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Telephone Interview  
of  
Col. Thomas O. Haig

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That I, Thomas O. Haig

have on (date) 16 OCT 2000, participated in an

oral-magnetic-taped interview with Major David Arnold

covering my best recollections of events and experiences which may be of historical significance to the United States Air Force.

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David C. Arnold DATED 4 July 01

DAVID C. ARNOLD, Maj, USAF

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TELEPHONE INTERVIEW

COLONEL THOMAS O. HAIG (USAF, RET)  
INTERVIEWED BY  
CAPTAIN DAVID ARNOLD (USAF)

16 OCTOBER 2000

DA: Can you tell a little bit about World War II and how you got into meteorology?

TH: Well, I was a student at Case School of Applied Science in Cleveland, and Pearl Harbor came along, and in a burst of patriotic enthusiasm, I, with a bunch of other guys, went down and enlisted. We signed up as aviation cadets, expecting to go to pilot training. Then, I was in the first semester of my junior year, orders came, but, well, I had had a couple of physicals in between, and my eyes didn't pass the test. So, when the orders came, they sent me to, well, first of all down to Boca Raton, where we went through basic training down there, and then out to the West Coast to UCLA for meteorology training. And so, they called us meteorology cadets, believe it or not. And, after a school year there, in the spring, we graduated and were commissioned, and that's how I got into meteorology.

DA: What were you studying at Case as an undergraduate?

TH: Mechanical engineering.

DA: Not exactly related, but it certainly helped.

TH: Yah, it was OK. From there, they asked for volunteers. Well, my assignment was down in Texas, and I didn't want to go there, so I volunteered for "instrument training," they called it, and went to Spring Lakes, New Jersey. It was Signal Corps then, you know. There wasn't any Air Force.

DA: Right.

TH: We went through the training course there for weather equipment, learned how to repair all of the primitive stuff that existed then, and uh, then they wanted volunteers, well, I guess I was selected then to go into kind of a research program to do "sferics"—S-F-E-R-I-C-S—an abbreviation for "atmospherics" where we used some radio direction finders built by Sir Watson Watt in England, and we set up one station in New Jersey, one in Florida, and I got to go to the one in Bermuda.

DA: Ohhhh!

TH: Yes, tough duty. We were trying to do radio direction finding on lightning flashes in order to locate storms in inaccessible areas. It worked fine for the British, because their stations were very close together—Wales, Scotland, and Ireland. Ours, being so far apart, did not function well, because we didn't see the same lightning flashes. But, it took us a long time to figure that out. I wrote a report about it while I was in Bermuda, which got everybody upset, because I tried to show them why it didn't work and wouldn't work. And, I was recalled and assigned to another little group and sent out to Saipan, where we set up a network out in the Pacific, originally Saipan, Philippines, and Peleliu, and then the Philippine one moved up to Iwo when that was secured. And, again, the stations were so far apart that the location capability was very poor. So, we didn't do an awful lot to help things. Flew a little bit of weather "recce" with B-29s, then, and sweated out the end of the war and came home.

DA: Was it demobilization for you, as well, when you came home, or back to school?

TH: I demobilized, you bet I did. Got married. Then went back to Cleveland, essentially to go to school. Well I started out as being the distributor for a power unit for bicycles, as a way of making money. And, we would have come out of it really very well off, except that Briggs and Stratton went on strike and stayed on strike for three years. So, the company making the power

unit went bankrupt, and I lost that business and started back doing engineering as a consultant, well, it wasn't consulting. Carl Mayer Corporation, it was industrial ovens and conveyer systems, and I became their sort of chief engineer, although I didn't have a degree. The chief engineer died, that's how come I got the job. But then, I got a letter from the Air Corps saying, "If you come back on active duty, we will put you in the second class at Cal Tech, four of you, and keep you there until you get a Ph.D. in physics—meteorology." That seemed like the only chance I'd ever get to have a Ph.D. So, we signed up. Orders didn't come, and didn't come, and didn't come. When they finally came, instead of going to Cal Tech, I was sent to the 2060<sup>th</sup> Mobile Weather Squadron down at Tinker Field as a supply officer. They had cancelled the second class of Ph.D. candidates out at Cal Tech. I wrote letters of protest to everybody, including the President, and got answers back saying "Tough luck. You signed up. You belong to the Army, and there is no recourse." So, I kept on writing letters. Eventually, I did get back to school, but it took thirteen years or so.

