ORAL HISTORY TRANSCRIPT

M. P. "PETE" FRANK III
INTERVIEWED BY DOYLE MCDONALD
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[This oral history with Pete Frank was conducted in Seabrook, Texas on August 19, 1997. This oral history was conducted by Doyle McDonald for the Johnson Space Center Oral History Project.]

FRANK: I was in the Navy ROTC in college and took a commission in the Marine Corps. Went through officer basic school and from there went into flight training and served a tour in … [a] Marine fighter squadron. And when I got out of the Marines, or got off of active duty, I went to work for a company in Dallas called Temco [Aircraft Corporation]. And they were making—they had three contracts. One was a trainer for the Navy, a basic trainer, one was a target drone and the other one was an air-to-surface missile.

MCDONALD: That was it, a small company?

FRANK: Yeah, it was a small company but that was—they had a lot going but all three of those—none of those three ever got into a production contract. They all flew through flight test phases and then that was it. But anyway from there I went to work for Martin in Baltimore. And that was one of those kind of career things, … [I] went up there for a specific job and when I got there they had reorganized. And the guy that I was going to work for didn't get the department that he was planning to start but he found me a very good job … doing reentry trajectory analysis.

MCDONALD: For which program?

FRANK: Well it was a general study. Kind of a basic parametric study of the effects of different things, lift and drag ratios and entry angle on trajectory results. And so I got to do a lot of that. … [There] wasn't anything available on that at the time and with a computer program you could do these things. Vary the parameters and see what happened.

MCDONALD: What kind of code were y'all running?

FRANK: Oh boy, I don't remember. Well, it was machine language.

MCDONALD: It was all machine language?

FRANK: Yeah, yeah. Yes, ones and zeros. But that evolved into working the Apollo study program. We won a contract to do an Apollo study phase. … [I spent] a couple of years working that … [but then Martin] didn't get selected to build Apollo. And some other things were happening there and I just found it incredible that people really thought they were going to go to the Moon, but it was fun working on it. And then when NASA actually awarded a contract and said that they were really going to do this, I decided that I really wanted to work on that, so I left there and came to work down here for JSC.

MCDONALD: And that was in '62.

FRANK: ’62, right.

MCDONALD: When they first started JSC. How did you get—most of the people we’ve talk to were in the Space Task Group, you know, under [Robert R.] Gilruth at Langley and they moved here. How did you get into the program? Did they put out a call?

FRANK: Yeah, they were recruiting people right and left. And having worked the study contract, I had a lot of experience doing reentry trajectory analysis. And we had worked the Apollo proposals so we knew all about the mechanics, the flight mechanics problems. And work on that was just experience they really wanted so it was no problem at all getting a job offer. In fact, I started out as a section head. They hired me as a section head for Reentry Study section.

MCDONALD: Mission planning.

FRANK: Mission planning, right. Morris Jenkins was the branch chief. He did a little bit of reorganizing after I got here and I was actually working the head of two sections for a while. One of them was the Guidance and Control Section and the other one was Reentry Studies. I got a fellow I knew from Martin to come down, Claude Graves, to come down and … [work] the Reentry Section. So he came and took that over and I just worked the guidance stuff.

MCDONALD: And where were y’all then?

FRANK: We were in—they called it the Houston Petroleum Center. It was … [an] office … [building complex] on Gulf Freeway. They had a fake oil derrick out in front of it… You know where Oshman's warehouse is?

MCDONALD: Yes.

FRANK: It was right next to that. In fact some of the flight control people, John Llewelyn in particular was one, … [were] in that Oshman warehouse. NASA had offices in there. But that was really, really good, interesting fun working back in those days because you were doing trajectory studies and guidance studies … [for which] there was no precedence (that we were aware of anyway). So you did a lot of … [creative thinking]. You did a lot of analysis and then … [developed] computer program[s] that would be a good simulation of it. And if you had confidence that it was a good simulation then you would run a bunch of further analysis and do things, trial and error, a lot of stuff on the computer, until you got something that seemed to work right. [This was the tool we used for planning Apollo mission flight paths (trajectories). We developed that from "scratch."]

