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RETURN TO
AIR FORCE
Historical Research Agency
Maxwell AFB, AL 36112-6424

Telephone Interview
with

Gen. Forrest S. McCartney

ANNED BY ISA

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KNOW ALL MEN BY THESE PRESENTS:

That I, FORREST S. McCARTNEY,
have on (date) 09 November 2000, participated in an
oral-magnetic-taped interview with Maj. David C. ARNOLD
covering my best recollections of events and experiences which may be of
historical significance to the United States Air Force.

I understand that the tape(s) and the transcribed manuscript resulting therefrom
will be accessioned into the United States Air Force Historical Research Center
to be used as the security classification permits. It is further understood and
agreed that any copy or copies of this oral history interview given to me by the
United States Air Force and in my possession or that of my executors,
administrators, heirs, and assigns, may be used in any manner and for any
purpose by me or them, subject to security classification restrictions.

Subject to the license to use reserved above, I do hereby voluntarily give,
transfer, convey, and assign all right, title, and interest in the memoirs and
remembrances contained in the aforementioned magnetic tapes and manuscript to
the Office of Air Force History, acting on behalf of the United States of
America, to have and to hold the same forever, hereby relinquishing for myself,
my executors, administrators, heirs, and assigns all ownership, right, title,
and interest therein to the donee expressly on the condition of strict
observance of the following restrictions:

Forrest S. McCartney DONOR

11 May 2001 DATED

Accepted on behalf of the
Air Force History and Museums Program by

David C. Arnold DATED 11 May 01

DAVID C. ARNOLD, Maj, USAF

Donated by [Signature]
5 Jan

TELEPHONE INTERVIEW

LIEUTENANT GENERAL FORREST McCARTNEY (USAF, RET)

INTERVIEWED BY

MAJOR DAVID ARNOLD (USAF)

9 NOVEMBER 2000

[BEGIN TAPE 1, SIDE 1]

FM: I came into the service in 1952 out of Auburn. This was during the Korean conflict. I never got to Korea. Mel Lewin served in Korea. He came in, I think, a year earlier than I did. And uh, uh, I came in as a regular officer. My initial duty assignment was over at Warner-Robins. Among the things I did at Warner-Robins was to work in the engineering office there and was on an engineering team that was in communications, and among the areas that we had to provide communications support to, engineering support, was the Cape. Well, of course, in '52, late '52, early '53, the Cape was just beginning to get in business, and we put, I was privileged to be a part of the team that put some of the original communications in down here, and I became kind of captivated by the space, or by the missile business, it wasn't space then by any stretch of the imagination. This was before the ICBMs. I wanted to get over out of Air Materiel Command (AMC), over into the ARDC at the time. Therefore, I sought a way to get there. Since I was on a directed duty assignment, about the only way I could get there was to go to school. So, I went to AFIT and took graduate nuclear engineering. I majored in weapon technology and graduated in early 1955. I went out to Albuquerque, which was, of course, the center for special weapons and a series of assignments there, but I got into the safety business for ballistic missiles. I met a guy named Charles G. "Moose" Mathison, Major Mathison, and worked for him, and he was one of Schriever's chosen ones. So, when Mathison, Colonel Mathison, wound up going to Florida, I

thought I was going to go Florida, down to the Cape, back to the Cape with him, but it turned out I stayed in Albuquerque and, then, when he was transferred from the ICBM-IRBM business down here up to Sunnyvale to the 6594th [Aerospace Test Wing, the Air Force's satellite operators], which was just being established, he brought me up there. So, I have been, if I can use the expression, in the missile business with the warheads and, of course, most of the people or a great number of people moved from the missile business into the space business, and that's kind of how I got up to Sunnyvale in early 1959.

I did not know what I was getting into when I went up there. I knew that Colonel Mathison was there. I had a great amount of respect for him, and if he wanted me there, that was good enough for me, and I knew it was in the satellite business. Well, if you will recall, in late 1958 is when Discoverer orbited and the Spitzbergen incident occurred [the loss of Discoverer II], so, really what they were doing was not under wraps at the time but was not really well known. Of course, I got there, I wasn't there for that event, but I got there and immediately became familiar with it, and I don't remember how many people were in the wing, but as I mentioned to you, both Keith and Mel were there in the wing. I think I got there for Discoverer II or just after Discoverer II. We were in uniform. It was part of Weapon System 117L, the Pied Piper. We were up in Menlo Park and, I believe, the building numbers were 501, 502, and 503, and they were up behind what was later, well, the Hewlett-Packard Company, and we had an 1103 AF computer, and that's where we had the office that we had, with just 12 officers and five enlisted. We did, in fact, wear our uniforms at that time. Later on, we, the decision was made to blend us in with the contractor. The early days, I believe, the path to follow was to take the Discoverer, Samos, and Midas and have them blue suited, and that was the original concept, which was later changed to have a much more active role by Lockheed at the time. They had not

yet built, they were in the process of building the satellite control center—STC—down at Sunnyvale and, I believe, we moved down there in March of '60. I am pretty sure of that, but you'd need maybe to check that.

After we moved down there, it was a little later on that the decision was made that the contractor would stay in it longer. They were in the process of sending quite a few military people in there. The wing was building up. They really didn't know what to do with all of us. I think there were, I want to say some of the people were from up in the northeastern part of the United States, up from Maine, that were part of SAC that had the photographic business, but the thought process at that time—and that was before the NRO was established—changed dramatically, and they really didn't know what to do with us. So, they sent three of us over to “assigned to Lockheed” to work for Lockheed, and that's when we all kind of went to mostly to civilian attire, which I really didn't have any big problem with that. I kind of pushed back on it in the beginning, but it was at such an exciting time we didn't really have a big deal with that. When we were up in Palo Alto and, then later, at Sunnyvale, of course, we were shooting an awful lot of vehicles. Rob Roy and, uh, oh gosh, he's my neighbor across the street, uh, William Heisler were very instrumental in shooting the Discoverer.