DA: Oh, wow!

TH: So anyway, while I was out there at Tinker Field, an old friend, Paul Worthman, who was then involved in research at the Air Force Cambridge Research Facility [AFCRL] that was headed up by Fritz Oder, heard I was there. I'd met Paul before during the war, and he knew a little bit about me. So, he sent a telegram down recalling me from [Oklahoma] and sending me up to Cambridge Research Center, where I, with another guy, Joe Bogart, developed instruments to measure the "after-wind" after the atomic blasts on the Greenhouse Project out on Eniwetok. We made pretty fancy anemometers. Mine had to withstand thirty-five atmospheres overpressure and still measure winds down to five knots. We did that with a great big solid block of chromium-plated brass with statham air pressure sensitive strain gauges inside, and had a lot of fun

calibrating that and figuring out how to read the results, and so forth, took them over to Eniwetok and sat through three of the blasts over there, and proved that there was no such things as the "after-wind," and then came back, I got another telegram out there "Come back. A high-priority program awaits you." When I got back from that one, let's see, I was, then given a program to measure atmospheric visibility jointly with Air Navigation Development Board, later the FAA.

No, I guess that isn't true. I came back to run MOBY DICK. MOBY DICK was the balloon program where we developed the big plastic balloons. Yah, that was what I was hauled back for.

DA: About what year was that, Sir?

TH: Uhhhhh, let me see, well, it was right at the end of Greenhouse. That would have been about 1952.

DA: O.K.

TH: We ended up flying about 780 of those balloons from three West Coast sites. We tracked them across the continent. The cover story, of course, was that we were measuring upper-level winds, and we actually did that very well also, and learned a lot about upper-level winds, which we really didn't know. At that time, the jet stream had really been discovered during the war when B-29s couldn't buck the high wind to get over [Japan]. So, we did get some good data, but we also developed the package and the balloons that were used for GENETRIX. We also started the whole UFO craze. Our balloons floated up anywhere from 45,000 to 75,000 feet; at twilight the balloon is a bright light up there because it is still illuminated by the sun while it's dark on the ground, and people with various forms of astigmatism saw whatever they wanted to see, and they didn't really see the balloons as balloons. So, we could track our balloons pretty much by radio and TV reports of UFOs, too. We tried very hard to explain to people, interviewed on TV and

radio and everything trying to explain what the balloons were, but when people want to believe there are UFOs, they will.

Anyway, after MOBY DICK, they sent me to the University of Illinois, where I got a B.S. in Electrical Engineering and graduated with high honors from there in 1955. Then, I was back up at the AFCRL, where I did that Air Navigation Development Board program (it was a joint Army, Navy, Air Force and Weather Bureau program under the ANDB) to develop a means of measuring and informing pilots of the height at which they should see the approach lights as they're coming in for landing in bad weather. We developed a pretty good program. It told them the eighty-five percent level and the twenty-percent probability level of seeing the lights. When they got down to the eighty-five percent probability level, if they hadn't seen the lights, they were supposed to go around again. The airline pilots liked the system, and they were about to implement this nationwide when a new generation of landing aides came out and made my little program obsolete. So, they went back to mechanical landings, which they're still using.

