

Nevada Test Site Oral History Project
University of Nevada, Las Vegas

Roadrunners Internationale
Contractors' Forum

October 6, 2005
Las Vegas, Nevada

Recorded By
Mary Palevsky

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Produced by:

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Roadrunners Contractors' Forum

October 6, 2005 in Las Vegas, NV

Panel participants: T.D. Barnes, Dennis Norquist, Robert Murphy, William J. Fox, Robert Davenport, Ken Swanson, John Byrnes, Wayne Pendleton, Frank Molinaro, David Bennet

[00:00:00] Begin Track 1, Disc 1.

TD Barnes: I guess everybody got a fast lunch between the events here. We did this forum—this is a new one—for the contractors, and being an Army guy I did it different. I said, you, you, you, and you have just volunteered. So we've got some more that will be up here that have not arrived and that's the reason we're stalling. But I'll tell you a little bit about what we are going to try to accomplish today.

I'll tell you a little bit about myself. I was previously on the NASA [National Aeronautics and Space Administration] high range. I was involved with their X-15—their X8-70 projects. My background was radar telemetry, ECM [electronic counter measure], ECCM and this sort of thing. And I was recruited by the [Central Intelligence] Agency off the X-15 sites for a special projects team at Area 51. My involvement was slightly different than some of the other gentleman here. I had formerly worked under top secret clearance, and being as I was working under a secret clearance, it had elapsed, so they had to get me reinstated, so they loaned me out. They recruited me but they loaned me out to the NERVA [Nuclear Engine for Rocket Vehicle Application] Project for about three months with Pan Am [Pan American Airways] paying my payroll and I worked on two or three little nuclear tests until they could get my clearance through, and then I disappeared into the black world and did my thing out there. Where's Jim Freedman? Is he here? He was one of my co-workers out there. We were cadre at the Area [51]. Whereas some of the gentlemen here, some of them worked on various projects out there, but we

stayed from project to project. I actually got in at the Area [51] on the tail end of Oxcart, even though I was working on it, starting in '65 while I was on the NASA high range. These other gentlemen, they were out there, they came out in '62 or maybe even earlier. After the Oxcart program ended, we waited around for the big program to start, which was Project Have Blue—and then we had Have Doughnut, Have Ferry, Have Drill—that was the first one. So some of us will be talking a little bit about some of the other projects other than Oxcart since the theme this year is fifty years at Groom Lake. The Roadrunners started what they have out there now. If we hadn't been there and got it kicked off, they'd be doing it somewhere else.

So that's a little bit about myself, and what I'm going to do is just have each of these gentlemen get up and tell a little about themselves, what they did as far as the Oxcart or whatever they want to talk about, we'll have a few others, and then we're going to reach out into the crowd because there's many, many contractors that did a lot of work out there. We don't have any of the camera people up here. There's supposed to be some up here, and hopefully we will have them before this is over. So we will be reaching out into the audience as we see one, because that's what we're wanting to do, is give you a broad spectrum of what all went on behind the scenes to put these planes in the air and to bring them home.

So I'll start with Dennis Norquist. Each of you can come up here and introduce yourself and tell a little bit what you did and who you worked for, and when we get through we'll have some questions and answers and hopefully you'll know a little bit more about what we did.

Dennis Norquist: Thank you, TD. I was with Pratt & Whitney, not in the early days but I know quite a bit about it. The J-58 engine program really started in the mid-fifties. Pratt & Whitney was under contract to the [U.S.] Navy for basically an experimental semi-high-altitude

engine. Ultimately that turned into the J-58. And our contract remained with the Navy all the way through the program. They were our funder.

The first engines tested—Bob, what was the first year we ran the engine? Bob was—by the way, I joined the program in 1962—Bob joined in East Hartford in 1958, and at that time was the beginning of where the J-58 engine was originally developed down in Florida. We called it FRDC, Florida Research and Development Center, out in the middle of the swamps. In the mid-**[00:05:00]** fifties there was two programs: basically there was a hydrogen-fueled engine that we were running, and what turned out to be JP-9. JP-9 didn't exist in the mid-fifties, and we actually had much better success with the hydrogen engine than we ever did with the JP-9-fired engine. In fact, I think we were about a year late in delivering the first J-58 to Kelly [Clarence L.] Johnson. So it flew with the J-75 engine first, which many of you know. Another interesting little tidbit, we had 3X engines, we called them, that were for the A-12, that version, and then the [U.S.] Air Force version, I think we had about ten more engines, so there was like thirteen or fourteen engines, or let me call them engine teams. There was about anywhere from four to six engineers assigned to each engine model, these ten engines I talked about, and we had – Bob, how many sea-level test cells did we have?

Robert Murphy: Six.

Dennis Norquist: Six. Those were just strictly sea-level, except for one I'll tell you about. The other one was an altitude test chamber where we could run two engines up to the mach design points and up to 100,000-foot altitudes. But that was a real operation to fire up these big steam turbines that came out of—they were ejectors that came out of some destroyer, surplus out of World War II. It would take a couple days to fire that thing up and get ready to get an engine tested. And I know one thing, we blew up a lot of engines before we started shipping them, and

probably the biggest was to get them to operate at that mach-3.2 design temperature. And so since it took so long in this altitude chamber to test these engines, testing at temperature and altitude, atmosphere, we took a J-75, fired up, exhausted it into a big chamber, mixed a little air with it, and simulated a climb-out on just sea level. So it wasn't a performance engine at all. It was just to get the parts to work at that 800-degree inlet temperature.

And a lot of things came out of that, like, as an engineer, you didn't go right up to mach-3-plus. You'd start out working your way up there and then shut down and go inspect and see if there's anything failing or ready to fail, because if it failed it was too late. It was catastrophic. So we'd have to crawl into this big chamber, and remember it's 800 degrees in there, so you'd have to wait forever and ever to shut down. And the biggest problem at that time on the front of the engine was the first-stage compressor blades of titanium were failing right at the root, and it was always started on the back. It wasn't something you could just look in. You had to really work your way around. So anyway, that was the beginning of the Moro scope. We just went and got some dental mirrors rigged up and put a hole in it. And at that time, if you asked your boss to do something, it was a lot easier for them to say no than do it, so that was the way we did things, and we'd just go out and do it as test engineers. And it was something we all learned and used throughout the whole rest of our life.

In one of the areas – is Jim Eastham here? One of the things I got out of it was we took for instance an Learjet engine, and this is not a very well-known fact, and I was at Garrett [Corporation] at the time and they says, we don't know anything about afterburners, and I said, what's that got to do with it? So we put an afterburner on the Learjet engine and for a while it was Taiwan's twin-engine version of the F-16 because the country wouldn't ship them F-16s. My boss at the time, and Jim's as well, the reason he understood what we were

doing, just a few people did, was a guy by the name of Jack Teske was our president then and he grew up on the control system, on the inlet controls.

OK, anybody next? Unless you got the questions now or do you want to keep going or what? Any engine questions?

Question: I heard in some of your early failures the compressor disc would just get really soft and floppy. Is that true?

Dennis Norquist: Well, the rear compressor discs got awful soft because the temperature was way beyond 800 [degrees] at the last stage of the compressor. I wouldn't call it soft and floppy, but they ran. I remember there was always seals in there like in that last stage, a knife-edged seal and a seal land, if you ever take an engine apart. And that was a big problem on the [00:10:00] back end because this knife edge is exactly that, and if it doesn't expand at the same rate, it's going to cut that seal right in two and there goes your engine. So somebody got the idea they were going to reverse that around to solve that problem. And the easiest way to solve it is just to make a great big gap so it can go into it. Well, somebody reversed them, and I happened to be running the engine at the time, and we made it to about mach-2.5 and it didn't work, and that was the end of that. That was tested behind that J-75, so it was a real quick test. I have no idea how many engines blew up down there, but it was a lot. Most every test engineer blew at least one.

Question: How did you come up with the JP-9 fuel; the characteristics?

Dennis Norquist: Well, I think it was a battle between the airframe, it wanted certain things and we needed certain things in the engine. Shell Oil did it.

Audience: They called Jimmy Doolittle.

Dennis Norquist: You know, I can tell a little story about compressors. You brought it up. I don't know what article it was in, but there was one that wouldn't go past 1.2 or 1.3 mach number, something like that. Well, it turned out that one of the compressor stages was put in backwards. Bill Brown was our chief engineer and he's really the second father to this engine. He was in Kelly Johnson's office and they were discussing this and I can imagine Kelly Johnson had a lot to say to Bill Brown about that. And Bill Brown is an exact opposite; he's just calm, just tell me the problems, and gives you a calm answer. Well, after they did a little ranting and raving, I guess, he says, Kelly, he says, you ever thought about trying and putting those wings on backwards to solve your problems?

[Applause]

TD Barnes: Probably we should've started with the gentleman who built the plane to start with before we could put the engines in it. Bob Murphy.