The Discoverer, at that time the payload was not really known to very many people. There were about four or five of us, as I recall, who had an insight as to actually the fact that the payload for Discoverer was a camera. It was pushed off as the R&D part of the Midas and Samos programs. Of course, all of that is declassified and was a few years back, as I'm sure you're aware. We had a great reunion up at the Smithsonian that summer [in May 1995] when they declassified it, a nice reception, *et cetera, et cetera*, but the point of it was, is that not many of us knew what the payload was. To the best of my knowledge, I had the midnight passes on the

console, and that's when we took our first operational photograph that we returned in August on Discoverer XIV. Discoverer XIII, which we got back, did not have a camera onboard. It was a diagnostic telemetry system, as I recall. So, I believe, I was on the console when we snapped that first picture and got it back. And, I have a picture of it in my office. It was part of the thing that, a part of the meeting up in Washington when they declassified it, which I treasure quite highly.

We really didn't, I didn't really have much to do with setting up the Satellite Test Facility or the facility up at Sunny, up at Menlo Park. Those were pretty much there or in process of being constructed when I got there. When I got there, we were just trying to figure out how to use all that stuff. I think I described to you the other day that the technology we used was a TV camera, which was hand plotted. We would, they would launch out of Vandenberg Thors, Thor-Agenas. We really didn't have much to do with any of the ground operation, but after launch we would get the tapes back. There was a telemetry ship downrange, the *Joe E. Mann*, and they would stage a C-119 out of Edwards to go down, and they would snatch the capsule, the telemetry capsule behind the ship to bring the telemetry data up to try to give us some indication of how things were performing during the ascent. As you know, they were about ninety-minute orbits, and you would bring up, we had a net, which usually didn't catch the first one, only a part of it. Kodiak was our prime station, and they would bring up "Kodi" [on Kodiak Island, AK] or "Annette" [near Ketchikan, AK] too, but depending upon what the inclination was, and of course, we weren't all that accurate at the time. And, they would, a few minutes before, we'd do a pre-pass in which you made sure that the tape which to drive the PRELORT [precision long-range tracking] antennas, radar, and you would make sure that that was sent. They were sent on telephone lines, so the data rate was pretty doggone slow. But, we'd send a punched tape up there, and they would start searching around the "acq" [acquisition] point, ohhhhh, something like

five to ten minutes before the estimated "acq" time was. And, they had the telemetry, had a tri-helix [antenna]. And, of course, if the tape on the bird was properly synched, and it usually was from launch, the vehicle would come up playing, up over the horizon. So, they could pick it up when it was moving pretty slow on the horizon for both the telemetry and, then, lock on with the radar, with a beacon on it. And, then, they would track this until we got TOC—Time of Crossing—of sixty-five degrees north. That was a very major point, because the time, we estimated the time that it was supposed to pass based upon a given across that point, and the radar would give that plot point. And, that was tied to the orbital period. And, our job was to synch up the orbital period with the onboard timer such that you could bring, you could drag the tape through at a given rate so you would know where you were on the tape, because the equipment was turned on and turned off by tape, because as we mentioned before, I think in our conversation the other day, we did not have enough power. We only had batteries, and you could not afford to leave the equipment on all the time. So, you had to grab that thing when it came up, get a time of crossing of sixty-five degrees north. There was an index point on each tape that was known as a reset monitor, and that reset monitor was to correspond with a given point on the ground. I believe it was sixty-five north, or it could have been a little bit further south. I don't really recall. I guess it was a little bit further south. And, when you hit the, sent that command, and I'm thinking it was "Command 3," but I'm not sure. It's a long, long time ago. It indexed that point on the tape. If it had advanced too far, it drug it back; if it was too slow, it drug it forward. So, you then knew where you were on that tape, and knowing when this thing crossed a given latitude, by knowing when it could cross a given latitude, you could compute how much you were off from the estimated period. You know, if you were ten seconds early in crossing TOC—sixty-five north—then you were, the period was ten seconds less than you thought. And,

we could step the timer in ten-second increments, and you either increased or decreased the speed of the timer to drag that tape through it.

So, now, you've got the timer, the clock system locked up, hopefully, to what the orbit is. And, now, you want to index the tape, and by sending the reset monitor at a given time, you then index that time on that tape to a given point on the ground or a given time. Now, since this thing cut on and off, the errors were cumulative. So, if you were off, and typically we would put somewhere five and ten steps in, which would mean you'd a minute or two off, and you usually got rev one, rev two, and "Hula"—Honolulu—picked it up sometimes, I don't think there was an overlap between the two, but they could pick it up. So, you got a couple of stations to take a shot at that thing, and if you didn't have that timer synched up by then, the times, the errors were cumulative. Maybe you could see it on rev three, if it was, it was a very low pass, and only "Kodi" could see it. Then, you wouldn't see it until the midnight passes and, I think, that was on rev eight or so, and before we got New Boston [the New Hampshire tracking station] as a tracking station, you didn't pick it up until it was back to Vandenberg. So, you could get, you know, anywhere from four, five, six revs, and if you had a couple or three minutes of period you hadn't adjusted out of there and it had all been cumulative, this thing could be away from you, get away from you, and you could never hear it or get back in it again. So, the point I'm trying to make is that it was extremely urgent that you acquired it, figured out what problems you had, synched that tape up, and adjusted the timer on rev one.