But then, right after that, I went off to Command and Staff School. And, then, after that, I was requested for the Missile and Space Division out on the West Coast, again by Paul Worthman, who was out there then as the deputy director of what they called "System A"—the CORONA Program. He was there for awhile, then he moved back to Washington and was sort of the office manager up there for the NRO [National Reconnaissance Office] in 4C1000. So, I went out there [to California] not knowing anything about what was going on, but was put into the ground station, what they called "Subsystem H." We worked on CORONA, MIDAS, and SAMOS ground stations and the control center. The second week I was there, I went up for a familiarization trip to the control center in Sunnyvale, and I was appalled by what I saw there. Lockheed had a subcontractor—Fenski, Federick, and Miller—who was supposed to be installing

at that time a projection system, which would allow the operators to see things in 3D. They had to wear these polarized glasses and, with those, you were supposed to be able to see 3D on the screens. The 3D images were made by projecting through two slide projectors, which were supposed to be in exact registry, and the flight of the launched missile would be etched on the surface of a glass plate with a little stylus coming across the plate, which had been smoked so that it was opaque. As the stylus went through, it cut off the smoke and, the trace of one of them is up there in one polarization and the other is up in the opposite one, and when you superimpose them, you should see them in 3D. The guy had been trying to install them. I talked to the technician at some length, and he thought the system would never function. From a mechanical engineer's point of view, it was a monstrosity and would never work, and so, besides that, I knew enough about pattern recognition and that kind of stuff to know that 3D—the third dimension—carries only about two percent of the information that X and Y does to the brain, and so it would be a useless display for decision making. You couldn't trust it. So, I went back and wrote a memo instructing Lockheed to cancel the subcontract and recover all funds and remove the equipment, and got it approved, and that's the way they knew I had arrived up there.

DA: When you came, you cancelled the contract?

TH: Well, it saved the government about a hundred, well, I don't know, some millions of dollars anyway, maybe, several hundred thousand to maybe a couple million, because they were, well they simplified the whole control center a great deal and made it functional then, instead of a fancy, elaborate place. They made it fancy enough, God knows, but at least we took that part out. O.K. That's a long string. Now, where are we?

DA: What I'd really like to know is a little bit more specifically about a few different things.

TH: O.K.



DA: First of all, Sir, when did you arrive in Los Angeles?

TH: It was about 1959.

DA: So, the CORONA program was well into development by then?

TH: CORONA was, yah, it was into development, and the ground stations were pretty well located. We went over and tried to site one for MIDAS over in Scotland. We went around and investigated half a dozen of the old fighter strips left over from World War II. And we didn't ever get a station over there. They decided not to put one in there, but we had a marvelous time going around partying at every one of these old fighter strips that we looked at. No, the problem that we were dealing with, at the time I got there, was the fact that the contractor had been running essentially open loop on ground stations. The fellow that was in charge was Gene Allison, who was a fighter pilot, not an engineer, [and] didn't understand anything about the tracking stations. He understood about contracting, I guess, but there was nobody riding herd on either Philco or Lockheed. So, what I guess I helped to do was to establish a more reasonable relationship between the government and the contractors. I tried to establish opposite sides of a contract where we could maintain some kind of oversight and a little bit of fiscal control. The original contracts with Lockheed and Philco were cost-plus, not fixed fee but a percentage fee, so there was no incentive at all for either contractor to be economical. The incentive was entirely on the opposite foot, the more you spend the more you make, and they're miserable kinds of contracts. STL [Space Technology Laboratories], or Ramo-Wooldridge, had not yet moved into the ground station area. They had had enough trouble stuffing Ramo-Wooldridge down Lockheed's throat on the space vehicle itself, on the Agena. And, I'm not sure exactly when it was imposed on Philco-Ford either. I remember Colonel Harry Evans came around to our group with a guy by the name of Miller from Ramo-Wooldridge, I don't think it was called STL yet, but it might have

been, anyway he came around and said "OK, now, I want you to write the contract to put Ramo-Wooldridge on contract for SE&TD [System Engineering and Technical Direction] on all of the ground stations and the control center." I said, "Sir, I'm sorry, but we cannot do that until that part of the work is terminated on the Lockheed and Philco contracts." He said, "What do you mean you can't do it. I just told you to do it." So, we had a little bit of an argument, which embarrassed him, but you can't write the same work statement to two contractors simultaneously. Sorry about that, that's illegal. So, it took awhile longer, and, as a matter of fact it was after I left that ground station area that they finally did put STL in an SE&TD role there. They were not needed. It was totally unnecessary, but it was done anyway.