MCDONALD: So what was the first thing—what system did you first do any trajectory analysis on?

FRANK: The Gemini.

MCDONALD: On Gemini. You did work on the Gemini reentry?

FRANK: Yeah, yeah, they were still flying Mercury but I wasn't working it at all. That was, let's see, [L. Gordon] Cooper was [the last mission]—I think [Walter M. Schirra, Jr.] Schirra's flight was in that time frame too. I think they were still doing two or three of the Mercury flights. But I wasn't involved in that. Morris Jenkins' branch was not involved in that at all.

MCDONALD: How did y'all interact with [Maxime A.] Faget's design team?

FRANK: A little bit testily, actually. But there was a lot of rivalry and trying to [gain control of the mission planning role]—I think some of the bosses were worried about turf battles and making their job bigger. And it worked down into the guys down at the section and lower levels. But there was a lot of … it wasn't actually antagonism but it was competition for things. And we would get involved with having a different idea or different way of solving some problem and then you'd actually compete to get yours accepted. There was some amount of wasted effort because of that but it probably was somewhat beneficial in that it kept you on your toes, there was always somebody to challenge what you were doing, because you needed, not only prove it to yourself but you had to … prove it somebody who had another idea. And I remember a lot of times going into meetings where the program office would be running a meeting and there would Max's people and then there would [Christopher C. Kraft, Jr.] Kraft's people, and then there's the contractor and there was a lot of debating that would go on back and forth about what was the right, the better way to do

something. I think in the end, Kraft's folks pretty much won out when it came down to the actual operational activities. We didn't necessarily have the right—the best equations for the guidance algorithms and stuff like that, but how you applied them and what you did with the mission with them was something that Kraft's folks seem to always come up with the answer that the Program Office ended up accepting as being a more practical way to do it. But there was lot of that going on for a long time between Kraft and Faget and it just filtered down to the people working for them too. But like I say, it was never an antagonistic thing, it was just a competitive thing.

MCDONALD: I don't think that's changed today.

FRANK: But I remember being bothered by it. That you felt like you were spending a lot of time trying to see if the other guy's idea really had a hole in it that you could move him out of the way and get your approach across.

MCDONALD: Did you work with the docking missions too, for Gemini?

FRANK: Yeah, but we weren't the main stream part of that. Ed [Edgar C.] Lineberry and … [his branch] were the ones that really did the rendezvous and the terminal part of rendezvous, the proximity ops and things. But they were focused on that and really worked that out during the Gemini part of the program.

MCDONALD: So when did y'all move onto the Apollo piece.

FRANK: Well we started, with Morris Jenkins, we started Apollo, … in '62. Most of our effort was on Apollo. And really the only Gemini effort was reentry and that was because they had a lifting component on the Gemini [entry vehicle]. They didn't on Mercury. And the guys that were running Mercury, Carl [R.] Huss and … [the] Flight Analysis Branch, … were doing all the Mercury work and they had no experience with the lifting body … [trajectories]. And so Morris' people got involved in doing the Gemini reentry … [analysis and planning]. And there was, within John Mayor's division, there were people competing for an area to work in between Carl Huss' guys and Morris Jenkins reentry people. In that case, Morris' reentry folks eventually took over that whole job because of the ability they had to do the lifting body analysis.

MCDONALD: What did you see as the biggest problem with the—if you're looking at Gemini and the reentry, what did you see as the biggest issues you guys faced?

FRANK: Well, I don't think it was—I don't recall it being any big technical issue. You just couldn't miss the ship that much because you didn't have that big of a maneuver envelope. And as long as you did the de-orbit maneuver in a reasonably good fashion, the lifting maneuvering stuff was just kind of like tweaking the thing a little bit. So …, I don't really remember a big entry problem with Gemini. It wasn't that big a deal.

MCDONALD: And you worked on Apollo simultaneously?

