss that we haven't mentioned? I'd like to spend tomorrow on the Shuttle, but anything of Mercury through Skylab that you think we need to cover?

YARDLEY: Let me see. I scribbled some notes here based on your notes. How you got involved in the industry; we got that. Sputnik, Explorer, responsibilities on work on Gemini and Skylab, and, of course, the Apollo fire we talked about. You asked did these relationships between people at NASA and us change from one program to the next. I think they all mostly got better, because nobody was double-crossing anybody or hiding things from somebody. That's the main thing. The Shuttle—let's see, the Shuttle here. Various challenges during your career. Various disappointments. I don't know. Have any of those things you want me to talk about?

BERGEN: Anything you'd like to talk about. Anything you think that I didn't bring up that maybe is an important point to make.

YARDLEY: I didn't have anything to do with the *Challenger* investigation, because I was part of the problem, whereas I did on the Apollo because I wasn't.

I don't know if I want this public. I'll tell you. I did probe around the edges, you know, and talk to people and so on. NASA had nine cases of burn-throughs of one difficulty or the other before that accident. Burn-through of the solids is what killed them, and they had one almost that bad the year before in January. That information never wiggled its way up to the top, I don't think. I mean, the people I talked to, it was a Marshall [Space Flight Center] problem. Marshall is on the East Coast [unclear]. You know, the whole philosophy in the program has always been if you've got a problem, let's go solve that problem. Let's get it out in the open. You know, when they found out that the thing blew and they came to that conclusion, they had, in a month, done enough testing to know what to do, but the fact that it never got up, nobody wanted to be the one that took the rap for this thing burning through. And the real reason is not necessarily the cold weather. That was a contributor, because this rubber gets stuck, but we've done a lot of them with that. But they stood the segments that they built the booster out of up vertically—that's what they're supposed to do so they get nice and round. Well, these laid on the horizontal trucks for months and got egg-shaped. They had to beat them to get them together, and when they did that, you got a situation like this. You've got the one segment fitting in the other one, and you press it down here to fit because it's egg-shaped, and it'll come out over here, you know, and the other one fits over [unclear].

They knew this, and they weren't standing—that's why they've got in the rules that they wouldn't let it sit this way, but nobody offered up that as an excuse. They thought it was all temperature or the rubber was no good or something. Basically, that is an accident that should not have happened. If they followed the rules, it wouldn't have. Maybe if they hadn't launched in the cold, it wouldn't, because all these things add together. The fact that they had had these—see, we recover all of the solids, all these segments. There's never one lost. And

it's sitting there. Look at these—burned, scorched holes in them. Now, I had to dig deep to find that, but I don't think anybody up in headquarters knew.

BERGEN: You mean before?

YARDLEY: Yes. I don't think so. And the guys that weren't telling are not very trustworthy guys. I knew them and I didn't care for them much. They were lower levels in the Marshall organization. But even Jerry [unclear], who I've got a lot of respect for and he's a great guy, he was the program manager for the solid boosters, he said, "[Unclear] shouldn't pull they off. I mean, that's not a real problem there." I just can't understand it. I guess people don't want to believe in their own hearts that they had this problem and they didn't do something about it. I'll probably edit all that stuff out, but it may shed some background [unclear].

They didn't put George Hardy on [unclear]; they put J. R. Thompson. I don't know if you knew J. R. Thompson. Well, he was the project engineer for Marshall on engines, a bright guy, and he went in and started his tests and everything and got the thing fixed. Which brings up another subject with J. R. He was a great guy, but he was the consummate engineer, and he had a counterpart at Rocketdyne, who was a [unclear] personnel, and they wanted the best engine in the world. They'd blow that thing up down at Mississippi, they'd find what the problem was, and they'd fix that, but they'd do something else. They say, "Let's make this improvement."

They kept improving it, and they kept blowing it up, and I finally said, "J. R., I don't want any more improvements unless you run it by me," because they were doing things that were nutty, and I wanted to start testing that thing so it would tell us what's going to work on it. [Unclear] diddling around, they didn't have a failure. We tested to 104 percent, and they all went, and went through the whole qual program, and it flew for the first ten flights. But these engineers are never happy. They want to make it better. Now, I shouldn't say that,

because I'm an engineer, but I'm not at the level I'm making these changes. [Laughter] J. R.'s a good guy, and so is Hardy, but I think Hardy was way off base to say that the facts that we had available weren't sufficient to cause us any alarm, because they were there. The fact that they all added together is not going to happen too often, and that's why we had, I guess, twenty good flights or twenty-five good flights or something like that before the *Challenger* went, because statistically they just didn't combine—the egg shape, the other things, the temperature, and so on.

BERGEN: That concludes this interview.

[End of Interview]