DA: Did that have more to do with trying to get STL involved in all aspects of the CORONA program?

TH: Yah, it had to do with politics more than anything else. STL had moved into a position of considerable political influence at the upper levels. They were great politickers, and they promoted the organization that way rather than by technical excellence. Those guys were, they came later onto the field, and so they were hiring the people, a large number of whom had been laid off or were either washouts or had quit at Lockheed or Philco-Ford, and a couple of Air Force people who had either washed out or retired. The quality of the people at STL was not impressive, except for a few people. There were a few smart people, but they hired rapidly to build up the size of the organization, knowing that in a bureaucracy the power comes with numbers, and so that was how they progressed.

DA: Sir, you've already mentioned the problems in Sunnyvale, and you've mentioned a little bit about STL and the relationship there. Were there any other challenges that you faced with the tracking station system when you arrived?

TH: Well, there were the usual kinds of problems. There were mechanical problems with the [antennas]; see these were three-axis mounts, and they had big dishes on them. They were big 70-foot diameter reflectors, because the transmitters that were expected to be flown were all analog and the signals were all analog, even for command and control, and the powers available from the satellite were not going to be very great, so, they had great big antennas on the ground. But, pointing an antenna with some accuracy and stability in high winds is not a simple thing to do. The dishes tend to vibrate, oscillate in winds, especially the ones that had been furnished by Lockheed. The ones furnished by Philco-Ford were built like battleships. I mean, they were. The pedestal for those was made out of inch-and-a-quarter-thick boiler plate and, I'm not kidding you, the total weight of one of those pedestals for a Philco-Ford antenna was enormous. I don't know what it was. But, it was a major job installing and outfitting them. They only built two or three antennas like that, as I remember, because they were just so expensive and so ponderous, so huge. They could just barely move the antenna at a rate that would let it track a low-orbit satellite, you know, a CORONA. It was just a great mass to move, and then, if you had to stop it, there was a big screeching of motors and grinding of gears, and all this stuff. They were learning. Nobody really knew how to build those things, so they were just figuring it out and learning as they went along. So, there was a lot of rework and a lot of arguments about those antennas and putting them up. Technology was progressing all the time, until it became pretty evident that it was possible to get a stronger signal, therefore the dishes could actually be made lighter, when they actually went to the TLM-18, the one that Lockheed put up, almost entirely. We went out to Kaena Point in Hawaii and oversaw the installation out there, got that going. They were pretty good technical installations when they finally got them done, expensive though, very expensive.

DA: On the order of how much, would you guess?

TH: Oh golly, I don't remember the numbers anymore at all, but they were, I just remember they were not cheap. One of the reasons they were not cheap was that they had to be reworked so many times. You asked if some of this stuff was left over from World War II. Some of the base structures for the TLM-18s, the ones that were supplied by Lockheed, were, as I remember, reworked stuff from some of the really old radar antennas. But, they had to rework them quite a bit in order to make them three-axis trackers.

(END TAPE 1, SIDE 1)

(BEGIN TAPE 1, SIDE 2)

DA: Did you notice in your travels, Sir, or in your work in Los Angeles, any kind of friction between Lockheed and Philco?

TH: Oh, sure. They were, Philco-Ford wanted to increase the size of their effort and, of course, Lockheed was resisting this. So, there was bickering and contesting that went on rather continuously. At these monthly sessions where everybody, all the contractors' representatives and the program people all got together and they went, supposedly, over all of the aspects of the programs for the last month, and everybody lied like crazy

DA: Was this the Schriever "Black Monday" sessions?