FRANK: Yeah, … we were working Apollo at the same time. Really from the start of '62. The biggest, well there were two big problems from our standpoint of Apollo. One was the reentry. The real narrow entry corridor that you had to hit coming back from the Moon and not do something really bad to the spacecraft. The other was getting to the Moon. The navigation that got you to the Moon was something that we had no prior experience with … and we used a lot of help from MIT [Massachusetts Institute of Technology]. … [We also] hired a contractor to work with us … called Analytic Mechanics Associates, some guys that had a lot of orbital mechanics, interplanetary experience analysis. … [W]e were trying to figure out how to get the spacecraft on a trajectory that was close enough to being perfect that it would take very little [subsequent] maneuvering to get it exactly where you wanted it. We had no hope of just launching it from the Saturn V and coasting to where you wanted to go to the Moon, … [we] knew … [we would have] to make adjustments [mid-course corrections]. There was something they called a free-return trajectory. And theoretically it was possible. From the cut-off of the third stage of the Saturn V, S-IVB, the spacecraft would go out and it would meet the Moon out there and circle around it and get slung right back to the Earth and hit an entry corridor that was satisfactory… [The spacecraft] wouldn't skip out and it wouldn't burn itself up going in steep. To find some guidance capability that would let you do that was the big challenge. You knew you couldn't do it perfectly but the closer you could come to it, to getting this free-return capability, the less propellant it would take to achieve it once you were doing your midcourse corrections. And that was the whole thing we were trying to do was minimize how much fuel it took to get back onto the free-return trajectory. [The trade-off was a desire for carrying lots of fuel for mission flexibility and safety vs. a desire to carry as little fuel as possible to save weight. A significant

consideration for mission planning was to be able to get the mission done but use as little fuel as practical.] And we got involved in doing Monte Carlo [probability analyses] studies of what the guidance system probably would do to you, and then how much propellant you needed to budget for that kind of thing. [The] Apollo VIII mission where we finally sent … [the crew] out there on that trajectory, that was a real nail biter because everything up to then had just been, "Well, that's what the computer says".

MCDONALD: Were you involved in the decision to send VIII to the Moon?

FRANK: No.

MCDONALD: Were y'all surprised when they?

FRANK: I was surprised. I was a little apprehensive about it but … [we were] going to have to do it sometime. The first time, it had to happen. By that time, I had left the Mission Analysis and was over working my way up through the Flight Directorate Branch. [I] [w]as really disappointed I didn't get put on that mission [as a Flight Director]. Really was. … [I'd] been working that trajectory for two years [in Mission Planning, I thought]. I'm the perfect guy to get put on that, but it didn't happen.

MCDONALD: When ya'll designed the trajectory to go to the Moon, you hear a lot about the Earth orbit rendezvous versus Lunar orbit rendezvous discussion?

FRANK: Yeah, that was going on when I came here in ’62. I mean it had been going on for a good while and I really don’t remember if it got resolved just before I got here or shortly after I got here, but I wasn’t involved in that tradeoff. That was a big decision to go that way and it worked fine.

MCDONALD: Did you work on the LEM [lunar excursion module] trajectories, as well, and finding the descent stage—?

FRANK: Yes, right. In fact, we were very much involved in that. The basic equations were derived by some guys up at MIT, the Draper labs at MIT. And we got involved, my Guidance Control Section got involved in doing a lot of evaluations, seeing how you could employ it and what it’s operational characteristics were. You’d look for things like if you get a little bit of deviation off, and you … [always will, it never is]—if it doesn’t go just perfect, what are the difficulties you run into when things aren’t exactly right and how close can we expect to get to the landing site that we want and all that. Those kind of studies, we did a lot of that. But I remember getting a set of equations from … MIT …, probably was one Friday because I remember spending some time over the weekend with these things going through and looking at them and reading them. Being a little confused at first on how that could possibly work but after studying it a while, I saw what they were doing and it dawned on me, just like the light coming on, I still remember that feeling, of say, “Hey, looks like that’s going to be the right thing to do.”

