NASA Santa Susana Field Laboratory Oral History Project
Edited Oral History Transcript

William Vietinghoff
Interviewed by Joy D. Ferry
Los Angeles, California – 7 May 2015

FERRY: This is recording. This is Joy FERRY; I am with Lori Manes, interviewing Bill Vietinghoff. It is May 7th, 2015, at about 11:06 a.m. And Bill, you are okay with this being recorded, right?

VIETINGHOFF: Yes, I am. I'm in total agreement.

FERRY: Okay. Yes, so we are here to ask you some questions about the NASA SSFL laboratory, the Santa Susana Field Laboratory. So let's just kind of start at the beginning with your pre-NASA experience and kind of get a little info from you on how you got involved in all of this in the first place.

VIETINGHOFF: All right. I'll start by talking about what I did before I got involved with any NASA programs.

FERRY: Yes.

VIETINGHOFF: I hired in at Santa Susana in July of 1953. At that time it was owned by North American Aviation. It was called the Aerophysics Laboratory. Later in 1955, the Rocketdyne Division was formed, and it became more well-known as the Santa Susana Field Laboratory. Sometimes it's been called the Propulsion Field Laboratory, but most of the time it's Santa

Susana Field Laboratory. I was hired in from college- I graduated from Northwestern in 1953, and was living in Chicago, but I was married when I was in college and I moved to California in 1953, and started up there at Santa Susana. It was interesting, I'm a chemical engineer and I thought they might have me involved with propellant chemistry, but instead they assigned me the task of analyzing high frequency chamber pressure recordings that were taken on the Navaho engine and the Redstone engine being fired in the Bowl Area. Combustion instability was a major problem at that time. They were trying to determine both the phenomena and the causes of instability. So my first jobs were within the research department, preparing actually, Polaroid pictures of the face of what was called the Panoramic Sonic Analyzer that did what was called a Fourier analysis, that is, it determined the amplitude and the frequency of these high-pressure instability waves inside the rocket engine. That was my first job.

FERRY: So, that was with Rocketdyne?

VIETINGHOFF: That was with Rocketdyne, yes, of course. But it wasn't called Rocketdyne at the time. It wasn't called Rocketdyne until '55. It was just a division of North American Aviation. Then, later on in 1954, I was firing a small 150-pound thrust rocket engine that had, actually, a glass combustion chamber through which we were able to photograph with a high-speed camera the fluctuations of the flame inside the engine, trying again to establish the cause and possibly the cure for instability.

FERRY: That was at the Santa Susana Field Laboratory?

VIETINGHOFF: That one took me up until 1955. And then in 1955, again, this is before I got involved in any NASA projects, I was transferred to the large engine development group and North American had the contract to design and build the Atlas engine which consisted of two boosters and a sustainer engine designed for the Atlas missile. So, I was firing those engines. I was the development engineer assigned to the Alfa area, which is now being administered by NASA. The Atlas engine was being fired on the Alfa test stands. There were two boosters and a sustainer. They were fired individually on the Alfa stands. I was in the development group. We'd specify the configuration of the engine, the instrumentation to be used, and the nature of the test to be conducted.

The test group had the responsibility to mount the engine, provide the propellants, the instrumentation, and the sequence of events that was required to conduct the test. Then we would get the data, analyze it, and determine if the engine was running properly and meeting specifications. I may not cover all the subtleties, but please ask me if there are some other questions in connection with that.

FERRY: So, you mentioned that you were working on the Alfa test stands. Did you work at any of the other test stands during that time?

VIETINGHOFF: Eventually, yes. The Atlas test stands, excuse me, the Alfa stands that we used for the Atlas, were slightly smaller stands. Later they built the Coca stands. We are able to put the complete Atlas cluster on the Coca stands. That consisted of two booster barrels, as we called them, and a sustainer. The complete cluster was too large at that time for the Alfa area. So, we were testing a complete Atlas cluster on the Coca stands, and that was maybe through 1958, and in '58 I was transferred to Canoga Park for flight support of the Atlas missile which has been used for other types of missions. For example, it put John Glenn, the first American, into orbit in 1962. That was in the Friendship 7 capsule.

VIETINGHOFF: But those were all pre-NASA projects.

FERRY: Yes. So, how did you end up working with NASA?