TH: Schriever had started these. Ozzie Ritland was in charge when I got there. Schriever had moved back to Baltimore, I guess, or to Washington. But, he was still a presence, Schriever was all the time, but Ozzie Ritland was the poor guy who had to try to make peace and hold things together during these Black Mondays. Well, I had so little at stake that they were kind of humorous. I had a lot of fun sitting there and saying my little bit when the time came around to talk about ground stations or the control center. I guess my major contribution while I was there was to try to control Lockheed and keep the control center of reasonable proportions and, also, to

try to get their horrible computer mess straightened out. At that time, very few people had any idea how to track a satellite. They didn't. The whole mathematical model for an ephemeris was a matter of great mystery. I remember the newspapers said the Russians were years ahead of us in the technology of tracking satellites, and I think they were. There was, I can't remember his name now, a fellow at Lockheed who had developed the most monstrous pile of punched cards, which was what software was all on then, for doing tracking, developing an ephemeris and then pointing an antenna, and he had patched and repaired, and patched and repaired that software so many times that the total number of cards that had to be run through the machine to run the program was probably four or five times the number that was actually needed. The rest of them were all patches and repairs, but if you didn't run them all, the program didn't work, and it was a monstrosity. He was literally the only one that could really make it work, and that they could track satellites, and this was the only resource there was for giving pointing directions to antennas and developing an ephemeris and so forth. It seems ludicrous now that that was true, but it certainly was. He resigned from Lockheed and, of course, Lockheed then had no way to track a satellite. This was before the first CORONA flight. So, there was panic. And so, he came around again. They went after him, and they hired him back as a consultant at three or four times what they were paying him before as a Lockheed employee.

DA: Of course.

TH: So, he sat there fat, dumb, and happy, and the only thing he had to do was to load those stupid cards in the proper order and, then, when he was through running the program, he would squirrel the cards away and screw up the order so nobody else could do it, and he had himself a very neat gimmick going there. But, that was, so help me God, that was the basis for the whole operations of the control center and the stations when CORONA started to fly.

DA: That's sort of amazing that one person is responsible for--

TH: Yah, well, that's one of the things they did assign to Ramo-Wooldridge and STL, was "Quick, develop a better tracking program." And, of course, things progressed then to the point where you no longer had to use old punch cards to load a computer; you could now do it by magnetic tape. And so, the technology had gotten better. The size of the computers was a little bit bigger. So, STL did come up with a program, which worked part of the time. I remember when our little program went up, we were dependent upon the ground stations that had been developed there for CORONA, SAMOS, and so forth for our first year of operation.

DA: When you say "our program" you're talking about the weather satellite?

TH: Yah, the little 417—Program 2, Program 35, Program 417; the name changed every year. Well, see CORONA is only up for about three days and, then, it's down. So, the stations would spend three or four weeks getting up to a maximum effort for a launch and, then, they would all shut down and everybody go away. But, we came around, and we were different. Our little satellite came around two or three times a day, you know, at every station, and so they had to keep them manned and keep them operating continuously, which was not the way Lockheed was manned to operate the stations, and we were a gross nuisance to them, and we weren't a Lockheed program, anyway, so the company had no interest in us. And so, the support we got from the stations was terrible. They only hit about half of the passes when our satellites would come around, so they missed an awful lot of readout, and we were never sure whether commands had actually gotten to the satellite until long afterwards when Lockheed would kind of reluctantly send a little message on teletype "Yah, we got it" or "No, we didn't." And so, I was constantly up there [in Sunnyvale] beating on people. Lt Col "Moose" Mathison was the guy I had to go up and beat on. And, Moose was the military type, and we would jointly go over and talk to the

Lockheed people, and they would look at me like "Who the hell are you?" and "I know who you are, and I don't care, and I'm not going to listen to you anyway." I didn't get much response from them, because they didn't want to be annoyed by our little program and, of course, [the Director of the National Reconnaissance Office] Charyk had issued the order that "Lockheed will support this program, period," but it takes a long time for the import of the order to get down to the people at the stations, and they didn't want to work every day. So, anyway, our support there was bad.