MCDONALD: Were you involved in the design and development of the sequencers that were used for, or computers I guess they were, for the LEM module?

FRANK: Yes, in that the operation folks made inputs into that. We didn't build it or we didn't say this is the way it's going to be. We'd make inputs into what we wanted, what we thought it ought to be.

MCDONALD: So when did you actually leave MPAD [Missions Planning and Analysis Division] and go into the Flight Directors Office?

FRANK: I believe it was in '68. It was … I remember being in a MOCR [Mission Operations Control Room] as an observer [(a flight director trainee) during] … the Saturn flight that Glynn [S.]Lunney was the flight director on. And we had really serious trouble with one of the [Saturn] stage's engines, … [he] couldn't tell whether it was burning or not. And I was sitting there, sympathizing with Glynn, as he was trying to get this situation resolved. He was just about to go LOS [loss of signal]and I remember thinking and watching him work that and thinking, "Boy, that's tough." Because it was the difference of whether there was a successful mission or [a] failure. And that was … we were flying Apollo missions but it was an unmanned flight. I believe that was '68, might have been '67, I'm not sure.

MCDONALD: So which mission did you work on? You were flight director on 12.

FRANK: Yeah, my first mission was Apollo 9. [Eugene F.] Kranz was the lead flight director on that and it was the first Lunar Module Mission, Earth orbit. I had one … [team] on 9, I had a … [team] on 10, did not have a … [team] on Apollo 11, … [had a team on] 12, did not have a shift on 13 and then 14, I was the prime flight director for 14, and then 16 and 17.

MCDONALD: What shift did you work on 12?

FRANK: I know I worked the reentry shift but I'm trying to think if there was [any other big activity for my team]. I don't remember.

MCDONALD: Were you there during the lightening strike?

FRANK: No, no, Gerry [Gerald D.] Griffin was … [the launch flight director].

MCDONALD: Did that change the flight plan at all as a result of that, you think?

FRANK: Only [in earth orbit]—I don't … [remember] if they spent … [one] extra rev or two in Earth orbit... I know there was a lot of reevaluation of systems to make sure they hadn't been damaged. They got things back on and running [during the launch but had to do evaluations in order to see if] … we [had] hurt them some way. We probably spent an extra orbit or two doing that. We had a window that you could [use], if you didn't get out on the [first] orbit that you wanted, you could come back around and try … [the next] one.

MCDONALD: Even though you weren't assigned during 13, after the explosion, did you have a function?

FRANK: Oh, yeah, everybody did.

MCDONALD: I figured you did. What was your function after this?

FRANK: Well, off line, we were working with the EECOMs [Electrical and Environmental Command Officers] and everybody trying to get the power requirements down to nothing. And also looking [at how to get them home]—I remember working with flight dynamics guys trying to decide whether to [do an immediate turn around and come back to earth]—We were getting data relative to doing a [direct] turn around or going … [around] the Moon. [We were] [t]rying to get enough information together to decide that, but … [the answer] was really based on the system's concern more than trajectory. Even … [though] you could have saved a whole lot of time by coming back directly, we probably wouldn't have tried it because of the concern about what would happen if you … [fired up the SPS] engine.

MCDONALD: So when you worked 14, you were the lead flight director after 13, did you think that had a lot more pressure?

FRANK: I'm sure we did. I know that there was a lot more media involvement that time then there was on the beginning of 13. Although I don't really remember the details, I'm sure that we were all a lot more alert all during the trans-lunar coast phase. I mean, we had it

demonstrated [to us]that things could happen at any time. And truly by 13, the trans-lunar coast was kind of a phase you just had to get through. You just sort of went into power-down mode while you [coasted along]—waiting till you got to the Moon. … [Apollo 13] showed that you couldn't relax … [anywhere].

MCDONALD: After the … when the program got canceled after 17, how did that effect the people you worked with and the morale?