VIETINGHOFF: Well, in about 1959 they transferred me to the F-1 program. It was just getting off the ground. I was the lead engineer in the F-1 development group, and our job was to start the initial planning and determine the design requirements for the F-1 engine. And, for example, one of the assignments was designing the start sequence. One of the hardest things about a rocket engine is starting it. You have to do a lot of thinking and calculation to determine: when you must start the gas generator, which is going to run the turbine, which is running the pumps, and when you must open the main propellant valves in relation to those timings, to bring the propellants into the combustion chamber. The F-1 used RP-1 or kerosene, high-grade kerosene, and liquid oxygen. My group – and I forget how many people were under me – I was not the supervisor, but I was the lead engineer – was looking at all the requirements and instrumentation, and we had to develop the start sequence. I was working with a fellow named Bob Biggs, who actually did the hard work of figuring out the sequence of how the engine would start. We had to deal with all these variables that I mentioned. And we did a very good job. He did a very good job. In fact, when we actually got to fire the F-1, in a smaller version up at Santa Susana, we compared the traces of the actual chamber pressure build up in the combustion chamber to the one we predicted, and they overlaid very well. So, we did a good job of learning how to start the F-1 engine.

That's when I was working on a NASA program. That continued through up until about 1963. For example, as I mentioned earlier, one of my jobs was to supply the engine interface requirements because in order to test the F-1 you need a very large, strong test stand, which they built at Edwards Air Force Base. I worked with a facilities engineer named Jim Bowman, and I supplied him with the drawings and other requirements for what the stand would have to do to accommodate and properly fire the F-1 engines.

So, that was my involvement up until about 1963. Then I was transferred to the Lance program, which was a 75-mile ground-to-ground Army missile. We fired that in the Delta area, so I was involved with testing in the Delta area on the Lance missile. That probably went until about perhaps 1966, something like that.

FERRY: So, just going back a minute, when you were testing out the F-1, you helped – you were part of the design of the test stand that was used?

VIETINGHOFF: Yes. Well, the facilities engineer actually designed it – you're talking about the test stand at Edwards?

FERRY: Yes.

VIETINGHOFF: I supported the facility engineering people. Designing the test stand was their job. My job was to tell them what was needed – give them the drawings. For example the ducting on the test stand has to match the ducting on the engine. They have to have information on the bolt spacing. And then there were a lot of other requirements like how much instrumentation, the electrical power to the engine, the need for helium or gaseous nitrogen. All those are called interfaces. I had to dig those all up and turn them over to the facility engineers who were designing that test stand so that it would meet the interface requirements to fire the engine properly. Apparently I must have given the right information because it worked.

FERRY: Okay, so, yes. Sorry for interrupting you, so, go on.

VIETINGHOFF: So, as I said, about 1963 I was off the NASA program and began working on the Lance, which was an Army project. That lasted up until about, as I said, maybe 1966 or so. Then I was transferred back again to the Saturn program, which was a NASA program. We were flying the Saturn, as you know, with the five F-1 engines, and getting ready, you know, to go to the moon. I was involved in the flight data acquisition, and I was working in a performance analysis group. We had to get flight data back from the Saturn launches to see if the engines, the F-1 engines, were performing properly. And, in fact, confirm if the other engines, they used a J-2, if those engines were performing. It was a major job after every launch to get back all of this data as quickly as possible. You'd think it was a simple job, just ship it back. But it was not. Sometimes the boxes, the crates with the data, were just sitting on a dock somewhere. It was my job to find out where a box was sitting and get that box shipped into Rocketdyne in Canoga Park so we could analyze the data. It wasn't sent to us electronically. Nowadays, I'm not even familiar with how that is done. I'm sure they have very sophisticated systems where the data becomes electronically available very quickly. But in those days we were waiting for boxes of paper to come in. I had to think of clever ways to get the boxes. For example, you're familiar with bumper stickers that people have on their cars. You know, maybe in a fluorescent green. I had special stickers made that they put on the boxes back where they has acquired the data at the Cape, so that when the boxes were on the dock, we'd know which were ours. They'd give them special priority. So, those are the kind of things I was involved with, getting the data from the Saturn program. That lasted until about 1970 or so. Then things were going downhill at Rocketdyne. The Saturn program was cutting back because we had reached the moon in 1969. The major part, believe it or not, of the effort at Rocketdyne was tapering off. So, thinking that I might be laid off, I took a job with the Litton Company. I was working on their ship program up until 1977. By then Rocketdyne got the contract for the space shuttle main engine, a NASA program. And they asked me to come back.

FERRY: Here, to Santa Susana?

VIETINGHOFF: Right. Well, there was testing going on at Santa Susana but they hired me to work in Canoga Park.