So, uh, and as it came down, the tracking station would call out TOC—time of crossing—and they used system time, which was GMT time in seconds. And, you would cross these points, and they would then mark those out on the plot board so that you would have a record of what was going on, so you wouldn't have to plot, you know, use all the crutches you had with you.

So, that was pretty much a description of pre-pass tape, I mean, of a pre-pass, pass, and then a post-pass. What we would do in pre-pass, we would brief the station and tell them what we anticipated the situation to be, tell them what we wanted them to do, to look for, and anything that we were concerned about. We were always concerned about acquiring it with the reset monitor on. If you didn't see the reset monitor come on, you really didn't know where you were on that tape, and you could be just before the fade point, which would have cut the system off. So, you know, you gave a good pre-pass briefing on what you expected to see and what you wanted the station to do. The station then acknowledged and read this back to you. They acquired; they tracked; they gave you data. You asked for data. You told them what commands you wanted to send, and when to send them. They sent them and gave you the read-back from telemetry as to what they were seeing and, then, after the pass, they would send you a post-pass tape, which was a record tape of acquisition with system time against it and "az" [azimuth], "el" [elevation], and range from the radar and the telemetry tapes. I guess the telemetry tapes, though, weren't sent, because they were too wideband. After the first rev, the first series of revs, revs one, two, and maybe three, we usually had an airplane up north, either a C-47 or a C-54, and Keith Smith was rated, and he flew that C-47 many, many hours. They would pick up the tapes from "Kodi," go over to "Annette," pick up whatever tapes they had at "Annette," fly them down to [Naval Air Station] Moffett [near Sunnyvale]. We would analyze the tapes. The data people would analyze the tapes and, then, you'd get ready for the midnight passes, which were north, I mean from south to north. The first passes were from north to south.

Then, that's pretty much the, I'd call it, routine that we went through for many years. We took variants off of it, but at the time we only had, I believe, thirteen commands that we could send. One command, which a few of us knew what it was, but it was a payload command, I think

we had one or two payload commands, and it was "image motion compensation" to try to synch the speed of the film, the photographic film, up with the earth underneath it, and the computers up in the second building up from us at Menlo Park would tell us what payload commands to send. We had a phone underneath the, that was a separate phone that would ring, and it would be the payload people and, if you weren't cleared, you didn't know what it was or who was talking to you and they would just say, you know, "Send Command Four two times." And, you'd repeat back and, then, during the pass, that's what you would do. So, the passes were technically from a minute to, oh, I think the longest pass you'd ever see would be about five, five-and-a-half, maybe six minutes, and they could be as little as a minute. So, it was, you had to get on it, figure out what it was doing, and figure out what you wanted to do, get the commands in, get them verified before you got to the fade point. At times, it was a lot of fun, to be fair with you.

DA: Sounds like it was a very quick pace.

FM: Yah, the thing you really did, was you worried very much about stepping the timer in the wrong direction. I recall on one occasion that was done. Thank goodness I didn't do it. But, if you stepped it in the wrong direction before you could, and didn't get it out fast enough, you lost the bird. So, there were a lot of opportunities to make errors, as normally is the case for any manually type of operation, and that's true today. But, that's pretty much what we did.

As I tried to say to you, Moose Mathison was the fellow in charge. I don't know whether he was the wing commander or not, but as far as I was concerned, he was the fellow in charge, and he was a very, very, very close person to General Schriever. He flew General Schriever a lot. General Schriever came up to see us fairly frequently. Shortly after that, as you know, he went to, early '60s, he went to ARDC and, then, set up Systems Command, and I'll come back to that in a minute. Menlo Park, what was it like in Menlo Park? You know, just a building you went in,

and uh, no windows, and offices, and you sat in there and practiced, and practiced, and practiced and read and tried to figure out how to do things better and come up with problems and how you would solve it. When we moved down to Sunnyvale, that building had been specifically designed for the control center. It had a lot of "gee whiz" things on it. The consoles were very modern. There are some pictures on some various command-and-control magazines. The consoles were not as functional as we would have liked them. The TV was, of course, a TV by TV standards in the mid '50s, or late '50s, early '60s, and you sat there for about eight hours watching those TV sets your eyes really bothered you. So, the equipment was not very what I would call user friendly.

We didn't have a lot of contact with the program offices. Of course, there was Fritz Oder. Lee Battle was big. He had the Discoverer program. Quenten A. Riepe. Lee Battle is still alive. He was one of the forty people recognized, as was Fritz Oder, recognized by the NRO for his contributions just a few months ago. And, Quenten A. Riepe is dead now. He had the Midas and, gosh, I really forgot who had the Samos. I really don't know, I don't recall who was in charge of Subsystem H when I arrived. I can see him. He had a scar across his face. I can close my eyes and see him very clearly, but he was a Lockheed person. We didn't deal that much with Philco-Ford. It was Philco at the time.

[END TAPE 1, SIDE 1]

[BEGIN TAPE 1, SIDE 2]

FM: Mel Lewin will know who had Subsystem H. And, of course, that was the subsystem that we used to get in and out of the vehicle, and it was paramount to understanding how it would work. What did I think about the leadership and organization in Los Angeles? At the time, I would say to you that at that point in my career, which was, you know, not that far along, I never

questioned the organization. I had great confidence in the leadership, particularly of Colonel Mathison, of the people, Hank Hester, who was kind of in charge of Lewin and myself. But, our leadership in Sunnyvale? I'll be fair with you. We were so busy and so wrapped up, and I was, you know, pretty junior at the time, I really didn't question the leadership. As far as I was concerned, they were made and handed down. It was a situation where "Hey, we need to get on with life and see if we can get this stuff back" and we did. I didn't have a lot of interaction with General Schriever, other than to know him, to meet him, to understand him, and to admire him. Colonel Oder was in and out a lot. So, that kind of much covers that.