[Applause]

Robert Murphy: Well, I'll have to start a little earlier than the A-12. I arrived at Area 51 on July 21, 1955. All the way up, Kelly kept saying, We're on our way to Paradise Ranch. First thing I remember is when I stepped off the Goony Bird was the dust was four inches deep. It had never been trod by man. And all the power was generated by four big diesel engines running twenty-four hours a day right outside your window. They served the food in the mess hall family-style. You sat down, here comes a big platter of New York-cut steaks. In the course of my year-and-a-half there before I deployed with Detachment C, I had lost thirty pounds, and I ate five full meals a day. It was a one-shift operation, flying twenty-four hours a day.

But I want to tell you about how it started. I was worked for Dorsey Kammer at Edwards' [Air Force Base] north base on the XF-104. And one day he said, Murph, would you like to go to work for me on another program? And I said sure. I was a bachelor, twenty-four

years old, and a flight test mechanic. And he said, well, you'll have to come down to Burbank [California] tomorrow morning on your own time, of course, for an interview. So Ernie [Ernest] Joiner, who was the chief flight test engineer for the U-2 program, and Dorsey put me in a car and drove me out on the taxiway. They wouldn't talk to you in a building, the security was so tight. Made me fill out a PSQ right there on the spot, from memory, and turned it in.

So a few weeks later, which was probably the end of February or the first week in March, I don't remember, I walked into Building 82 and was amazed to see how far along this airplane was under construction after the short time that the contract had been assigned. And we put the [00:15:00] instrumentation in until it was shipped up in a C-124 in late July. And we put it together that day, completely reassembled the airplane that day, went out for an engine run, Pratt & Whitney's trusty J-57. It wouldn't start on LF11A, lighter fluid first class we called it, whatever the fuel was. So we hooked a pipe to the bottom of a five-gallon can and hooked it into the fuel system, and we started the engine on that and then switched to—it'd run on the other fuel but it wouldn't start. Now that was bad for the pilots because if you had a flameout, it wouldn't start.

But anyway, a very, very small group. I was on the first airplane. That's three people, total. And we had two people who worked in the shop, one jack-of-all-trades ran the stock room, supply, logistics in general, and a guy whose classification was a painter but he was also the time keeper and the aircraft dispatcher. Total people cleared for flight test support: there were nineteen. That included the pilots and everybody, but they all weren't there at the same time.

Made the first official flight the first of August. Had a very interesting flight prior to that where Tony was taxiing and we were following him in a pickup truck. Dorsey Kammer, who weighed about 300 pounds, was driving the truck, Fritz Frye [sp] the crew chief was in the front

with him, and I'm standing on the back for dear life. Tony all of a sudden went into the air – he didn't even realize it at first – and then he shut the engine off and crashed down in a big cloud of dust. Dorsey roared right into that cloud of dust, going as fast as that pickup truck would go, and I'm going [grips the podium], if he hits the airplane I'm going [grips the podium again]. We had one of those huge fire bottles in the back with two big black wheels—I guess everybody has seen it at one time, they used to have them out on the flight line—upside down in the back of the truck. So when I see the tires are on fire I start to grab a hold of this thing to get it off the truck. Dorsey leaps out, grabs the wheel, and picks it up—I don't know what the hell it weighed—and me, because I was between the wheel and the bottle, out of the truck—he and I grabbed a hold of it, upside down, didn't bother to turn it over, and drug it under the airplane and put the fire out.

Anyway, first flight in August. By October we had met the design requirements. We'd been to altitude, and we'd taken some pictures. So Kelly says, *Well, the flight test program is over. We're finished. It's still going on.*

But anyway it was a very unique experience on that. I stayed with the U-2 program until late 1960, then went on the A-12. I made myself forever with Kelly. I unmade myself with him a couple of times, like when I wrecked a starter on the way out to the first flight and things like that, but I made it. We were sitting in Building 82, a little teeny conference room, and all the manufacturing managers, of which there was six, I believe, including Quality, were there, and Kelly had picked a rollout date, I believe, in early April of '62. And he asked each guy what they thought of that date. Well, let me tell you, because of the sheet metal, or the machining of the parts, we were really in bad shape. Now my responsibilities were the electrical, the electronics, the plumbing, the controls, all the development people. And all these guys had been the original people that formed the Skunk Works for Lulabelle in 1943. So as he asked each one and they all

told him what their problems were. Anyway, I'm sitting next to the Director of Operations, the head of all manufacturing, purchasing, and everything—which I later got his job—he gets around to me and he says, What do you think about that date, Murph?

[00:20:00] And I said, No sweat on that date, Kelly.

God, these other guys looked, and everybody looked.

Kelly says, When are you going to have power on?

I said, The twenty-sixth of December at nine o'clock.

He writes this down. My boss told me later I wrote down, Fire him. He doesn't know what he's talking about.

So I immediately left and ran upstairs to where my electrical supervisor, Roy Setzer was and I said, Roy, we're going to have power on on the twenty-sixth of December at nine o'clock.

He says, God dang, Murph, he says, that's going to be really tough. They haven't got the back end of the airplane built yet.

And I said, Well, we'll do it to seven-fifteen, which is where the fuselage hits—mates to the rear end. And I said, I think we're in pretty good shape up front.

I said, I just want to make sure the instrument panel is lit.

And he said, Oh, we can probably do that.

So on the twenty-sixth of December I was in the electrical, which was on a balcony overlooking the airplane, first airplane, and at nine o'clock here come the door out of Kelly's office, *chunk, chunk, chunk, chunk*, up the stand, looked in the cockpit, instrument panel is all lit, one of my electricians is still in there working—he had cut off these wire ties, string ties for the wire, and thrown it right over Kelly's head—but he didn't care. He got down.

So anyway, they rolled on that date. So from then on out, for my life's history in the Skunk Works, I was known as No Sweat Murphy.

Anyway, my involvement at Area 51 on the A-12, I came up to help get the trainer going, shipped four, and I forget, I spent about a month here at that time. And then I went back and built the D-21. And had the privilege, after I had the first D-21 in checkout, number ten in the jig and the rest of it in the production line, this is August of 1964, Kelly calls me up and he says, Murph, you want to run the SR-71 at Palmdale [California]?

And I said, Yes. I want to go back where they fly airplanes.

Now this is the total instructions from Kelly, and this was standard for Kelly: OK. You got to move. Move to Palmdale. OK. Get Site 2 away from Rockwell. It's an Air Force-owned plant. No instruction on how to do this, just go get it away. Hire the people. Train them. The pieces will be up on the first of November, and I want to fly on the twenty-second of December.

That's the last conversation I had with him. Now Bob Gilliland is sitting over there saying, That goddamn airplane had 400 open items on it when I flew it. And he was right. Right, Bob? That's right. Don't have the exact number.

Anyway, the big deal for me in that day, the SR-71 made its first flight and the D-21 made its first flight. One of the deals of being able to do these flight tests with Kelly was very involved on a day-to-day basis with the early flight testing of the airplanes, and on the U-2 especially, it was my experience, he made the decisions on the spot. You know, the airplane would land and he'd talk to the pilot. He'd make a decision on what to do. He was leaning over my shoulder on day and told me to cut a half-inch off the end of the airplane. I'm this young twenty-four-year-old kid and he's leaning, watching me while I've got this nibbler, and he's

[saying], Take a little more, take a little more, he's saying, and I'm about to drop it on my foot. But that's what made these programs go and so successful. Great guy.

Any questions? Good.

[Applause]

TD Barnes: OK, Bill, it's your turn up here. This is Bill Fox. He was with Honeywell

[Incorporated]. One of our former presidents of this fine organization.

William J. Fox: Good afternoon. I bet that a lot of you didn't realize that I actually worked [00:25:00] for Honeywell before I worked for Lockheed [Aircraft Corporation], on the Blackbird program. I happened to be out at Palmdale working on the F-104G model, German model, and two guys came to my house one night, Honeywell guys. I knew who they were. Didn't know what they were doing. They said they wanted to talk to me. I said, well, come on in. They said, well, we can't do it in here. They said, We got to go out and take a ride. So this kind of bothered me a little. They had trench coats on and hats, you know.

But I got in the car with them and we drove around Palmdale and Lancaster and they said, We want you to go to work on a special program.

I said, Well, what is it?

[They said], We can't tell you.

I said, Where is it?

[They said], We can't tell you that either.

[I said], Who's it with?

[They said], We can't tell you that either.

Well, I'd been working with all these guys from Lockheed, you know, and I'd heard a little bit about the Iron Curtain and all that stuff, but I didn't really associate it with the program that they were doing.

But finally they said, It'd be really a patriotic thing to do and you'll really enjoy it.

So I said, OK, I'll take it.

They said, Good. Don't go back in to work at Palmdale again. Just stay home and fill out your forms and mail them in and we'll tell you when to report to work.