FERRY: Okay.

VIETINGHOFF: So, I was working in Canoga Park on the space shuttle main engine starting in 1977. You know, again, the basic requirements are the 101 things that have to be resolved to get it working.

FERRY: Yes. So, where were you working on the space shuttle main engine at?

VIETINGHOFF: In Canoga Park at the Canoga Park Avenue facility. They also have a De Soto facility. I was working at the Canoga Park facility on the space shuttle main engine program. And as I said, it started in 1977, and I was working on that program right up until about 1979, and then I was transferred. It seems like the moment you get good on a program they steal you and put you somewhere else. So, in 1979 I left the space shuttle main engine program and went to work on stage IV of the Peacekeeper Missile at Canoga Park.

But, again, as I've mentioned earlier, while I was working on the space shuttle main engine, I worked on those Incredible Facts that the communications department wanted to send out to the newspapers and magazines, and television stations. Because the space shuttle engine was a very unique, very powerful, and a very dependable engine. It had variable thrust, for example, and of course it was using liquid hydrogen for fuel. That was one of the key things. There’s an extreme temperature range on the shuttle engine between the temperature in the combustion chamber, which was 6,000 degrees, higher than the boiling point of iron, and the extremely cold liquid oxygen and liquid hydrogen propellants. So, it was a major design challenge to for them to accommodate all those variables.

FERRY: Gotcha. Yes. So, let's see. So, since then you went on to be part of this – a senior engineering specialist?

VIETINGHOFF: That was my title most of the time, engineering specialist. Later, it became senior engineering specialist.

FERRY: So, did you work at Santa Susana Field Laboratory during that time?

VIETINGHOFF: Well, what would happen is things would come up where I might travel up there, but I wasn't actually stationed there. As I said, from 1953 up until about 1958 I actually had a desk at Santa Susana. But later I was transferred to Canoga Park. For example, when I was on the Lance program, I spent most of my time up at Santa Susana in the Delta area. But my desk, if you would, was in Canoga Park.

FERRY: So, let's talk about some of the time that you spent at Santa Susana, during that time period from 1953 to 1958.

VIETINGHOFF: Yes.

FERRY: Maybe you could just elaborate some of the things that you did there, and what it felt like to be part of that, and to be working there?

VIETINGHOFF: Right. Yes. In the beginning, even in 1953 when I was doing the instability research I was working in the office. I'd go out to the test stands. My desk was at one end of Santa Susana, but I'd try to hitch a ride to get to the test stand. As you know, you weren't allowed to drive your car on company property. If you've been up to Santa Susana, you know it's quite a distance from Area I to Area II.

MANES: Yeah.

VIETINGHOFF: The office where those modular buildings currently are is a long distance from the test stands. You were not allowed to drive there. North American had purchased a surplus World War II ambulance, and it was painted blue. It was probably the noisiest vehicle in the world.

You'd go out in the road – you're familiar with the road Lori – and try to hitchhike a ride, hoping the ambulance would come by. We'd jump in the back of the ambulance, and it would take us out to the Alfa area. But other than that, if the ambulance wasn't driving by, you'd have to walk there. That's very beautiful up there, as you know, with animals. And even back then, we were always concerned about scorpions, well not scorpions, but tarantulas and snakes. But it's a beautiful place to work.

But you have to remember: not only North American, but America had never built any rocket engines of that size. There was some experimentation going on. North American got this contract to build the Redstone engine, and also the Navaho engine. They were being designed and built by a company that had normally built airplanes. North American built more airplanes than any other company during World War II. So, the rocket engine reflected aircraft design practices at that time. We were following advice from the German experience. There were two gentlemen working at Santa Susana who had come over with Wernher von Braun in Operation Paperclip. There were about 100 or so German engineers and scientists from Peenemünde who were brought over to America. Two of them were working up at Santa Susana: Walther Riedel, whom I got to see, but I never worked with, and another gentleman named Dieter Huzel. He was a very brilliant engineer who worked on the German A-4 engine, and I got to know him. We were using their advice in the method of the testing in the Bowl area on VTS-1, vertical test stand one, and using their experience on how to deal with problems on the engine. We were capable engineers, but you have to remember, there was no textbook on the subject. There was nothing that we ever learned in college about what you do with a rocket engine problem, you had to look at the nature of the problem, and use engineering skills and judgment to figure out what the next step was.