FRANK: Well I think people recognized the two sides of that situation. One of them, you got these Saturn Vs and the spacecraft sitting there [what a waster] even though it's still a big effort to use them… [H]ere you got this great equipment and you [were] just going to mothball it or really scrap it. And that's when I think the question's really of, "Well, why in the hell did we go to the Moon in the first place?" started. You begin to see that the answer to that wasn't so simple. In my opinion, we were going to the Moon just to learn how to go to the planets. To me, it was a learning experience, a steppingstone, and you were going to get all this operational knowledge and understanding about that process and then going to apply it to Mars missions and really going to start manned exploration of the solar system and beyond. And that's pretty naive but that's really what I thought. [That was] my view of what was significant about Apollo. Sure I understood the geologists and the physicists position that, "Hey, we can get stuff off of the Moon that's going to tell us a lot about how this whole system got formed and where it came from or how it got formed." And okay, that's good, that's good reasons to [do Apollo]. But then once you start … you got that kind of information from the three or four different sites that we went to, do you really need any

more of that. I think there was understanding that, "Why do we keep taking this risk when we've got everything out of that mission, out of that program, that we really went after." You could get more of the same or maybe find something totally different at another landing site but you've got 99% of the goody out of the Apollo program so why risk crewmen another two or three times going out there. So it didn't seem all that bad a deal to me to shut down the Apollo. What bothered me was when we shut down the Skylab because that could have every bit of potential of involving something really big, really good but was very short-lived.

MCDONALD: Back to the Apollo for just a second. On the Apollo program, as a flight director, what did you see as the biggest challenge with the flight control team?

FRANK: … [The biggest challenge to the flight control team was to always make the right decision about what course of action to take. In a problematic situation to know whether it was ok to continue the mission or whether it was prudent to modify the plan, or even whether it was time to abort. So much effort and cost goes in to each flight that you don't casually quit, but the risk to the crew and the spacecraft must not be unnecessarily increased. A "go/no go" decision in a time-critical situation puts a great deal of pressure on the flight control team.]

[Some other less critical challenges that I felt as a flight director were] getting the team to work as a team [and maintaining a high state of alertness. Early in the program,] … what struck me and surprised me was that the disciplines … worked really well within their discipline. The EECOMS … knew their EECOM stuff and they worked really good with

their back room… But I was surprised at how narrow[ly] focused so many of the flight control team guys were. They … it was almost like a guy was looking … EECOM would be looking at his displays and his systems are all working fine and he's just happy as a clam. He almost couldn't care less what was happening at GN&C over here. I don't mean that in a cynical way but in training, in simulations, when you got to see a lot of these problems and how it affected the team. A lot of times people would … their inclination or their instinct was to just … if their problem was working fine, good. They weren't too concerned and they weren't that focused on what they could do to help the other guy out. I can't remember specifics but I've got a feeling that they could very well have debates going on between a couple of the disciplines because some guy wanted to infringe on their margin. Maybe it was to save his from totally crashing. [For example, the propulsion system might have to use some of their reserve fuel to help solve an electrical system problem. They] … use some of your margin and then they'd argue about it. They didn't start off with that overview feeling. That was part of the task that I saw that a flight director had to do was to instill that and get that teamwork kind of attitude going. Now, when I got involved as a flight director, it had been going on as a discipline for awhile. I wasn't there in the beginning of developing the flight director role but there still was that element that, to me, was a big part of it. That was kind of a surprise. Later on, I think that … went away. You didn't see that so much. Later on, the big problem was keeping people as alert and on top of things as they could. It was easy to get complaisant even after Apollo 13. You still would see long hours of smooth operations, no problems coming along, nothing exciting happening, and people would get kind of powered down and not as alert as they could be. That's human nature, I guess, and it probably will always be there. I think that could be a problem in space for a real … an Earth

based mission that goes on for two or three years, you couldn't keep up that real intense level of focus. Maybe you don't need to, you [could] get a computer to do it for you.

MCDONALD: What was your assignment after Apollo?