So nearly three months later—I'm on vacation, you know, I get my paycheck every week in the mail and I'm doing nothing. And I keep seeing these guys going to work and coming home, you know, that I'd been working with, and they all look at me kind of funny. And one day I finally get a call that says, Meet a guy named Fritz at a motel in Van Nuys [California].

I said, OK, I'll do that.

And they told me what time, where to be. So I got to the motel. There this guy was that I knew him. And he says, Follow me.

Well, where do we go? We go right over to Lockheed, right where I had checked in about a year-and-a-half prior to that. And go into the security center, and they used the same security center for the Skunk Works as they did for the main Lockheed gang. And I go in there and the guy says, Fix him up with a badge.

He says, What's your name?

I says, William J. Fox.

[He says], Who do you work for?

I'd already been told: Midwest Engineering.

And he says, What's your address?

So I give him my Palmdale address where I lived, and he started going through the—he says, You know, we got another guy with the same name, William J. Fox. He said, Damn, he's got the same address.

And about that time the big boss come out of the back of the place and he said, You guys all come in here a minute.

So we went back in his office and he said, Damn you, why didn't you turn in your badge?

I said, Nobody told me.

And so I was still registered there as a Honeywell guy and now I'm getting registered as a Midwest Engineering guy, and that caused a few problems.

But shortly after that, went over and I saw what the Skunk Works engineering facility was. It was a room about half the width of this room and about twice as long, but every engineer was in there, and I met a lot of them that day. But just to tell you about the size of the organization, if that was the B-1 it would've been eight floors, five times this size, with half of them being government people. But not there. There was one government guy that came in there and that was Norm Nelson.

So that's where I started, and then I worked out there on that simulator, trying to get that working, and fed Lou [Louis] Schalk a lot of unstarts so he could sit there and try to keep the needles in the middle. We spent a lot of time together working on that simulator.

But then I went to the Area [51]. Well, first we went over to Bob Murphy's shop and checked out the airplane, and I had the dubious honor of almost shaking it off the jacks because the rate gyros were loose and somebody bumped the airplane when we had hydro power on and I

had the SAS on and those gyros started jumping and the whole damn airplane [00:30:00] started jumping and it was on jacks and almost came off of them before I could get the switches shut off. And Murphy gave me heck for that.

But we got the bird checked out, and amazing, it was a fairly complicated SAS system, triple redundant. And you all heard yesterday about when [Mele] Vojvodich bailed out because of the pitch-and-yaw gyro, the wiring was crossed. Well, if they had just crossed one or two of those plugs, it would've kicked the SAS off, but by crossing all of them, the two channels both tracked perfectly; they just were putting the wrong signals into the wrong pocket, you know, so when the nose come up the airplane would yaw, when the airplane would yaw the nose would go down, when it would go down it would yaw the other way, and it was just kind of getting worse and worse. That's why Mele got out of it.

But there was a fix on a table to keep that from happening at that time, and it was kind of a shame but it hadn't gotten put in. Kind of had to do those things in spurts, you know, when there was a bunch of stuff to do, they'd lay the airplane down and do it, but you just didn't stop flying activities to put some little change like fixing the gyro connectors so they couldn't get plugged in wrong. It was kind of a screw-up, but Mele got out OK and we learned a big lesson.

I stayed with Honeywell through quite a while out there in the early flight test program, and then they decided they wanted me to come back to Minneapolis [Minnesota] and help in the design work on the SR-71 system, so I went back to Minneapolis for one winter and I then called Ed [Edward] Martin and I said, You got to get me out of here. So I was going to California on a business trip anyway and stopped in to see Ed and got my job offer and a month later the moving van was moving me to California.

I have another dubious honor, I guess you might call it that, but the first three years on the program, three babies, though I guess my wife had the honor more than I did, but I think that had the record there for a few years. And you weren't always able to make contact, getting in touch with your wife or having her get in touch with you. She'd have to call some guy that she didn't know at some phone number that was not listed and say she wanted to talk to Bill Fox. Well, she didn't know I was Midwest Engineering. She knew I wasn't Honeywell. But she just said, I want to talk to Bill Fox. Well, then the guy would go through his list of people that were at the [Nevada] test site and he'd find somebody and then he'd call up there and you were allowed then to call home, find out what was going on: Yeah, the baby will be here before you are.

But working for Honeywell was kind of a neat deal because I ended up working on almost every system on the airplane when I was working for Honeywell. I used to even help load the drag chute. It was kind of fun. I ran the power carts and I ran the hydraulic carts, and didn't have any trouble with anybody telling you not to do anything. If you were willing to work, you could. And that's kind of the way the program was.

Well, then after I got back out and working for Lockheed, I started working on the inlet control system, and spent a lot of time trying to get the kinks out of some of that stuff because the connectors were going bad because of being cycled hot and cold. Connectors have little tiny pins that go in little tiny sockets, hundreds of them, and the little sockets have a little tiny spring in there. Well, if you heat and cool that spring enough, it isn't a spring anymore; it's just a little piece of metal that doesn't fit very tight. And these things are in the inlet where they get hot and cold all the time. And so we'd have to take those connectors apart, squeeze that little spring down again and make it into a spring again, and put it back together and seal everything up, and

[00:35:00] then it would work fine for a while. But the unstarts were a headache more for the pilot than it was for the guys working on the airplane.

I got to work on the automatic life vest inflator, which a couple of you pilots probably almost drowned because you thought it was going to work. And I found some problems with it, thought I had it really fixed, so I went to Dick Adair [sp] who was in charge of our finance and contracts group. He had a house right next to the plant there in Burbank. I fixed the thing, so I had to be the test model. So I put the suit on and go to Dick Adair's pool with a little guy named Dan Zuck [sp] that did most of the cockpit design. And Dan and Dick Adair's wife were standing there by the pool and I jumped in. The damn thing didn't work, and I was down in the bottom in about eight-and-a-half or nine foot of water, and all of a sudden I feel this thing hit me in the ribs, and it's Danny's Zuck with a pool net, jabbing me, trying to get me to grab it so he could pull me out. Well, he couldn't hardly move me. So she helped him haul me out of there because the suit had a leak in it and it filled up and I was really heavy.

But anyways, back to the drawing board, and then we found out that there was a little incompatibility between a couple of metals that was used in that thing, and we got that fixed, so I thought, oh, we got it made now, so we'll just go ahead and let the Air Force test it next.] So we got four sergeants to jump out of a helicopter into Lake Isabella. And Dan Zuck and I were in a little motorboat and we were going to kind of watch the operation. Jeez, they all went to the bottom. And it was not a nice scene. A few other guys came out of the helicopter and helped get those guys back up to the top.

But we found out, the thing didn't work in pure water. It had to have some minerals in it. Isabella was melted snow. So it didn't work. But yet you had to have it so you could stick a hose on it and it wouldn't go off if a guy came down in the rain, it wouldn't pop his survival kit or his

life jacket underneath his suit before he got down. You wouldn't want it to come open while you're riding that seat down. So we had to kind of adjust things accordingly and, weird, we'd take a hose and go out, spray down this suit for five minutes and see if it would fire the life inflator. And that's kind of how we, you know, tested it to make sure it would finally work, and I guess it did work a few times. And I remember there was one deal where a U-2 pilot, I think, went out and everything worked and he was unconscious landing in his life raft the next day or something like that, somewhere over around Japan. But that was a fun little thing to work on.

I guess the biggest thing that I found about working at the Area [51] and working with this bunch of people is everybody pitched in, everybody appreciated what everybody else did, and everybody was good at their job. And that dedication and determination is what made the program go.

So if anybody's got any questions, I probably don't have any answers. Yeah.

Question: You and Dick [Richard] Estey had a project up there—?

William J. Fox: Oh, Senior Prom? Yeah, in fact there were some pictures of that over there. Yeah, we had quite a time with that program. We got to fly it over the base at 500 feet without a pilot in it, which shook everybody up. But they run everybody into the chow hall that wasn't cleared on the program. I don't know whether they fed them good in there or what to keep them happy. But the little bird flew over the whole facility and right down that radar's throat and it never did see it, so it kind of made us feel good that the stealthy drone did work. Dick Estey worked on that. We had a really neat crew there. And I hold a record for that also [00:40:00] because I threw the biggest party that they ever had up there after that program finished. We hauled King Air full of booze from Burbank to the test site. And Brownie and crew out of the kitchen, they put on a great big meal, so we had a great time.

And we had an APC out there that we used for Have Blue tie-down. The APC, most of you probably know what it is, armored personnel carrier, and it had tracks on, but we tied Have Blue to it when we'd run the engines. And they took away part of the electronic, like the coil or something out of it and hid it so we wouldn't be driving it around. But some guys found it, and so occasionally we'd take that thing for a spin. I know one night I got to drive it, and I drove it right up to the bar door. I parked it right where nobody could come out that door, and of course they could all hear it rumbling and rattling out there. We got in a lot of trouble for that.