You said what challenges did I face? I guess I'd say the biggest challenge was to try to learn orbital mechanics and understand orbital mechanics, and understand what you were trying to command, and there were no real good books on that either, by the way. So, we were really depending upon Lockheed to help us with that and, then, to understand the Agena and the commands and what the commands did. Now, they were building Agena right across the street from us. 104 was the engineering building. So, we could over there and see that equipment. We had a lot of relays and these kinds of things, because we saw the stage wasn't there very much. So, trying to understand orbital mechanics and why you sent the commands and what you were trying to do and, then, the hardware were the biggest challenges. And, it was a constant study and internal class. It wasn't formal. These were things where you went to meetings, you got data, you would say "Hey, that's a good book on that," so, so, we were, if I can use the word, kind of "scavenging" all of our equipment or our libraries to a great degree and kind of figuring out what forms would make the best sense. Mel Lewin has an uncanny ability to be able to put an enormous amount of data on a single slide. He is the best I have ever known about that. So, he was particularly helpful in getting what I would call the forms and the data and the tools that we

needed—crutches, crib sheets—these kinds of things that were, of course, we'd make our own crib books, and you always carried a set of your own "cheat sheets" with you that would help you prompt, and we'd do a lot of rehearsals, almost every day whether we had a vehicle up there or not. You'd take old tapes that were on previous flights, and you'd then play them back and, of course, everything was recorded on reels, and so, you'd have the audio, and you'd try to synch it up manually with the tape, and then you would start.

If you were in the back, you would try to see if you could devise a problem that would fool the guy who you were, who was trying to control it. So, it got to be I wouldn't call it a game, but it got to be a challenge to see if you could cope with the problems. And, boy, we'd sit there and think of devious problems. And, all that paid off to us in big time—big time. I had a little bit of a problem working for Lockheed. They weren't particularly hard to work with, but they kind of looked upon us as not the customer so much as they, you know, their competition, because to be fair with you, I don't know if it's true or not, but certainly Lewin and a guy named Alvan Crews and I were the three Air Force controllers, and we thought we were pretty good, and we thought we were better than the Lockheed people in the way of capability. So, it was kind of a friendly contest, but the bottom line to it was that we got along, no big problems, didn't really worry about the contractor. They accepted, I think everybody accepted each other if they could produce. If you couldn't produce, you didn't have the respect. We got off a couple of Midas birds out of the Cape that were Atlas-Agenas—1,007 and 1,008, as I recall the [vehicle] numbers—that was the early Midas birds that had some experiments on board. Neither of them worked. They were both failures, or the missions were failures. But, we got a little bit of experience on the Atlas-Agenas and, then, of course, they started launching the Atlas-Agenas out of Vandenberg, and we got the first SAMOSs up there. And, as I recall, that was done in '61,

about the middle of '61. I was the lead person for the Midas transition work, and also one of the controllers on the original Samos bird that went up. We had two packages on it. One was an ELINT package, as I recall, and the other was a photographic package, but that was an awful long time ago.

And uh, that was in '61. General Schriever had gone to Andrews. There was a big decision being made as to whether or not, how they were going to manage this new system. Of course, we had by that time gotten fifteen or so, maybe twenty, Discoverers back. Nobody ever got to see the film in them. Like I say, people didn't know what it was, but the intelligence community knew what they had, and the big fight was on as to whether or not, or how they were going to be managed, how they were going to manage those programs. So, General Schriever felt like he wanted to bring some people up there, and be able, he wanted to manage them, of course, out of Andrews. So, he brought some of us up there in his manned-spaceflight office. The MOL program was going. So, the bottom line to it was he wanted to have people who he thought had experience in on-orbit work up there on his staff, so when he could take those programs, if he was able to get those programs, he would have a staff built. So, the Office of Manned Space Flight was established up there, and Major General Osmond J. Ritland was that. We also were dealing with NASA, and General Ritland had an office down in NASA. I never really knew whether General Ritland's office in NASA was a front or whether or not there was really manned activities going on in it. But, I worked on General Schriever's staff. General Schriever was an individual who had a very close staff and, then, he had the regular staff, and I was on his close staff. By that time Colonel Mathison had moved up there, and then in the fall of '61 Mrs. McCartney and I went up there. So, I was at Sunnyvale from early '59 to the fall of '61.

Mrs. McCartney: Halloween.

FM: Yah, Halloween. We left on Halloween. That's exactly right. The rest of the story, of course, you know. The decision was made to establish the NRO. This was a bitter blow to General Schriever and the staff that he had pulled together for this. So, the space program, or the reconnaissance programs, then were kind of siphoned off of the "Air Force programs." Special Projects was kind of off to the side, then. 4C1000 [the office in the Pentagon where the NRO had its offices] and the staff at Systems Command was really relegated to providing support to the NRO and taking on the new systems that were just beginning to evolve.