FRANK: Well the last Apollo was the Apollo-Soyuz.

MCDONALD: You worked Apollo-Soyuz? I know you were in a working group.

FRANK: And I had the lead flight director role and the Worker Group [No. 1] responsibility on that.

MCDONALD: How was it working with the Soviets before they were the Russians?

FRANK: It was the most interesting things I had done because they were so—they had such totally different personalities and views about things. And to work closely with them, you got to really understood what their problems were and what was motivating them. They just reflected a lot of that secretive society that they had. When you could kind of peel that back, underneath it all, they were just humans like everybody else and we all know that now. But back in the mid '70s, it was strange working with the Russians. To realize that a part of the group you were dealing with in this meeting in building 4, there was a certain number of KGB guys mixed in with that group. [They never acknowledged it, but] … they didn't know squat about the technical work; … they were there to exercise their prerogatives over the rest

of them. There was a lot of suspicion. I think they … first of all, they were really impressed with NASA, the facilities, and the things we had available to work with, just basic office equipment. For gosh sakes, they didn't have anything like that, they really were backwards. And that was a big eye opener that how crude things were that they did. Their ability to run computers was very, very archaic. We ended up doing a lot of the routine administrative kind of things that they just couldn't handle because they had no facilities to do it. But you get away from the office and you get out in a social environment and they were great. Really friendly, loved to party, and just had a great time. We'd ride on a bus somewhere with busload of engineers and secretaries and administrative people and there's always, if it was at night or any [significantly long] period of time, they'd end up starting some big song contest. They loved to sing. They knew these songs that, of course I had never heard of, but they all knew them. They'd sing them real well and it was kind of embarrassing how much talent they had for doing stuff like that we didn't. And they also had real talent in basic science, basic physics, and basic mathematics. What they lacked was the computer … [applications]. But they knew as much or more about the fundamentals of orbital mechanics than we did. They knew as much or more about aerodynamics as we did. It was just the ability to do detailed, in-depth analysis of a lot of parameters that they would have trouble getting the … [answers]. It took them a long time to do it because it was mostly done by hand kind…

MCDONALD: What do you see as the—what was the biggest challenge you saw in ASTP [Apollo-Soyuz Test Project]?

FRANK: The language difference. Yeah, the mission was not that complicated, it was just simple rendezvous mission and docking in low Earth orbit. So it was relatively easy to do, but the language was terrible. And I think, I guess we must have spent three years on that program and if they'd have been all English/American thing, it would have been six months. The language combined with the geographic separation just added tremendously to it and it added a lot of uncertainty. It added risk to it, I think, because, a lot of times, you'd have no idea what they were talking about and vice versa. We'd be talking along and thinking we had understanding that everybody was in agreement and [it would turn out] we were agreeing on two different things. And it was all in the translation. That was when I really began—had a feel for how much jargon that we were using in our day to day operations that translators or interpreters [didn't understand and couldn't translate accurately]. People that were taking the English and putting it into Russian, they wouldn't know what we were talking about a lot of times. They would misunderstand what we were telling them and then they'd convert it into Russian and it wouldn't make sense. And early on, we would get into these discussions [with the Russian engineers] and you'd say, "What in the world—what's wrong with these guys. Why in the world do they want to do that. You know, that doesn't make sense. It's going to be a lot harder and all of this." And we'd argue about something for two days and, come to find out, it was a misunderstanding. And so it got to be that whenever they were proposing something and it came across as, "That's really stupid", hey there's a language problem here. And we caught on after a while that if it was something that really didn't make sense, then it didn't make sense, there was a misunderstanding somewhere that was a cause of it. And that helped a lot when you finally realized that. That they didn't have some

different kind of physics or mathematics, you were just struggling with the language interpretation problem.

MCDONALD: In terms of the KGB [Soviet secret police] guys, did you feel like the Russians, not the KGB people, but the engineers and flight ops people, do you feel that they distrusted the Americans? Was there a lot of that to overcome initially?