Then, when the second year of operation came around, we were told to extend the program, we went back to Lockheed to get an estimate of the cost for another year of operating support, and they came up with a cost which would have consumed better than three-quarters of my total budget, and I still had to buy boosters and satellites, and so it was impossible. So, that's where we spent two weeks of frantic effort and designed our own ground stations and control center and located equipment, uh, parts of equipment out on the Eastern Test Range, out on Eleuthera, and put together a proposal and went in and got approval to go ahead. For about twenty percent of what Lockheed was going to charge us for one year's operation, we built and equipped the ground stations and the control center for our program. And, we did it all in less than six months. A bunch of guys moved very rapidly.

DA: Did you use a systems engineering contractor?

TH: Absolutely not!

DA: Was that from your experience with the tracking stations in CORONA?

TH: Yah, I knew what a tracking station required, and we had one very smart, young fellow named Lou Ricks in my program office. My program office, then, was four officers and a secretary, the five of us, and we could, therefore, move fast and make decisions, and I didn't

report to anybody but DNRO, the Assistant Secretary of the Air Force. Bob Greer was technically in my line of command, but he was so busy with CORONA that he didn't have an awful lot of time to pay attention to our little program anyway. So, I would normally make up my little charts, jump on the "red eye" and go to Washington once a month, report to DNRO, get instructions, come back and, then, tell General Greer that this is what Dr. Charyk or [Dr Brockway] MacMillan, whichever one it was, had told me, directed me to do, "Did you want to get the briefing?" and he would, about half the time, say "Yah, you better come tell me what's going on." So, I'd go up and give him the same briefing, plus all the instructions I had. He would then get on the telephone back up to Washington and confirm what I had told him. And, that's the way the program ran.

DA: It sounds pretty sleek and efficient compared to CORONA.

TH: Oh, it was the best job I ever had. It was fun. Both Charyk and MacMillan considered my little program as sort of a toy. They used us to tweak Lockheed's tail and to do battle with STL, too. The fact that our program was succeeding extremely well with "blue suiters" on fixed-price contracts without any STL involvement of any kind whatsoever was choked down their throats many times. Ivan Getting considered me the biggest pain in the butt he'd ever had. In his autobiography or whatever it was, that book that he wrote, he claimed that STL ran SE&TD, conceived of the program and supplied SE&TD from the beginning, and that's a flat out lie.

DA: Conceived of the weather satellite?

TH: Yah, that's right. In his autobiography, that's what he put down. I find that a great many things that have been written by the people at STL—Ramo-Wooldridge, STL, Aerospace—are not true. They claim a great deal more credit than they deserve. They actually were, with a few exceptions of some rather nice work by a couple of people, ninety-five percent of what they did



was to delay and procrastinate and get in the way of programs. Well, anyway, some people might disagree with me, but not too many.

DA: At Peterson Air Force Base for your induction into the Space and Missile Pioneers Hall of Fame last month, you said that your faith in "blue suiters" is "unbounded" and that there is nothing that you can do with contractors that you can't do in the Air Force, or that you couldn't do at the time that you were building the weather satellite program. Do you think that's true today?

TH: Oh, absolutely! I think that the Air Force continues to have extremely poor personnel retention policies, as far as people are concerned, the engineers are concerned. There just aren't opportunities for engineers in the Air Force like should be, especially in R&D. I am out of the Air Force now, and have been for quite awhile, so I'm not absolutely sure I know what I'm talking about but, from what people have told me, and I know that Aerospace is still around and MITRE is still around, so they're still doing SE&TD nonsense, and by employing these people, the Air Force damages itself greatly. It robs their own personnel of the opportunity to assume true responsibility and authority in engineering situations—situations where an engineer is required—and keeps them from doing good, original, responsible work. Instead, it makes paper pushers and totally bored out of their skull managers, which is not what an engineer should do for at least the first twenty-five years of his useful life. He should be doing some engineering. I agree with [retired Colonel] Ed[ward N.] Hall completely when he said that the whole Ramo-Wooldridge concept—SE&TD assignment outside of the direct line between the producer and the government—is an abomination. It is, well, first of all, I still think it is illegal, but it has never been satisfactorily challenged in court. And, I think that it has been highly detrimental to the Air Force over a period of time, far more than it has been a benefit. There is no reason why you can't

write a contract with a contractor for the technical direction part of a program, as well as the production part, within his own company and use your own engineers, then, as participants in this program and as people who do their engineering and direct the contractor properly. I'm completely convinced that the "blue suiters" that I have met are at least the equal to anybody I ever met in STL, Aerospace, or Ramo-Wooldridge.