I became the project officer for the Titan, Titan III program. And, of course, from that came the Titan III and the Titan IVs, which we launch today. And, we built the facilities here at the Cape in the early '60s. General Blaymaer was the person in charge of that, he and Lang Ayres. That was when we were trying to figure out how to use solids and building big solids, and that's another long story down the side, but it doesn't have anything to do with the Satellite Control Facility. The Satellite Control Facility was becoming locked down. The programs became closed. You know, they went underground. When you used to advertise to get people employment for the 117L—Discoverer, Midas, and Samos—they all became numbers, and they began to go away, and that's when Colonel Haig and his vehicle came into being, and those kinds of things. And, I kind of walk that line between being on that side and on the, I'll call it, the "black" Air Force and "white" Air Force. So, I was in and out of that quite a bit. Gosh, I think it was '62, fall of '62 or so, the Army was in charge of the communication satellite programs. They cancelled the program, and the Air Force assumed responsibility for the communication satellites. I had the Agena. I was project officer, program officer there for the Agena and the Titan. I moved over and picked up the communication satellites and Lincoln Lab. And, from there, I got into the communication satellite business and with it, of course, the transfer of data and all that

comes with that, and did that for several years. So, I was really on the ground floor of all of them and was the prime person at the action-officer level in Washington for all the communication satellite programs.

I went away to Armed Forces Staff College down at Norfolk, thought I was going to go back to Sunnyvale to run, to be the lead for the MOL. The MOL was cancelled. And, I wound up at the Pentagon, thought I was going to be able to go up to the CIA from there, since I was in other classified programs by then. I always wanted to come back to the Cape, and I got a job at the Cape. I ran range engineering here for a while. So, I came down here to the Cape for a couple or three years, then went out to L.A. to work for General Kenneth Shultz. Shortly after I got there, he put me over in the communication satellite area, which is where I should have been. I then had the AFSATCOM program, the FLTSATCOM program, DSCS II, DSCS III, and had all the communication satellite programs when I made my first star.

They wanted to send me up to the special weapons business again. General Alton Slay didn't like that. Lew Allen was a close friend. He was Chief of Staff at the time, and he was the guy that was going to get me up to Germantown, because they were looking for some people to assign to the Department of Energy. And, while he was on leave, General Slay got that turned around, sent me over to Norton. I was the deputy, then the commander, of the ballistic missile organization developing the MX and, then, General Marsh sent me over to be the vice commander for about a year, a little less than a year, at Space Division to General R. C. Henry. General Henry was the first person to be, he was dual-hatted, he was the vice commander of Space Command and the commander of Space Division. General Henry left, retired in about a year, a little less than a year. I assumed the commander's position at Space Division and assumed the position of vice commander, was the second person to be the vice commander of Space

Command. General Herres had come in, General Hartinger was there, then General Herres came on board. I told General Herres he needed a full-time vice commander. He agreed. We transitioned.

General Henry had set the switches to transition the launch sites and the Satellite Control Facility over to Space Command. Of course, Falcon [now Schriever AFB] had been built, as I mentioned to you the other day, I completed building of Falcon. As a matter of fact, that's not true. We completed the construction of it, but not the equipping of it. General Hartinger and I went out in, I was the vice commander, in May of, gosh, I guess it was '83 and turned the first shovel of dirt to break the ground out there to build Falcon. So, that was to be built for them. Of course, Falcon's original mission was to be the backup to Houston for when we were all going to go ride, we were going to do away with the expendables and everything would be handled off the Shuttle. I remained commander of Space Division. After Challenger, I only had about a year to go before mandatory retirement—thirty-five years. They wanted to replace the person down here running Kennedy, as they did here, Huntsville, and Johnson. The Air Force allowed me to come down here, much to the chagrin of General Larry Welch, but Pete Aldridge was Secretary of the Air Force by then, and Pete and I were very close friends. So, I came down here and ran Kennedy after Challenger for a little over a year, well, about a year, as an active-duty officer. Mandatory retirement came about. I retired and stayed about four more years commander of, I mean, as center director. I left NASA, consulted for a couple of years, not doing anything but hardware. I don't do proposals. I don't do "red teams." But, looking at hardware that had failed, trying to determine if it was ready to fly or not, and flight worthiness, and then went to work for Lockheed Martin. I really hadn't intended to go to work for them, and completed six years with them, and that's the career.

DA: That's great, Sir. You've been talking for a good forty-five or fifty minutes. If you need to take a break, please let me know.

FM: No, I don't think so. If I look down through here, I think that I have covered a great degree of what you put down.

DA: You sure did, General. It's been wonderful. I'd like to just fill in with a few more questions, if I can.

FM: Yah, I think that would probably be the most useful thing is to let you ask me questions and, then, maybe get me going down some path.

DA: O.K. What I'd like to do is go back a little bit to the time when you were on console with the Lockheed guys.

FM: Yah.

DA: What was the arrangement like? Were you the director of the pass, or was there a Lockheed guys who was in charge?

FM: What we always did, we had a guy who was primary and, then, we had a guy who was his backup. At first, we were backup to the Lockheed people. Lewin, myself, and Al Crews. Well, you know, it didn't take long for them to figure out that we were a little bit sharper than some of the Lockheed people, frankly. So, we kind of shifted over into becoming primary for the pass, and we would trade off on it. When we kind of shifted over and became primary and they understood that we could handle that and do it as well as they could and in some cases, I think, better but that's pretty biased thinking, we got to where we would do it as military, you know, they would have it and we would have it, but, you know, I was primary sometimes and Mel Lewin was backup, vice versa, same thing with Al Crews. So, it was kind of a mix, but I'd say, as I recall, we all started out as I'll call it backups to the Lockheed people, but we displayed we had

the capability of doing it, and they let us do it. There was some concern on Lockheed's part, like I say, it was easy to trip up and make a mistake, and there was some concern on Lockheed's part, and I think probably on the program office's down in L.A., but I couldn't be that for sure, that if we goofed something up by making a mistake and they lost a bird what the implications of that would be, but we never did that.