But the day of the party, all of a sudden here comes Larry McClain, Colonel [Larry D.] McClain, who is the base commander, he come rolling in to where the party was at in that APC, and he said, Foxy, he says, I know you want to take it for one last spin. I say, I sure do. So I got in, he got out, and unbeknown to me there were about thirty people crawled in the back end of that thing. It was just full of people, but I didn't know it. And I took off out for the junkyard, we called it, and I went over a couple of old wrecked cars and through some ditches and off some ledges, and I was just having a ball. And I took it back and parked it by the hangar, and I started crawling out and I saw all these people all beat up, reeling around. I had no idea those people were in there. But we had a lot of fun.

Any questions?

Question: Bill, one thing I heard about during Oxcart, a guy named Raymond Laqua [sp] and Westinghouse [Electric Corporation] figured they could produce a radar return from the inlets, that they could put a cloud of ionized gas and run in it. The official CIA history said that they never worked. Do you ever recall they ever flew any hardware for that?

William J. Fox: I don't recall it.

Question: OK. Nobody I've talked to actually remembers. It probably died in the wind tunnel.

William J. Fox: At Senior Prom?

Question: No, no, no. No, this is A-12.

William J. Fox: Oh, A-12. No, I don't recall anything like that.

Question: Yeah, they were going to put these ion guns about Station 715 and squirt ions out in front in spikes.

William J. Fox: Well, I heard they were thinking about building the engine by putting some ions out in front of the airplane and just make—

Question: Yeah, the air spike. That was something else.

William J. Fox: Yeah. Never worked.

Question: It was about '64, '65 they were doing some work in that area and it did not work. I don't have any details on how far it went, whether it was turned off very early in the game.

[Applause]

TD Barnes: Bob, you got anything you would like to add to the Pratt & Whitney? Meanwhile, have we got any Hi-Con people out there or CarCo or any of these other contractors? I want you to volunteer. We'd like to hear some stories on that. Bob.

Robert Davenport: Well, I was just asked to come up here to support Dennis if you had any more questions on the engines. I don't really have anything to add, other than what Dennis had brought up here about the engine. Question?

Question: Didn't the SR-71 and A-12 operate off of JP-7 and not JP-9?

Robert Davenport: Yes, that's right, it was JP-7. And did you ask the question about how did the JP-7 get developed?

Question: I know how it got developed.

Robert Davenport: Yeah, that was a very significant part of that development effort in [00:45:00] Florida, was the tests that were conducted to try to develop a fuel that would come into the fuel pumps at 300 degrees and be used subsequently throughout the hydraulic system, since you know the engine fuel was used in the hydraulic system and then was later consumed in the combustor, so by the time it got to the burners it was already at 450 degrees at the cruise condition. So coking in the fuel lines and in the variable fuel nozzle mechanism, as you can imagine, was a real challenge. There was years of fuel development that went on. I wasn't directly involved in it but I was aware of the testing that was going on there. They would develop tubes, they called corker tubes, and they would put a heating element inside and then they would suspend them in various combinations of fuel. But what I had recalled, I've been away from the program almost forty years, I've been at another company for forty years, but I recall Ashland Chemical was instrumental in doing most of the fuel development. Who ended up with the production of the fuel, I'm not aware. I'm sure most of you probably know. But there was a very significant effort that went into that. The formulation, the additives and so forth that went in. Of course I also had the combustion section for a number of years, developing combustors, you know, relight capabilities, light-off, atomization. There were a lot of considerations that went into the fuel.

And I'm sure most of you realize the oil system was somewhat unique. It was totally new to Pratt & Whitney at the time. That was the PWA-524. I'm not sure what the military spec was. But it was an oil that had a pour point of just about room temperature, so if you ever were out trying to start an engine at 50 degrees with oil in it, it's just like a rock, you know, it's like molasses. So we used a diluent, we called it, it was trichloroethylene, I believe, and it was put in

the engine oil system just before or just after shutdown and motored to dilute the oil so that on the subsequent cold start, it would start. Of course, in flight a lot of the oil system had picked up heat, so the oil tank would keep it hot for a long time. Unless you did a long windmilling, I'm sure that the oil wouldn't be a problem.

Question: You know about the sniff test? You want to tell then about the sniff test?

Robert Davenport: Are you sure you want to?

Question: It's up to you.

Robert Davenport: Well, I'll try to keep it as clean as I can. There was a requirement, I know, on the compressor bleed air, which was I guess used in the environmental control system. Correct me if I'm wrong but I saw it from the engineering standpoint.

Question: That's what they breathe.

Robert Davenport: But they breathe the air of this and I guess if there's a seal leaking in the engine in the compressor section forward, you can develop a real bad odor. So we did a lot of tests and somebody said well, how are we going to do this? And so in the development of the engine we'd run these tests where we'd bleed air off the compressor, run it through a—I can't remember whether it was a bottle or a can, off the compressor discharge. And it wasn't working out quite right, so somebody decided we'd take a sanitary napkin and use it to collect the fumes and then at the end of each one of the tests, that sanitary napkin was sent to the chemical lab to do a test to see whether we were effective in reducing the oil residue in the bleed air system. I'm not sure how we fixed the problem, if we did.

Question: Well, the real test ended up, one of the chief project engineers was faster, so he just did a sniff test.

Robert Davenport: I don't know how many of you know, but the engine ignition was accomplished not with a typical spark plug, spark igniter, exciter box, it was done because at those kind of altitudes, all of the spark energy from the exciter wants to go on the outside of the wire and doesn't get to the spark plug. So we developed a system there using pyro four fuel which was a canister that was charged up with nitrogen, an inert material, and of course when you start the engine, it gave it a pulse of this pyro four fuel which is ejected into a combustor.

Audience: Bob, it was really called the pyro four ignition system, PIS, PIS system.

[00:50:00] Robert Davenport: Oh, OK. It was triethylborane. It's been a long time. I don't know how many lights you could get off of this. It's probably six or eight or ten.

Audience: Sixteen.

Robert Davenport: Oh, sixteen, Frank said.

Audience: Yeah, sixteen shots, either into the main combustor or into—

Robert Davenport: Yeah, it was also used for afterburner ignition.

In the development program of the J-58, I was involved in the fuel control development work and afterburner development, combustor. I was kind of a jack of all trades, master of none.

But there was a record we used to keep in the test cells in Florida. Each one of the six test cells were open-air cells. They had a big pond of water behind them to try to cool the exhaust temperature, because a lot of times we'd actually light the swamp on fire. You don't think you can light a swamp, but if you run the J-58 long enough allowing endurance, you know you would dry up the weeds and pretty soon you'd have a fire that would go clear over to the highway. But these water tanks behind were just kind of dredged out to make the room for the test cells, you know, they had to have an elevation difference there.

And in the development program we had a lot of problems with the afterburner liner. This is the cooling liner that's the full length of the inside of the liner. And we tried a material there called ridge-a-mesh at one time. It was like you're taking a bunch of screen wire and smashed it all together, and what it did, it provided a very good uniform cooling of the cooling air around it to keep the liner cool, because other than that, you know, it's pretty hard to eliminate hot spots in the combustor.

So these things used to run for maybe ten or fifteen minutes, then we'd get into a condition called "screech." And what it is, it's a combustion phenomena at sea level. I don't know if it occurred at altitude, but the phenomena was such that it created a vibration level that would destroy anything that the screech liner was made of, including this ridge-a-mesh. So we used to have records—of course if you're running an afterburner, when it goes, it's instantaneously. It'd be a big gob of sheet metal that's about five feet long and about three feet in diameter and probably a sixteenth of an inch thick, and it'd go *whop* right out through the exhaust nozzle into this pond.

I remember one of the nights, I had the distinction of running an engine where I lost the liner, so my boss at the time said well, be sure, before the morning meeting, be sure and take the canoe out there, or this boat that we had, with the grapple hook, and he says be sure and bring it back so that our stress group can determine the cause of the failure. I said OK. I went out there, and we were out there in the middle of the night with this grapple hook and flashlights. And I grabbed up this liner and I pulled it up and I said, you know, this isn't mine. And I started looking around and I finally picked up three of them before I got the one that had the right—of course we serialized all the parts in the engine so we had history records on how long they ran. But I had the distinction, I guess, of digging the most up in one shift, from people that couldn't

find theirs, I guess, on their failure. I had to do their dirty work for them. But we had a number of things that were kind of humorous at the time. They were serious but looking back, they were very humorous.

So if there are any other questions, that's all I had to add. Yes, go ahead.

Question: Were there some things you tried later for the J-58 that you never used? Like I guess the high-energy fuel was one example, but were there other things like that, that you tried out and then didn't use?

Robert Davenport: Again, I've been away from the program about almost forty years. The high-energy fuel, it wasn't used very long there. It was triethylaluminum, I believe. It was to increase the heating value, get more BTUs [British thermal units] per pound, increasing range. But it was very toxic. And I know the one test we had that—we had one test cell set up specifically for that, such that the exhaust was collected into a duct work through a spin chamber and a tower and the water spray was sprayed in to try to collect the products of combustion because some of that was recyclable, and it was extremely expensive. I'd heard some very, very high numbers on the cost.