FRANK: Yeah, I think they thought that we probably were spying on them or listening to what they had to say. We were having a meeting in my office one time and there were several of them there and we were discussing something… [T]here was a noise in the ceiling and they all looked like … [they thought] somebody['s] eavesdropping in a real crude fashion. And I don't know [what it was], it was something in the ducting that made some noise and I know damn well that's what they thought that we were somehow secretly recording what was going on. But that wouldn't have made sense because there wasn't anything going on that they would be ashamed of or they couldn't live with. But they just tolerated the KGB guys. They had no choice and so they had learned to just live with that and go on about and do your job and try not to let them slow you down too much.

MCDONALD: What did you do during Skylab?

FRANK: Not much. By that time … I guess when it started, I was the head of the Flight Director Office. And I didn't work on the console on Skylab. And toward the end of that, I also became the Flight Control Division Chief, so I didn't work on the console during

Skylab. I kept … my biggest problem with Skylab was keeping Putty [Don L. Putt] and Neil Hutchinson apart.

MCDONALD: I can understand that.

FRANK: … [There] was—I thought one time those two guys were going to have a fight in the MOCR.

MCDONALD: I was going to ask you, you mentioned keeping people, during trans-lunar coast, keeping the people motivated, not motivated, but alert.

FRANK: Alert, yes.

MCDONALD: I was thinking about Skylab needs especially …

FRANK: Yes, Skylab. We were concerned about it before we got into it. You know, we thought that was something to really be concerned about and so there was a lot of emphasis put on that to try to look out for it and keep it from happening. But you know, it was such an intense period of planning, that there was a lot of activity going on in the Control Center trying to keep every minute of every day useful onboard. That helped a lot but there was still a lot of periods where it was just really, really boring in the Control Center. And you saw all kinds of peripheral things involved during those missions. People spend a lot of time working on some screen image, it was almost like an entertainment kind of thing. They

would put some big image up on the big screens up there. It had very little to do with the mission.

MCDONALD: You went to Flight Control Division in what, '74?

FRANK: I'm sorry?

MCDONALD: When did you move to Flight Control Division?

FRANK: '74, yes. Let's see, the ASTP was in '75. That was the flight, it was started about three years ahead of that.

MCDONALD: Were they working on Shuttle when you moved into that position.

FRANK: Yes... In fact they were working Shuttle, some of the Shuttle analysis anyway … [T]hat was going on before we moved over to building 4. I remember some—Carl Huss and folks looking at aborts off of the Shuttle launch. Yea, that's a whole other problem.

MCDONALD: Being Flight Control Division lead, included in the Shuttle was the idea of the partially reusable spacecraft, how did that affect the flight control aspects of the missions, where part of the spacecraft came back and you used it again?

FRANK: Yea, you know the parts, other than the main spacecraft, I mean, the SRBs [Solid Rocket Boosters] were the things that really got used and abused. But the orbiter being a reusable, I don't remember that being a whole lot different. The thing about Shuttle that gave us a lot of concern, gave me a lot of concern, was this idea that it was going to be so operational that you power way back [in the MCC] and you [would] have very little ground support involved during missions... They were trying to make it run like an airline where you checked it out, launched it on its mission and when it came back … did whatever you had to [in order to get it back in the air. The in-flight ground support for the payloads would be the main activity]… [T]he original design would have been closer to allowing you to do that than what we ended up with. … [The Shuttle Program] … had to keep cutting costs and weight … so things kept getting taken off, capabilities kept getting taken out of the Shuttle. It was supposed to operate at, like, 50 or 60% of its capability and by the time it flew, its capability was so much less than what was originally planned, you couldn't afford to only use 50% of it, you had to use it all, nearly. But that [made the] concern about being able to really do that and have everybody cutting back on the support of the Mission Control [even greater]. We were really struggling to retain capability in the Control Center. … [There] was always somebody ready to stop spending money in the Control Center because … "it wouldn't be needed."] We finally found … [an] argument [that justified a major control capability in MCC.] [O]nce we got that argument on the table and accepted, then I felt a whole better about it. I said, "Well look, maybe it's eventually going to get that way [(nearly autonomous)], but you're not going to fly the first few flights with no Mission Control Center." And they said, "Oh …, you're right." So we got a Mission Control Center. Well then, "Okay, fine, we got one. We'll use it and only … [quit using] it if we prove that we