DA: Some concern about who to place the blame on when they lost it?

FM: Yah, yah, because you know you're out there on the end of the pole, you're making the call, you don't have opportunities to get that second bite of the apple. So, it was a pressure cooker thing, because in those early days that equipment was not very good to you. You never knew what the problems were going to be. You never knew when you were going to lose lock, and you really had to think ahead, and you had to be able to think on your feet. That was the real crux of it, was being able to assess the situation, understand what was going on, think on your feet, figure out what to do, and do it. And, you didn't have time for other people to do any real prompting of you. Now, as the vehicles more sophisticated, they began to then put the Lockheed orbital programmer and deprogrammer, which was known as, I guess, the deprogrammer and programmer, which was known as the LODAP—Lockheed Orbital Deprogrammer and Programmer—and it had sixty-four rows of sixty-four bits. And, we could, so the system was such that we could begin to do on-orbit programming and targeting. The early systems, they figured out before they launched, when they put the tape together, what the targets would be and, then, they cut the tape, which was a very crude device, a mylar tape, I think it had thirteen channels on it and there were thirteen fingers that rode on top of this mylar tape, and there were just holes in the tape, rectangular holes, and depending upon how long the hole was, when the contact went into the hole it would ground out, pull a relay in, and do the function. You could

turn the receivers on or off, or whatever it was, camera on and off, or the reset monitor, or whatever it was. But, there were errors on that tape, by the way, you had to take into account in trying to figure out what the situation was. So, it was a pretty complex thing, but all that was, flew canned missions, and there was nothing you could do except to try to synch that timer up and get that tape synched to perform the way you wanted it. After they came in with the LODAP—sixty-four rows of sixty-four bits—and you could sequentially read that out, what it would do is you had the ones and the zeroes for the various functions, and then you had the time, and then you had an on-board timer, and when the on-board timer matched up with the time, it would empty that register out and would do whatever commands you had put into it.

So, then we began to be able to do on-orbit programming and that, of course, required more sophisticated computers on the ground, and we traded in or got the first CDC-1604 computer. They had 1103-AFs up at Menlo Park, and we had the first CDC-1604s that were ever built in the Satellite Control Facility. Now, that was the first high-speed, real-time digital computer and high-speed, depending upon at the time very high speed, you know, it was very archaic. But, there were two competitors for that. There was CDC, which was a brand-new company. It spun off from people who used to have, that used to worked for Rem-Rand and got disenchanted with it, and the other one was the Philco S-2000, which was a big competition. And, the Philco S-2000 lost out to the 1604, and that's how CDC got started. But, I think, the point I'm trying to make in a round-about way is that once you got to where you could program this stuff, it was a whole lot more planning, of course the whole mission was planned out in the beginning for the entire life on the mission, and you could plan days ahead, so the need to do fast-time calculations and decision making on the console was no longer needed. You did a lot of that before the pass.

DA: You said you thought that the three of you, the four of you, blue-suit operators were better than the Lockheed guys.

FM: We thought so.

DA: Why did you think that?

FM: We thought we could fool them, you know, on the rehearsals. We just thought we could, we were sharper than they were. It was probably pretty cocky too, you know, but we were good. I just want to tell you we were good. We knew what we were doing, and we could do it well. We could execute well and, of course, we kind of set our hat to be better than they were. So, there was a competition there. I call it friendly competition, but we were dead serious of making sure that we would be better than they were. And, what is better is meaning that you can handle the passes smoother. You had better command, knew what the equipment was doing and not doing. You knew the capabilities of the crews. We used to practice endless hours with the crews at the stations, and we could work problems faster.

DA: You didn't think it had to do with education or with blue-suiters being better than civilians?

FM: No, all of us were educated. We were all engineers with comparable degrees, but I don't think education was the, it's kind of like flight controllers. There was a lot of similarities there, although we never tried to draw that correlation, but you know, those guys' education is good but it's a knack to being able to do it. And, the knack was to be able to think fast and think like that hardware would think and keep your cool and, you know, figure out what you need to do and do it under a pressure condition. And, while everybody had to have a good education and understanding, it's really how well you react.

[END TAPE 1, SIDE 2]

[BEGIN TAPE 2, SIDE 1]

DA: Let's talk a little about the tracking stations. Your experience with them is, obviously, vast from the perspective of you needed them to do what you were doing. Were there tracking stations that you preferred to use over ones that you didn't?

FM: Yah, a few were. We had "Annette," which was up on Ketchikan, right across from Ketchikan. We had "Kodi." We had "Hula"—Honolulu. We had Vandenberg, and that was it. We took station, or the Discoverer program office took the station from, they were building up in New Boston tracking station, they were building, that was to be a big Midas station. They took the equipment out of, that was in trailers, out of "Annette" and took it to New Boston. There was a guy up there named Nick Polio, Colonel Polio, used to call him up everyday and get my "Polio booster." But, so those were the stations. I always preferred "Hula" as the number one, closely it and "Kodi" were the two best stations, and that's where you wanted it, right there, because on rev one they could hand off, and I've forgotten that a guy named Moleski was the station manager for "Hula." It belonged to Lockheed. At the time, the Kodiak station belonged to Philco-Ford.