DA: Well, it's certainly nice to know that the Air Force is hiring quality people, but it sounds like it is difficult to keep them.

TH: Well, they can't retain them. Well, what the hell, Aerospace turns right around and hires, talks a guy that's in the Air Force into resigning or retiring and, then, hires him, and then the Air Force pays for him at double or triple the salary over there at Aerospace Corporation. It's stupid. It's a dumb system. And, the Air Force is the only service that really does this. The Army doesn't do it, still to this day. They tried it and quit it down there in Huntsville. And, the Navy tried it, and I don't think they're using this system at all anymore. The Air Force is stuck with it, and I can't understand why the service continues to be so stupid, except the politics, now, that radiates, that is functioning from these so-called "not for profits" is very powerful. They've got people in Washington in positions that assure their future, I'm afraid.

DA: If we could move back to the weather satellite for awhile, I keep wanting to call it DMSP [Defense Meteorological Satellite Program], but it's really not DMSP at this time is it?

TH: It wasn't DMSP until it was declassified.

DA: That's what I figured.

TH: It moved out into the outer world and "matured." See, when I left after four years from the start of the program, we had fifteen people in the program office. We'd grown from five to fifteen, mostly because we had, by then, about five guys from SAC [Strategic Air Command, the

eventual operator of the satellites] in a constant rotation in the office. So, we had, and we had more secretaries. God, we'd gotten up to four secretaries, so we still had about six productive people, about five SAC people, and four secretaries to handle the increasing amount of paperwork as we were moving toward "normalization." After I had retired, I took a job with a little minority company down in Chicago in their so-called technical section, and we got a contract to do a study for Cambridge Research Center on the use of weather satellites to support the tactical air force in Europe, and I ended up doing that study all by myself, because my buddy quit and left me holding the bag. But, I had occasion, then, to go out to my old program office out on the West Coast. It now was up to 120 military and civilian people, and an equal number of Aerospace people. And, they were doing exactly the same program, except the ground stations were all developed. They didn't have to do any of that. The booster was all done, no development there at all. The only thing they were doing was trying to monitor the contract for, and administer the contract for the satellites, and they screwed that up so bad that the NRO went without support for almost two years, a little better than two years, as a matter of fact. What happened was that they "normalized" everything. They went back under, what was it, the 375-series regulations, and in five years they had six program directors, so they were running fighter pilots through as program directors to get that on their records so they could be promoted. And, then, they wondered why there was nobody in charge of the program. My purpose in going out there was to learn the details of the latest sensors that were going on the spacecraft at that time. I could find no one in the program office that could describe the sensors or how they operated. I had the clearances. There was no reason why they couldn't have told me. There was nobody there who knew. They could point to shelves and say "It's all there in those books." "Have you read the books?" "Oh, no, I don't have to read that shit."

DA: So, they had replaced your engineers, who would have known everything there was to know about the sensor, with program managers who were interested in the contract?

TH: Yah, but I couldn't even find an Aerospace person who knew anything about the sensors. I finally went back to RCA and, there, I found people who could tell me about the sensors, because they were building the spacecraft, you know. It was crazy. The knowledge, well, when we started our little program office with those few people, I knew everything there was to know about the spacecraft, Lou Ricks knew everything there was to know about ground operations, as a matter of fact he simplified the whole tracking procedure, made a bunch of nomograms and tables, and we got rid of the whole necessity for the computer entirely to do the tracking. He got the data from the tracking stations, the look angles for the first couple of passes, put those things through his little nomograms and came up with an ephemeris. Then, he would predict the next pass from this, refine it after two or three passes, getting a little bit closer each time, and from that time on there was no need for a computer at all.