don't need it. It's there and we've got it and so we've got something that we can work with. And if do have to power it back, it's only because the Shuttle works out as well as the designers hope it does." And so once that came about, then I thought that we were going to be all right in Mission Control. And that's pretty much the way it worked out. But they were really talking about having five men on the ground as the full complement [in the MCC]. We were going to budget meetings defending against that proposal. … [The program office was] really serious [about] trying to do that. But nobody wanted to fly the test flights that way, so we had to put a Control Center in place that would work for the Shuttle

MCDONALD: I don't know how closely you're following the Space Station activity today. Every year to hit the budget cuts—the people in congress want to cut the budgets, they say, "What's the relevancy?" Similar to the question about Apollo. How do you respond to people who say, "Why are we building Space Station?"

FRANK: Well there's, I guess there's … maybe it's the same argument. There's two arguments. You believe that's an area that offers a great deal of potential for the best interest of society, civilization. It's a region of human involvement that has a lot of potential for making society viable in the long term. There's all kinds of subsets of technical disciplines that benefit from doing research in that area. People either accept that or not. If they don't accept it, then it's a waste of time, waste of money, not only expensive but dangerous. Well you know all of those arguments. And you either believe that those kind of motivations to look into fundamental research that has potential, that you can't really appreciate until you

get into it or you don't. I guess you can believe … that's okay, that's fine as long as you're not spending my money doing it. Go spend your own money but don't spend my tax money. And I don't know how you argue that. That's just a person's attitude. That's the way they feel about things. I don't think you can change that. But when you really look at the … don't think in terms of twenty years or a hundred years but really long term. If there's going to be anything resembling a human race or living organisms they're going to eventually need to be somewhere else. And it's pretty well accepted that the Earth is not infinitely long lived, it's got a limit. So everything we know about gets totally destroyed unless some of it goes somewhere else. That's what appealed to me about Apollo. It was the first preliminary step that maybe several centuries from now culminated in something like that, moving humans to another part of the universe. It's a whole lot different from remote sensing of cornfields in Kansas. That's another aspect of it.

MCDONALD: Looking on the career, we always ask people, "Who stands out as the people you remember working with?"

FRANK: Oh boy, there's a lot of people that really stand out. I think one of the most outstanding people in the whole program was a guy name Bill [Howard W.] Tindall. He just amazed me what he ended up accomplishing. Pretty much through his own personal hard work and efforts. He had a personality that got people to follow him and go along with him and do work with him. He could really get people to work together. You got all these diverse elements of Program Office and Max Faget's people and Kraft's operations people, MIT people, and Rockwell, and all that. After a little bit of introduction of working with

Bill, everybody was ready cooperate and work with Bill Tindall because you knew that his motivation was to get the job done right. He didn't want any credit for it himself and he just wanted to make damn sure that it got done right. And he was smart enough to recognize when things were not being done well and could pick out the guys that were telling him the good stuff and filter out the guys that were telling the bad stuff. But he just, to me, was somebody—if you didn't work in the program, you probably never heard of Bill Tindall but he was an amazing guy. And oh, there were a lot of characters around but guys that seemed perfect for their job were Kranz. He just … I couldn't imagine him doing another job than what he did as that flight director role and flight control leader. If you'd put him some other kind of job, he'd approach it the same way and maybe totally destroy everybody involved but the job he had was, he was made for that job and he did it real well. I thought, certainly Kraft but those are all of the big name guys. You know my memory is real bad about names but there were some folks in the Flight Control Systems area that were really dedicated to a particular area that they worked and they were really motivated to make sure they did that really good. And I can see them but I can't come up with their names.

[End of Interview]