I thought the poorest station in the whole crowd was Vandenberg—"Cook." And uh, I never really felt comfortable. They were not flexible, and you could never tell, I never had confidence that they would be able to act swiftly. And, sometimes, when you got into a situation, you know, you didn't have time to give them much opportunity to set up. They'd be set up, and you'd start peeling off commands, what you wanted sent, and then after the capsule was separated from the vehicle, we would continue to use the vehicle after it, as long as it had any power in it, which later on, after solar cells, it did, as a trainer until it came back in. So, you would see how many commands you could send accurately from the stations, and you would test the stations to see how well they could respond, and I'd say to you that "Hula" I always thought was number

one. I thought that it was a toss-up between "Hula" and "Kodi," and I felt Vandenberg was probably the poorest of them.

DA: Was flying a satellite like flying an airplane?

FM: Yah, to a great degree. I mean, you know, you have to understand predictably what it's going to do, but it's thinking ahead, being ahead of it. See, that was the whole thing is to stay ahead. I talk about management like you play racket ball. If you ever play racket ball much, you know that if you get in there when you first start to play, you start chasing that ball around, and you never catch it, and you're never in good shape. If you get a good shot, it's by accident. But, sooner or later you say, you know, "Why am I chasing this ball? Why don't I think ahead and go position myself and let the ball come to me?" And, that's thinking ahead, and thinking ahead and staying out of trouble, and that's what we were good at, the Air Force people—Crews and Lewin and myself—were good at was being able to think ahead and stay out of trouble before we got into trouble. So, I think, that's the major thing you have to do on any fast-moving thing, whether it's an airplane or not. You know, the mechanics of doing it are pretty easy.

DA: What about checklists and that sort of thing that you would associate with flying an airplane?

FM: Yah, we made our own checklists, and we would go through a checklist, big time when you would set up the console, you would check what you had. They weren't formal checklists, but those are the things that, like I said, Lewin was extremely good at was putting a lot of data on a single piece of paper. He was great at checklists and what you needed, and your crib notes and, you know, when you had time you would check yourself, but that was the responsibility of the guy helping you through with the pass was to double-check you, and if you had confidence that he was just as good as you were, then he wasn't going to let you go wrong, because he was your

backup and your real-time check. But, checklists with the stations, yah, you would go through and run checklists. They were pretty primitive, but you wanted to make sure that they had the tape, it was loaded, status of the equipment. Quite frequently, you'd do a, the clocks were not as accurate as they could be, so you did a system time check in which you synched the whole net up to the time, and we always synched it up to the time there at STC, so, and of course its call sign was "Stick." And uh, so, yah, you had a checklist, and we ran checklists, but they were not really that formal of a checklist. They were more the things that we learned and gleaned from each other, us and Lockheed people, as the tools of how to get the pass organized and get out in front of it.

DA: It sounds like some things have changed, but the big picture really hasn't.

FM: Nah, you know, some things never change. You want to get all the equipment up and running that you need, all the tools you need to do it. You have to know what you want to do. And, we didn't have, like I say, these were low-orbital passes, so they whistled by pretty fast. No faster than the low orbits do now, but we didn't, it was just unbelievable for us to think that Tiros, you could sit there all day and look at it. So, we never got involved in any of that. Midas was, the real Midas shots started after I left, but they were longer dwell times. They were, I think, they were at 10,000 miles roughly and, then, of course, you know, you got out to the synchronous, equatorial machinery that we have now.

DA: That's what I used to fly. They were very easy to take care of.

FM: Relatively speaking, they're different.

DA: Yah, I mean, you can impress people with the stories of a bus spinning at 22,000 miles, but really it's easy to keep your eye on a spinning bus at 22,000 miles. It's not so easy to do it at 200 miles.

FM: No, it sure isn't. One thing that you can do now, when I was running Space Division it never ceased to amaze me, is how the DMSP folks could, you know, do patches and that sort of thing and, I call it, resurrect failing hardware. In those days we, of course, did not have redundancy in the beginning, that you could switch in and out, and you just didn't have any opportunities for flexibility. It either worked or it didn't. And, boy did we, all you gotta to do is go back and look at the Discoverer shots. Man, did we pump those things up. Whew! If a failure, no problem. They'd launch the next week. It was something to behold, and failures were tolerated in those days.

That's a very important point. Failures were tolerated in those days. Failures today are not tolerated. You could not take a program today and, you know, have twelve successive failures until you had a success. It just wouldn't, Congress wouldn't let it, couldn't afford to let it go on. So, it was a different premium on success but, hey, folks were kind of stumbling around. They'd never done this before. As my daddy would say, "This time once more will make twice we did that." And uh, we would, a lot of firsts, but the one thing that we did, and I guess, I didn't really realize it, today we talk about lessons learned and they formalized a lot of that after then, but we were very sensitive to lessons learned, but we didn't call it lessons learned. We just called it experience. But, that's one thing we were doing was trying to go to school on each day, each thing we did, those things that would work, those things that worked well, and those things that didn't work so well.

DA: Fast forwarding to your days at Space Division, what kinds of discussions were there about the Satellite Control Facility?

FM: Well, the decision had been made to move the Satellite Control Facility over to, as were the launch bases, launch bases were cut over to Space Command early on. General Henry had made

those decisions. I did not have a part of it. I didn't think it was the right thing to do, and neither did the NRO. The, uh, let's see how I can say this without being too critical of Space Command, General Hartinger's background, god bless him and rest his soul, was one of flying in operational outfits. I do not believe that either the launch business, and I don't know about the on-orbit business right now, I guess it's a little bit more orderly, but I don't think that all of things that you did for airplanes and the way you handle this, the train people, the way you rotate people, and all of this, I don't think that's necessarily the optimum for space operations. And uh, space operations, as you know, are very expensive, very important, can do things that you can't do otherwise. So, they are essential to the Air Force and the armed forces, but I was not in favor of, I didn't know what was broken that we were fixing. And, I could never understand that, even as long as I was in the Air Force, to the day that I retired. I never knew what we fixed when we moved this over.