Dennis Norquist: Well, generally Pratt's philosophy has been build them and break them till they don't break anymore. And general rules was you'd have ten designs on paper, you'd turn five of those into hardware, and hopefully out of those five, through all those test procedures, [00:55:00] you'd get one that you could get qualified. So there were literally hundreds of parts that never made it into production.

Robert Davenport: Including one [that] was a major engine redesign, when I was working in the combustion section. The engine is set up similar to a J-57, J-75. The burner section is a canned annular system and it's approximately three feet long. We did a development and almost

to the point of qualification of an engine that had an annular combustor which is, you know, that's current-day technology in all the engines, even the commercial engines. And it would shorten the engine eighteen inches. And I remember as a young budding engineer, trying to push a design change through for shortening the engine eighteen inches. Of course this was well after the aircraft flight test program had started, and that's one of the technologies that never did reach it. I know it was close to a thousand-pound weight reduction, shortening the engine, but it would also have major impact on aircraft CG and qualification and a number of things, so it was put aside. But other than that, I'm not sure of any other technologies. There might've been some later after I left the company. I don't know.

Dennis Norquist: Let me just comment on that 10:5:1. That was throughout the whole program, so you went through that cycle of ten designs many, many times, then something would fail, so you'd get ten more new designs based on that.

Question: Could the engine eventually get up to 34,000 pounds of thrust? Because I remember a version of the engine called the 34K engine. That was the final thrust.

Robert Davenport: Oh, yes.

Dennis Norquist: That's what the Air Force flew.

Robert Davenport: Yeah. And the primary difference there was the installation of inlet guide veins which would put a negative preswirl into the first stage of the compressor, and it just superflowed it. It upped the air flow.

OK, if there are no other questions, that's all I had. Thanks.

[Applause]

TD Barnes: OK, we got one of our ECM guys here. Ken, if you would come up here, and John Byrnes, we'll have you, and then I'll do a little story about what it was like to be cadre out there.

Ken Swanson: Hi, I'm Ken Swanson. I was out in the Area [51] from late '66 through the close of the project in '68. Chuck Blucher [sp] was there from about '64 to '68. He pretty well ran our program for Sylvania. We had the package in the right-hand chine, forward chine. We took control of the SAM [surface to air missile] missiles if they were launched. We detected the presence of them, we could take control of them once they were launched and got close to the aircraft. While we were out there, we also did all the testing between the simulator, which was on EGG [Edgerton, Germeshausen, and Grier, EG&G] Row with the Fan Song radar. We could handle fourteen missiles in the air at one time, redirect the guidance on them. What we did is jam the rudders to the starboard side, I can't remember which way, make the SAM missile spin, and tried to control it. We put out a thousand times as much power as the SAM site transmitters down below because we had to get into the electronics through the back door and through the nose because their receiving antenna was in the jet exhaust of the SAM missile pointing back down to the SAM site.

I was thinking of a lot of stuff to say. The equipment had seven receivers. Each SAM transmitter could control two SAM sites per one of our receivers, so that's how we came up with fourteen. There was a day on the anniversary of the Russian Revolution that North Vietnam [01:00:00] launched, according to analysis, fifty missiles, and one came close but never hit us.

Is there any questions? Oh, I can talk a little bit about some of the other systems, electronics systems on the plane. Sanders Associates had jammers that would jam the Fan Song radar and give it false targets. There was another system, I can't remember who had it but it was

the proximity fuse for the SAM missile. It jammed the proximity fuse so that the fuse wouldn't trigger and blow up close to the aircraft. After [Francis] Gary Powers being shot down, they were deathly scared or afraid of getting this bird shot down. There was a fifteen-second window when the SAM missile could hit it in the tail chase, if everything was in the right scenario. So that was one thing.

Any questions? Yes.

Question: Was that the Big Black system?

Ken Swanson: No, this was Blue Dog and Red Dog. When we first came out, Sylvania developed the Red Dog system, and that was in '64 or '65, and they realized early on that it was not putting out enough power, so the Blue Dog system which came on after that put out a thousand times more power than the predecessor. It also had a wider frequency range of detecting the SAM missiles, tuned from 720 to 960, whereas the Red Dog system went from 760 up to 810 or something like that. And that was totally dependent on previous ELINT [electronic intelligence] data. And that was all preset. The Blue Dog system was totally automatic. It was also the first system, for you electronic buffs, that had integrated circuits and flat packs in it, in the U.S. government arsenal.

Any more questions?

[01:02:33] End Track 1, Disc 1.

[00:00:00] Begin Track 1, Disc 2.

[Applause]

TD Barnes: Thank you, Ken. John Byrnes. John was sort of a Lone Ranger out at the Area [51], one of these that's very mysterious. I'll let him tell about it.

John Byrnes: In order for Ken's system to work, we had to know how the other guy's systems worked. And the way we did that was typically we'd go out there with receivers and a lot of tape recorders and we'd somehow or other tickle their fancy and get them to start to at least send up their control systems or maybe even fire some missiles and send up control systems and we'd record all that and then take it back to the Head Shed and try to make sense of it. And finally somebody up there would say, oh, this is what they're doing, this is how it works, and everything would be fed down to somebody at Ken's company's level and they'd try to make sense out of it and how to spoof them, and as you said, put them into hard rudder, right, left, or whatever, and so they'd miss their target. Well now here was a perfect opportunity. We had a platform going over denied territory, and I'm sure at some point they're going to wake up and finally realize that we're up there, and they're going to do something to us. Let's put recorders on here and see how they're doing it. Well, we don't have an awful lot of room up there and whatnot, so somebody came up with the concept that we're going to take and put an in-air processor onto this whole thing so that instead of having tons and tons of tape recorders, we're going to have a bunch of ones and zeros and we're going to do it digitally. Well, this is fine except this is a very new concept. So there I was, sent out to Area 51 with this new package. Good lord, it was only two feet long at best and six or eight inches around. And in this new package, we're going to take and collect a whole bunch of intelligence, we're going to process it and put it into a very few ones and zeros onto a tape which is shared by Minneapolis Honeywell, the I&S people.

Well, in order to do anything this new, there has to be an awful lot of liaison back and forth, so they had me going back and forth to CIA headquarters every couple of weeks, every month at best, and meeting with somebody, and we had to sit down and we had to negotiate

every bit, every one, every zero in the format and on down the line. So this is working quite well. So they bring somebody else new in back down there that's going to take and bump it up a notch.

So I go back there as requested, and back in those days, you remember you used to go down to your dry cleaner and he had this machine about this wide and he'd take and write down your name and everything else and he'd turn the crank and two copies would come out. One he'd give to you so you could pick up your laundry, one he'd stick with your laundry, and one remained in the machine.

Well, in the reception area of CIA headquarters there in McLean [Virginia], they had exactly that same machine. So I go in there, I'm So-and-so and I'm supposed to meet So-and-so, and they write it down there and they crank it around there and I don't know. And this guy comes down, picks up his copy, [and says], You John Byrnes? [And I say] Yes. Tells me his name and he shakes hands with me and he takes me upstairs into the bowels of the headquarters. And they put me in a little conference room that was barely bigger than the conference table was in there, and they sit me down there, and [say that] So-and-so will be right in.

So a minute later somebody comes in, introduces himself, and he said, Well, let me tell you a little bit about what we do. And he starts talking about the socioeconomic blah-blah-blah of some Eastern European country. And I sit there with a little bit of a scowl on and say [to myself], well, this must be leading somewheres.

And I said something or other about, Are you sure that I'm in the right place?

[And he said], You're John Byrnes, right?

And I said, Yeah.

And so he continues on and continues on. Anyway, I let him continue on. And then finally he says, Now, is this the kind of work you'd like to do for us?

I said, No.

[00:05:00] And he says, What do you mean, no?

I said, It's not the kind of work I do.

He says, What kind of work do you do?

I says, I'm a microwave engineer.

And you watch all the blood drain out of his face as his whole career flashed before his eyes.

And he says, Just a minute, please.

So he leaves. And here I am in this little six-by-eight conference room, whatever it was. And pretty soon the door opens and somebody offers me a cup of coffee. And there my blood drained as I watched my life flash before my eyes. [And I thought] Oh, this is how they get rid of their security blunders. [And I said] no, thank you.

So I sit there for a few more minutes, and pretty soon somebody comes in that was apparently several levels higher. He says, oh, yeah, I'm So-and-so, I'm the director of blah-blah-blah. [And I say] Yes.

He says, John, he says, we checked you out. You have every clearance, every access that was necessary for what we told you inadvertently. It was a mistake. Can we forget the whole thing ever happened?

[And I thought], They're going to spare my life. And I said, what happened?

We shook hands and that's the last I ever heard of it.