DA: How long was a weather bird on orbit, typically?

TH: Well, from the time the first one went up, we had one, or two, or three, or four, or five up there continuously. How long did they last? Well, they lasted everywhere from a couple of weeks up to about six years.

DA: That's a significant difference from three or four days, or two or three weeks.

TH: Oh, yah! No, our little weather satellite program was the first what they call "operational" program, because it had to be operated every day, and it required manning the stations and manning a control center on a continuous basis. The SAC people, when they took over these stations, they were magnificent. For the six years after they took over that I still paid attention to what was going on in the program, they never missed a pass, not one, including the time that a

hurricane came by and blew the inflated radome, ripped it and blew it off the antenna up at the Loring, Maine, station. The men got out there, and they held the edge of that dish. It's only a forty-foot dish but, still, in that high wind, the dish is vibrating like crazy. So, even while it's tracking the bird to do a readout, they held the dish to keep it from vibrating so that they could stay on there and get a clear signal. I tell you, they were great guys. You'd never get that kind of performance out of a contractor no matter what. The whole experience with the "blue suit" launch crew and operating crews just confirmed my opinion that "blue suiters" can run a program so much better than contractors can.

DA: What's the difference do you think, Sir, between contractors and "blue suiters" in this particular regard?

TH: Well, one's focus, dedication, and uh, basic intelligence and competence. I think that the quality of the individuals, of course we had quite highly selected people, SAC went out and interviewed and got really good guys at these ground stations and control centers, and they were just really good guys, and they were determined. Their morale was very high. They were told "You're the first military crew to run a space program. You are the basis. You're the foundation for the Air Force's mission in space." And, they got that drilled into them by SAC, everybody from [General Thomas] Power on down, and they believed it, and they performed that way. Charlie Croft in my program office found a couple of old Nike stations that had been abandoned that were about to be made into county parks and things like that, and he latched onto those for our two ground stations, and they had a bunch of old wooden buildings on them left over from the Army's Nike installation. When we got permission from DNRO, I went out and I briefed [USAF Chief of Staff General Curtis] LeMay and I briefed Power, and within a week they had crews at those two stations repairing the buildings, fixing the place up, and by golly, by the time

we got the equipment up there, they had "Spic and Span'd" the buildings and grounds, and the morale was so high you just couldn't stop them. They were great guys.

(END TAPE 1, SIDE 2)

(BEGIN TAPE 2, SIDE 1)

DA: Your position as the decision maker for the weather satellite program—do you think that made it possible to react to situations like the Cuban Missile Crisis?

TH: Oh, of course.

DA: It was a need for a particular type of data quickly.

TH: Yah, we had no bureaucracy that had to be satisfied before we could move. There wasn't anybody except DNRO that could say no to us, and he almost always said yes when we proposed something. The answer was "Hey, that sounds good. Why don't you do it." We had, well the morale in the program office was very high, also, because my guys were responsible; they made decisions, and they made the decisions stick on the people that were involved. Dick Geer ran the booster end of the operation, and he was a peculiar, all of these guys were individuals anyway, but Dick is a very smart guy. He's the one who figured out why were losing so many Scouts. I don't know whether you've heard that story, but our first launch was a failure, because the one stage simply blew up. That was an ignition, a bad ignition and a blowup. The second one was a success. We got the bird into orbit. It was not a perfect orbit, but it worked and satisfied the NRO's requirements for data. The third and fourth were failures. Again, it was the third stage that blew up each time, only this time it looked like it was not an ignition failure. And so, Dick was the one who figured out that what was happening was that the range officer was shutting down his range control transmitter that was illuminating the bird all the way up until it ran out of the range boundaries, and once it was beyond the range boundaries he wasn't interested in it