Now, people will argue that you got the product, be it reconnaissance, or weather, or communications, or whatever it is, you got that out to the what's called now the war fighting forces. I always called them the troops. But, I maintain that that was because of leadership deficiencies that they didn't get out there before. I don't think any one organization can do anything, organizations don't make things work. People make things work. We, in fact, were no smarter or dumber than, generally, than Lockheed in the Discoverer days. Today, now, you know, I'm in the launch business today, and it comes up all the questions of should you have blue-suiters do it or not. It's not a question of whether or not blue-suiters are "smart enough" to do it. I think the smartest, most aggressive, best motivated people are blue suiters. I believed it when I was in the Air Force and believe it now, and wish I was still in the Air Force. So, it's not a question of are they capable of doing the job. The question is whether that is the best use of the

resource. And, I don't have enough insight into it to know whether or not the satellite, the activities at Schriever and whatever is left at Sunnyvale, whether it could be more efficiently or less efficiently done by military versus contractor. But, all of those decisions were made. It was a matter of chopping it over and, of course, the NRO was against that all along. And, the NRO was rapidly becoming, you know, the Defense Mapping Agency, the NSA, and the CIA. But, hey, those are decisions where you've got only so many blue-suiters. How are you going to use them? You sure as hell can't use contractors to man those missile fields, those ICBM fields. We both know that. But, you can use them to do much of the stuff that, I guess, is done by blue-suiters now. You could use contractors if the Air Force thought that was in their best interest. So, I think the decision is not one of who can do the best job. It's how do you want to use the limited resources that you have as blue-suiters.

And, I didn't see anything broken in the way we were supporting the on-orbital operations the way we were doing it. But, General Welch thought that was the big thing to do. So, General Henry had a big part of persuading that, and the Air Force wanted to "make space operational," whatever that meant, I could never figure out what that meant. But, I can't figure it out now. But, the decision to move the Satellite Control Facility was one that was political as far as I was concerned.

DA: You certainly can't use contractors to operate ICBMs. You'd want an Air Force officer in charge of those weapons.

FM: Exactly!

DA: But, on the other hand, you could use contractors to do other sorts of things that are operational that don't need an officer in charge, like flying satellites or flying antennas for that matter.

FM: Yah, you're absolutely right. You're absolutely right. We did it for years with contractors. Now, you know, is it better to have blue-suiters? That has to be for reasons other than "just getting the job done." There have to be other reasons. I guess that's a good way of saying it.

DA: What sorts of reasons, General, do you think they would be?

FM: Oh, experience. Uh, roles and missions of the Air Force. Uh, see, one thing that's wrong with Systems Command, Space Command today is, as we kind of talked before, they just don't leave their people in place for a long time. And, as a result, you get a transient force. Does that mean that they're not as smart as they used to be? No, it's just that on complex things, and in space business almost every part of it is complex, experience weighs out. There's no way to "quick time" that experience. So, the bottom line to it is that I disagree with the policy of the Air Force that rotates their personnel through the jobs as rapidly as they do, because about the time you get someone trained or someone who really is becoming proficient in what they're doing, hey, it's time for them to move. And, lessons learned, the space business is not forgiving, particularly on the launch side. On the on-orbit side, maybe a little bit more with the way those computers will put things to sleep and, then, you can wake 'em up again, but this is not a forgiving business. And, you get one bite at the apple, and in situations of complex, dynamic situations, there's just no substitute for experience. And, you don't get experience overnight. So, I think that it just do the corps very much good.

DA: So, you think, going back to your days at the Satellite Control Facility, at the "STC," was there any conscious feeling one way or another on your part or on the parts of the people around you about moving satellite operations to blue-suiters?

FM: No, we just always thought it would happen, taken for granted. We just believed that would happen. I mean, it was just a question of time.

DA: Before blue-suiters came in and were doing everything?

FM: Yah, there was no question in my mind. I never questioned but what sooner or later it would transition to blue-suiters.

DA: Was there any discussion about whether it would be good for the Air Force?

FM: No, no.

DA: How did the Lockheed folks feel about it?

FM: Oh, it was, they wanted the job forever. I mean, you know, it was, on their part, it was clearly a moneymaker for them. But, to be fair with you, we were moving things so fast, that never really entered my mind. I never really worried about or took time to think about what motivated them along those lines. The philosophical things that I've spoken to here are things that are subsequent to then when you really think about roles and missions and what should you do with the limited resources that the Air Force has and how best to use them to get, you know, the biggest bang per buck out of them. In those days, resources, limited resources were, I never worried about them, you know. I had my pencil and my paper, and we were scrounging around books.

Now, when I went to Washington and you started trying to get funds, it became more of a fight as to how to get funds, and this was during the, oh, during the times when we were getting ready to get involved pretty heavy over in Vietnam, pretty big drain on things then. So, I guess, later on I began to, I appreciated the lack of resources and the implication of resources a whole lot more, but gosh, in the early days it was, resources were not that big of a factor to me. I think, today, that resources, you know, I have used this term many times in talking to management or talking to the folks who used to work for me, you know, if you're not violating the laws of physics, you can do anything with enough resources. You can go to the moon in ten years. This

country did that. The challenge is trying to get the job done on limited resources. That's the challenge of the Air Force today.

DA: Well, thank you, General McCartney, you've given me a real sense of what it was like to be there in the beginning, and I appreciate it very much.

[END INTERVIEW]