And here I was out in California, living in California because the contractors had to live in California, and we go to Burbank every Monday, they take us up to the site in a [C-]121. And my mother lived in Connecticut, so sometimes I'd take advantage of my trips back East and I'd run up to Connecticut to see her. So this had to have been, I guess, '64 because the New York

World's Fair was going on. So maybe it was the same trip, maybe it was a subsequent trip or whenever, I went up to Connecticut to see my mother and we go down to the World's Fair.

Now one of these new computer machines that I had to work with the package, not me, I was out there with the old SR-33 teletype machine, that was the input-output on my computer out of the site as well as overseas, but we hadn't deployed at that time. But back at headquarters, their computer that handled my digitized collection had a new concept. It was the IBM [International Business Machines], remember the Ball-o-matic, I think they called it, typewriter. And I looked at that and thought of all the time we spent repairing the stuff we had out on the site, and I was just really envious.

So I take my mother down to the World's Fair. In the IBM pavilion, here they had a typewriter with their new ball I was just saying there. They had this stack of postcards. You could take and write somebody a postcard. So I says, OK, fine, I'm going to do this. And lower case it was English, upper case it was Greek. So that's fine, I'll send a message to the guys that were working with me out at the site. And we had a sterile P.O. [Post Office] box. So in the lower case I did the address. In the upper case, I just take and run my fingers up and down in Greek. I get out to the site and Security met me at the plane. What I thought was Greek was Cyrillic. So it immediately became know as the "From Russia with Love" postcard. And after we chatted about that for a while and they realized what it was and how innocent the whole thing was, one of the comm [communications] people said, John, I told them that all along but don't worry about it. So the "From Russia with Love" postcard was another anecdote of stuff that went on.

But all and all, we took and collected quite a bit of signals collection there in a package called the SIP [special intercept package], and we take and convert the output to a form that we

could transmit back. Art Fischbach is in here somewhere. Univac Sperry. He handled the transmission of it and it used to go back and forth and we collected. For that matter, yesterday when you heard that Denny Sullivan had been hit by a piece of shrapnel actually, I was called to ride down and we met the plane, and riding back up to the Ops [Operations] building with Denny and whatnot, he was a little bit concerned that maybe our ECM suites and whatnot [00:10:00] had not served the purpose to their greatest extent, but I remember telling him, Denny, it worked. You're here.

So that was all part of the ECM suite that was carried as a secondary payload to the photo suite that was carried on the bird.

Are there any questions?

[Applause]

TD Barnes: Thank you, John. As I indicated at the beginning, my group was recruited and utilized a little bit different from the rest of these gentlemen. Actually as Oxcart was ending, the CIA had several projects lined up to continue after Oxcart, and their intent was to create a cadre of personnel to operate Area 51 for whomever the customer was. For example, Oxcart was managed by the Science and Technology Division of the CIA. Our next project was managed by the Foreign Technology Division of the CIA. We actually switched to a different branch of the CIA for the big project. But at the same time, we were starting to do a little preliminary work on Have Blue, the stealth technology, which was still Science and Technology. So we wore several hats while we were out there. I'll tell you a little bit, first of all, how they got our group together. I'll give you a little background on myself and then kind of explain it.

While I was still in the [U.S.] Army at Fort Bliss [Texas], I had attended just about every air defense missile school there was. I'd get out of one, I'd go to school for a year, they wouldn't have an assignment for me, they'd be full up, I'd volunteer for another. So during the course of

this, Bud Wheelon, who was our boss for the CIA on Oxcart, was head of the Project Palladium, trying to evaluate the capabilities of the Soviet radar. The Soviets had just started putting radar in Cuba. And Raytheon [Company] had built the Hawk missile, and I went through the second class of the Hawk missile, must be six months. We were still evaluating the ECM, ECCM capabilities of this missile, so we would take a missile and take the ray dome off of it, put it into the belly of a plane, [and] we would take a sashay at Cuba. The Hawk missile traveled and it followed the radar reflections of CW, Doppler radar. We had a CW transmitter on the plane. We would start illuminating the island of Cuba with the CW, the Russians would turn on the radar and start jamming, and I'd sit there and watch this missile and it would stay locked on, and then if the jamming was working, the ray dome would start drifting off, and I'd sit there and tweak on the electronics. We had all the skin off of it and the electronics laid out here where you could work on it, and then it would snap back in. Meanwhile, we were recording all this data as well to develop a steady system for the Hawk missile.

Well, later on, when I left the service and was on the X-15 project, I was at Beatty [Nevada] and when the A-12 started flying, we would pick up a skin track over in that quadrant of the chase planes. They always sent chase planes out to check the area, and then soon there'd be one of these fast-moving dudes, we didn't know what it was, would follow them. We could track it just in and out, but we knew something really, really fast was happening, and so anytime we weren't on an X-15 mission or XB-70 or one of the other missions, we'd be in there playing with the radar, just sitting there looking at that little area of Nevada, waiting for one of these planes to come up so we could track whatever it was.

This went on for about two years, and then we participated in 1965 in the speed run of the YF-12, and that's probably another story by itself. In fact I'll elaborate on that a little bit.

Johnson was real proud that we had a Mach-3 plane, and he wanted to set a speed record so he could announce it to the world. So he got a hold of Bud Wheelon and I think Jack Ledford was involved in this. I don't think he was a general then. Anyway, they ordered the CIA to conduct a speed run using one of the A-12s out at the Area. The CIA just flat refused to do it. They told the President [Lyndon B. Johnson] to fly a kite. If he wanted a speed run, use the YF-12 that he had just blown the cover on by saying they had it down at Edwards [Air Force Base, California]. And so that's how come the Air Force got the job of running the speed run. Well, being on the NASA [00:15:00] high range, we tracked everything that happened in this part of Nevada, whether it was the B-70, the lifting bodies, we developed the lunar landing modules, it's the stuff out of Buck Rogers. We tracked it. We had every mission imaginable.

Well, anyway, about two years after the speed run, this would be about '67, we started getting some interference on the HF [high frequency] channel of our radio when we were having X-15 missions. So I complained to NASA about it, so they got to investigating it and they came back about a month later and they told us the source of this interference had higher priority than we did and not to mention it again. About thirty days later, then, Mr. John Grace with EG&G knocked on my door and says, We would like for you to go to work for us on a secret project and we think you know what it is. I think they were trying to shut me up because I did know something was going on out there. But like I elaborated at the beginning, I was not cleared and it took a while for me to get cleared and they kept me, loaned me out here and there and whatever.

But I'll tell you a little bit about our group. There was twenty-six of us. Well, some of the EG&G guys were already out there. They were on Oxcart. Well, I went out and joined them in March of '68, right at the tail end. I had played with the YF-12 but not the A-12, and I got there

just in time to see all these guys coming back from Kadena [Air Force Base, Okinawa] to start wrapping everything up. And then they recruited a couple more guys, but I was one of the last ones.

But the reason I was out there, I found out, was the CIA had arranged for one of my NIKE radars down at Fort Bliss to be brought out there. They didn't have an X-band radar out there. What we had out there was just about every radar known to man at that time, including the Soviet. During the Six-Day War in '67, we did a little trade-off with an unidentified country. In exchange for a little bit of intelligence, we got our hands on several MiGs, MiG-17s, MiG-21s, and Soviet several radar, which was some of my toys. I got to play with the Soviet radars and see if I could make them work, and we put them in the array, so we had an array of radar all looking—I'll show you.

Up here, I don't know if you can see it, I'm sorry about the small map, this little curlicue up here, we had a pylon. We called it the Pole. And if you look on the website of the Roadrunners, you will see the A-12 sitting on this pole upside down. Well, what we were doing in Special Projects, we would take all this radar and look at whatever we had on that pole, and later on it became MiGs, it became the Have Blue, everything, because we were just starting stealth technology. The A-12 was one of the first planes that we took that in consideration as we developed it. But we would put the prototype on the Pole. I won't talk much about the A-12; I'll move on because I'm more familiar with the—they had already finished the A-12 when I got there. But we would put those MiGs out there on that pole and we would circle them and look at them with all these radar and we would see the radar cross-pattern of them and it got where we could identify what type of plane we were tracking just through practice and just repetition of

this. We would put maybe an F-4 out there, or everything that was flying. We'd just put anything out there and take a look at it.

Our main project, this was during the Vietnam War, the MiG-21 was giving us a really rough time in Vietnam, so this is an interesting period for us because everyone, Navy, Air Force, everybody wanted to compete with our MiGs out there, and every day we'd have a dogfight. They'd have an F-4 going up and tackle one of those MiG-21s and see if they could outdo it. At first, they couldn't. We finally, through practice and through the technology, and through—we had several projects. We started with Have Drill, Have Doughnut, Have Ferry. Each one of them had a different mission. Some of them were technical and others were physical maneuvering and whatever, the dogfights and what have you.

But that's what our group was doing. Like I say, there was twenty-six of us. When they recruited us, mine was different because I had worked for the Agency before, but all the other guys, every one of us either had a boat on Lake Mead or we had a cabin on Mount Charleston. No exceptions. They interviewed the people for their qualifications, but just as equally they interviewed the families—we all had two kids, all of us that were married—because they knew that we were going to be out there from Monday through Friday at some place our wives had no idea where we were, and they didn't want some housewife calling their senator and say, I haven't [00:20:00] seen my husband in two weeks and I'd like for you to track him down. So they looked at our families just about as hard as they did us. And sure enough, we would go out there on Monday morning and we'd come home on Friday night.

Well, toward the end of Oxcart, actually when we got the Soviet equipment, the Soviets knew it and they couldn't take a joke. They started hitting us with satellites, and somehow, to this day I don't know how they knew, but we'd work maybe two or three months getting ready to

test an object out on the Pole. The night before we tested, they would launch satellites, one every forty-five minutes, to take a look at us. Our security would know what type of satellite it was. They would give us a list and say here's what they launched last night. This is infrared, this is RF [radio frequency] seeking, and just on and on and on. We would sit there sometimes weeks on end waiting for one of these satellites to drop out of orbit, and their orbit would decay, and we would know about when they were going to do it. But that's one of the reasons they kept us out there all week long. Maybe three o'clock in the morning that satellite would fall out of orbit [and] that would be our window of opportunity to go out and do what we wanted to do. But meanwhile any other time, we did not venture outside with any equipment. If we had an aircraft out on the tarmac or taxiing in and one of the satellites came over, we had what you call hoot-and-stroop sheds that they'd run into until the satellite passed over, and then they'd bring it on in and put it in the hangar. But we would shut down all the radar, we shut down all transmissions until that particular satellite was gone. If it was infrared, we didn't care because we could go ahead and transmit, but we couldn't have anything out in the open.

Like I say, I worked with these guys. We worked all week out there. Our group, to keep us out there, all of us were engineering types, we would work eight hours on regular pay, four hours of overtime at time-and-a-half. After four hours we went on double time. We stayed on double time twenty-four hours a day until we went home. We made some big bucks. But that's how they kept the group out there. And I'm sorry about you Air Force guys, I know you did not get double time. They even bought snake boots for us to keep us from getting bit.

There was two of us on the X-band radar that we were not allowed to ride in the same common carrier, on a plane going home, even to the mess hall. They kept us separate because we

were supposedly further advanced than anyone else they had at the time in our fields. But the two of us, to go up to Sam's Club or wherever, we had to ride in separate vehicles.

Talking about the security, how tight it was, my wife had a phone number she could call out to Nellis [Air Force Base, Nevada] and she'd get a hold of some lieutenant and could get a message to me if she needed to talk to me. I could call home anytime I wanted to. I made a phone call home, I did quite frequently to check on the family, and I could tell she was very, very upset, so I asked her, what's wrong? She said, I just had an obscene phone call. I immediately reported it to Security. I guarantee you, within an hour, there was security people with my wife and our children. They stayed there for three weeks until no more calls occurred and they decided probably it was a random phone call. Nothing came of it.

And to continue along that line, when I finally left the project, for five years after I left, every year the FBI [Federal Bureau of Investigation] would come to the little town that we were living in, start talking to all the merchants – we were in business for ourselves – and see how we were doing and any problems, and of course the merchants start calling us to say the FBI is back again. And then finally they would come and knock on our door and they'd sit down and want to talk: You got any financial problems? Anyone try to approach you on anything? And this went on for five years. They would, you might say, debrief and look to see if anything was happening in our lives that would make us subject to blackmail.

Of the twenty-six guys that I worked with, now on the weekends, like I say, we either went to the lake together or we went up to Mount Charleston. We went to the lake. Our entire group would go out there, and we were so security conscious that we would not associate outside of our group. And so we'd play all weekend; we worked all week. To this day, I do not know what some of them did out at the site. We did not talk about what we did. Now we kind of knew,

[00:25:00] of course, because most of us worked in the same building, and if one was working on a computer – we had all kinds of specialists there – and they'd need some help, we'd help them, but you did not ask, what are you doing? What are you building? What is this going to be? You did not do it. That was the fastest way in the world to be kicked out of the project.

I'll talk a little bit about the early days of Have Blue. This started long before the record books show that Have Blue started. And those of you that don't know what the Have Blue was, this was one of the first stealth prototypes they built. They built two of them. They weren't full size, but they later became the F-117, of course, as most of you know, and Bill Park, all of you know him, he crashed both of them, incidentally. [Laughter]

[At this point, there is some conversation between TD Barnes and Wayne Pendleton in the audience. Much of it is unclear due to overlapping voices.]

Wayne Pendleton: Well, I was there forever, but I was there prior to you with EG&G from '60 to '67, so if you got time, I can regale you with some jammers and stuff and the LO aspects of the program.

TD Barnes: Good, good, good, you're next. Anyway, they started bringing this little prototype out in I believe it was '69. We didn't know who was bringing it out. As far as we were concerned, anyone that we didn't know, they were *the* customer. That's what we called the CIA, and it may not even have been the CIA, it could've been Lockheed or anyone, but we didn't know them, they didn't give us their names, we didn't give them ours. But they would come out there and they'd put this little prototype on the Pole and we would start looking at it. And they'd see it and take the little charts and stuff that we produced and they'd leave and about three months later they'd come back out with it and we'd look at it again. And this started long before the stealth program actually, I guess officially kicked off.

Let's see, there was something else I was wanting to tell you. Come on up. While I'm getting my thoughts together, I'll let you come up.

Wayne Pendleton: My name is Wayne Pendleton. I started as a young engineer with EG&G in 1960. I realized at the time that they hired me because the Army had trained me as a radar officer when I was in the Army. They had a Special Projects Branch that Ted talked about because their main business was blowing up bombs at the Nevada Test Site. So I went up in there in 1960 as a young engineer and in 1967, by then I ended up being the project manager for Special Projects. John P shut the place down and it went on for another year and I'll tell you about that in a minute after I give you a little bit of the LO aspects.

The airplane had an LO requirement. Kelly and Lockheed were committed to building it and it had to meet the specific cross-section goals, and it was designed to meet those goals. Two big target goals were Tall King, which is a real bad Russian early-warning radar; it can see the gnat when it flies up over the horizon, and at 163 megahertz basically, and the Fan Song that was alluded to before, the SA-2, which shot the missiles at the airplanes. And so there were goals at both those frequencies that the airplane had to meet, and so the government went to MIT [Massachusetts Institute of Technology] and said we need these kind of skills, and formed one of their infamous companies to design two radar ranges to measure the LO results so they could know if they met them and if it was a ground range. Well, the ground range was on the dry lake bed and it had a bunch of vertical antennas at the south end of the lake, and there was a quarter-mile site which was a reference, one metasphere, and a half-mile out was an inflatable bag where you could put sixteenth-scale models, and then at one mile out was a fifty-two-foot-tall pole, and [00:30:00] feet are significant because you bounce radar energy off the lake and go straight to get more signal back when you do the measuring. And it was designed by Lockheed. Three

destroyer propeller shafts were actually the pole, welded together, to rotate the real article. And they actually put one up there upside down and rotated it so we could measure it. A guy named Luther D. McDonald [sp] at Lockheed says, you know, Kelly knows I got seventeen million dollars on the Pole. We better not drop that sucker. And so it was designed to meet specific LO goals.

In addition, there was some testing done on it to defeat Tall King and I'll just talk to this one because it was so interesting. Westinghouse labs came up with a concept that if they generated an electron plasma cloud in front of the spike inlets, and the spike inlets were a known huge radar cross-section reflector. They were like a big antenna. Like you can see infrared eyes on cats and people, same way with radar with the Tall King. And so the spikes were fully loaded with radar-absorbing material, but they were still huge reflectors. They had these two big spotlights basically looking back at the Tall King radars. Then someone came up with the idea, well, if we generate an electron cloud in front of those, it'll absorb or deflect the radar energy and reduce the cross-section significantly.

And they actually built one. And I forget which airplane, 924, I don't remember that much of the details of which airplanes, but they brought it out to the site and it was really a lab curiosity, filled up the whole Q-bay. I think it had a capacitor on the front end that sucked up every power on the airplane whenever they tried to turn it on. They had to redesign that. But they put a young Ph.D. in charge of it that they had trained, a guy named Nick Demaskos [sp], and he kept the thing going for about three years as opposed to the two. And finally got it to work, finally got it up to altitude, finally got it flown.

And I remember being in the control room and looking at the ground radar that we used to simulate the Tall King. That was that big sixty-foot dish. And the signal was bouncing by at

least 15 dB [decibel] which is a significant reduction in cross-section. The poor operator wasn't briefed. He didn't know. He wanted to tweak up his radar to make sure it was OK, and no, no, no, it's OK.

So we proved it was great and it worked, but no way could we put it on an airplane because you couldn't do anything else with the airplane except carry that. So they mothballed it and I'm sure they learned from the technology.

There's about fifteen hundred pounds of RAM on the airplane to make it smaller in cross-section. And it worked. The plane met the goals, but the radars were so hot, I was amazed as I learned more, that the LO was that much of a concern because it was like fifteen hundred pounds of parasitic RAM by the time they got it on the airplane, because our S-band radar slot, whenever it flew, when it took off, we had a spooky IFF so it couldn't get tracked once it got over 60,000 feet. But we had early-warning S-band radars in the [United] States and they'd track it anytime it went up in the air. There was a NORAD [North American Air Defense Command] site up at Reno [Nevada] and they could see it and he didn't want to launch his 102s and they didn't want to shoot Nikes at it till they finally got them straightened out. And I ran the numbers at that time and yeah, Angel's Peak would see it and our early-warning radars would see it, as would anybody else's early warning radars.

So again, we learned a lot because LO technology did grow and did get transferred to Have Blue as Ted says. If you want to get into that, I can get into that too, but I'll just tell you one more interesting thing. In '67 was when John P said we're going to have to shut it down, and I cried and moaned and groaned about it's unique. RATSCAT [Radar target scatter] was just starting to get built down in Alamogordo [New Mexico] and they were using us as design

consultants because we had a working range and they were building a better one down there.

And then no, no, we can't do that, you know, it isn't in the cards.

But all of a sudden they wanted to use the range between '67 and '68. And lo and behold, the MiG-21 came out there. And I found out later on that we got her from Israel and wanted to exploit it, and so we had a review committee to figure out how and where we can do this, and this one guy, he's Agency, we can arrange it. It would probably be great for this. You guys don't have those kind of facilities. Got them cleared, got them up there, runways, control towers, machine shops, we can build parts if we break them. So they cleared the Air Force FTD, brought them in, and had a real rushed test program because the airplane had to go back to Israel to fly over Tel Aviv in '68 in celebration of the win of the '67 war. So it shut [00:35:00] off about September of '68 so it could get back to Israel, which I guess they did. Didn't have an Internet then to see if they flew it down over Tel Aviv.

But as Ted said, that's when all these funny radars started coming out from the woodwork, again scattered all around the desert. And the politics went on for, oh, another decade before the Air Force finally took over the place.

After the airplanes got sent to Kadena, the Agency had this great range and they were flying U-2s all over it and they were worrying about them getting shot down by SA-2s. They put black boxes in them, and maybe that guy from Sanders build them, and if they detected an SA-2, and the SA-2 had specific signatures, pulse code groups, frequencies that you know you're being tracked, you even know when a missile is being launched, so they could detect when they were locked on with these receivers, and the U-2 would make a left turn to go around the site so it would be out of range of the missiles. And before they went over Vietnam or overseas, me or someone else would go down to Edwards or North Base and put a transponder on the Q-bay door

so it could lock onto it when it came by the site, and turned on a simulator and see if it sought and make its right-hand turns in the sky to avoid the thing. Also, it measured its RCS [radar cross section] to make sure it hadn't gotten badder than it was. Make sure you take that transponder out of there when you get overseas so you don't get tracked by that. And I guess it never did. I wasn't in on that part of the business.

But that was from '60 to '68, like I say, to '67. And when the guy from Sanders was talking about it, it was Dr. Perry [sp] that had the big blast and it was doing the same thing that you talked about, where it was putting enough power to get through the front-to-back ratio, the antennas on the SA-2 missile guidance, so that it could make it zig instead of zag and the PK would go down and the plane would be more survivable.

But that sums it up, unless you have some questions.

Question: There's a view? There's a small one, there's—

Wayne Pendleton: Oh, yeah, there's a picture of the Pole. The Pole itself is a big back scatterer, so you hide it, so it's got a clamshell around it, tapered clamshell. Everybody thought it was a flying wing when it was built, which was a great cover story. And you attach it to the Pole while it was down. It was a hydraulic elevator, fifty-two feet high is what it was, in a twenty-six-foot cube of concrete buried in the lake, a mile from the lake edge. And it had a rotator designed by Lockheed that carved the space out of the airplane, you know, and made it fit into the airplane. And then you put it up upside down so you're looking at it as you rotate it. You take different conical cuts as the mathematicians call them for the cross-section of the airplane versus rotated angle. Then you can tilt it and do the similar type thing. And the half-mile site was an air-inflatable bag so that wouldn't be big to radar, and put scale models on there. And we were in

millions of plots for about five years, and go back to Burbank and try something else and come back and do it again.

Question: Were you out there when we built the Pole out of Styrofoam?

Wayne Pendleton: Yeah.

Question: You might talk to them about that.

Wayne Pendleton: Well, yeah, every range tried Styrofoam, and you can tune them to specific frequencies. I forget which one. The one I remember is that the way you basically calibrate these ranges is you have your standard calculable reference. In those days, spheres were the thing of choice. People like flat cylinders nowadays. And the sphere had to be out in free space so it's pure, and we put it on a Styrofoam pole that had a crank that would go down into the hole in the lake and it'd pop up, you'd measure that, and electronically transfer that to where the Pole is so you'd have a reference to make against your measurements on the airplane.

Question: Let's see if I can find another pole here. We made all kinds of them.

Wayne Pendleton: And there were all kind of sections. Section of the fuselage, twelve feet long. Tail all by itself. The tail was loaded to be transparent. It was full of loaded material so the Tall King would have less of a thing to see. And a lot of work was done and a lot of knowledge was gathered, but the ground radars just get so darned powerful, it's pretty hard to defeat them. And Have Blue was designed so that the shooters couldn't track it. Some of the early warnings could see it pretty well out there, but transferring it to a shooter and getting it shot down was [00:40:00] very, very difficult. Couldn't do it. So it made many sorties against all these crazy radars Ted was talking about, too.

Question: Here's another pole shot.

Wayne Pendleton: Yeah, that's a great shot, and that was one of the real airplanes. I forget which one it was. Murph might remember.

Audience: I think it's a 122.

Wayne Pendleton: One-twenty-two sounds like the right number. Yeah.

Foxy [William J. Fox] was there doing a lot of this stuff with me later on, too.

On Have Blue. Well, no, there's a few others, too. But I'll never forget that big chunk of X-ray generator. They had an X-ray tube buried in the chines with a hole in the anode so that when you shot the electrons at the anode, they'd go flying out and end up making a big sphere that you can't see, of course, and you'd think the higher you go in altitude, the more they'd be recombined because of the thin air space, but apparently not. The higher you went, the bigger the sphere got, the better it hid you. And it was pulsed. It wasn't there continuously. But it took up the whole Q-bay. The airplane couldn't do anything else except defeat Tall Kings.

Question: One of the other photos you have, model on the Pole, had these big cylinders with a point coming out where the exhaust would be. Can you talk about that?

Wayne Pendleton: Yeah. And Pete probably can give you more info. Someone came up with the idea that if you doped the fuel with barium, and I think barium emits electrons, your plume cloud will be absorbing as opposed to reflecting, so it will reduce the cross-section aft of the airplane, or the aft cross-section of the airplane. So Lockheed built these big radar-absorbing—they looked like—in those days the radar absorbents was basically horsehair that was loaded with carbon, two-by-two sheets typically, and you'd dope them with different values of resistance of carbon to get different attenuation levels. And so yeah, you see this picture with these big cigars sticking out the back of both exhausts, and that was to simulate the barium radar absorption. And I think the engine people tried squirting barium in the fuel and all that, and it

was disastrous. It didn't work. They also talked about painting the airplane with, it wasn't barium but it was another radar-emitting compound, and it would've helped but the price was ridiculous, so that never went anywhere either. Pete, do you know anything about the barium? OK. Outside of the classified thing that we won't talk about? Yeah, lower-GI barium.

OK, then, fine. Glad I could regale you a little while.

[Applause]

TD Barnes: Well, we've gone overtime about twenty minutes here, so I guess we better vacate this place so they can get us ready for the banquet.

Yes, I want to express some thanks to Frank over there. He brought in some material for us that we'd been looking for for quite some time, and I want to thank him for surrendering it, and at the same time, as I did in the other side, plead for you guys, you got anything in your footlockers that will add to the history of the Roadrunners, send me a copy of it. Thank you, Frank, for—

Frank Molinaro: This is from AERO Corporation—

TD Barnes: Yeah, it's from the AERO—

Frank Molinaro: —before that oil well—I don't have all the details on it, but here's the guy that surrendered it today under duress, and—worked on this thing, this good-looking gentleman over here, and great golfer—also worked for the same company. You've got a couple of us—

Audience: One thing. We're not from Buffalo [New York].

David Bennet: I don't know if you understand that. Nobody's from Buffalo. Oh, can I just say something real quick? We were working there and Charlie and Dick Wilson, they were very nice to our guys. We appreciate that very much, Charlie.

TD Barnes: Yeah, we missed including a lot of different guys out there.

Yes. There you go. Thank you, folks.

[Applause]

[00:44:38] End Track 1, Disc 2.

[End of Roadrunners Contractors Forum]