Of course, at Santa Susana, we didn't build or design hardware. We were sent an engine, and told, “Fire it.” If you had a problem, the word would have to get back to North American, say at the Slauson facility, to the designers, to make that change. It was a very enjoyable job, but it was extremely stressful. I didn't work on the Redstone engine or on the Navaho engine, but I know on the engines being fired in the Bowl area, there was a great deal of thought put into what pressures were needed throughout the system, and what were the sequences of the valves. There were no computer programs to tell us how to do that. Nowadays they have what’s called an engine balance, where you can put in the characteristics of the rocket engine, and it'll tell you the flow and the pressures throughout the system. In those days, we didn't have any computer engine balances; we didn't have any computers. We used slide rules, and we had notebooks with little hand-drawn charts with plots of flow versus pressure relationships.

So, to answer your question on the tone of what was going on, there was a great deal of attention given to selecting the correct valve timing and pressure parameters, but also a recognition that we weren't 100 percent sure that what was being spelled out on the test requests that we’d turn over to the test group would ensure a safe test. You have good wishes, but there were always these many stressful periods, because at the moment they'd press the start button, you really weren’t sure that the test would be successful. We're talking about very expensive equipment. No one wanted to be responsible for blowing it up, but in spite of that, things happened. Because it was beyond our understanding at the time, as smart as we were. As I said, there were no books on what you have to do to ensure a good rocket engine test. So when things went great, there was a sense of elation that you probably don't get at other types of jobs. There’s a sense of satisfaction. At the same time, when things went wrong, it ruined your day. Yet, as tough as it was, I'm sure everybody looked forward to going to work the next day. It was an exciting period of time.

Nowadays, I'm sure there are more sophisticated ways of setting up an engine and firing it. But in those days, we recognized that we were dealing with an extremely powerful piece of equipment, and we weren't 100 percent sure that what we were doing would work each time. So, I'm trying to answer your question, what was it like in those days? We spent a lot of time in our group discussing what the changes were going to be from one day to the next. It was not routine in that sense. In addition to adjusting the setup, there were a hundred and one other problems, like we might be lacking a bolt. The engines, as I said, were designed perhaps like airplanes, but they produced a tremendous amount of vibration. Bolts would vibrate loose, and of course there was overheating. The pumps might be rubbing; the turbines might be throwing blades. We were learning these things as we went along.

FERRY: So, it sounds like there was a lot of uncertainty mixed in there, with a lot of excitement, and-

VIETINGHOFF: Yes, yes. It was, as I said, a very engrossing type of job because we knew we were learning things that no one else knew. Our engine was certainly much more powerful than the one that the Germans had built, the A-4 engine, which was a remarkable piece of engineering. It was called the Aggregate 4. The engines von Braun had built had a thrust of 56,000 pounds. From that engine they modeled the Redstone engine that was being fired in the Bowl area and that's the one I was getting data from. That had about 75,000 pounds of thrust. Then they went to the Navaho engine, which I think started out at about 126,000 pounds of thrust. Of course, ultimately, we built the F-1, which had 1.5 million pounds of thrust, each engine. So, when NASA launched the Saturn V, there was 7.5 million pounds of thrust in the first stage. It's inconceivable, but it was done.

FERRY: So, how did you feel about successful launches, having been part of designing the engines and testing them?

VIETINGHOFF: Yes. That's the thing. You knew that it was important, because in the early days the vehicles weren't man-rated like they were later in NASA programs. So, now you have to make them even more reliable. But we were concerned that whatever we were doing had to be as perfect as we could make it because the vehicle had to be successful. I don't think we cut any corners. Of course we tried to communicate to the launch site what you have to do to make sure the engine is serviced properly.

Here's a related experience I had on the Atlas program. I was flight support in 1958. I'd be in touch with our Rocketdyne engineer at the Cape. He would call me if they had problems with the Atlas engine. You know – if it was being used for an experiment or maybe there was a special mission. I don't think they were launching satellites yet.

But I got a call from our representative at the Cape in the middle of the night in December of 1958. It was about 1:00 or 2:00 o'clock in the morning. It was a fellow named Fred, and he said, "Bill, we have problem." I said, "What is it, Fred?" I'm standing there in my pajamas, and I was living in Canoga Park. He said, "We have a launch planned for tonight, but we have a leaking main fuel valve on one of the booster engines." I said, "Well, change the valve, Fred." But he said, "Well, we have a very short window, and we have to get it off. We don't have time to change the valve." I said, "Well, then, you can't launch." He said, "But this is a very, very critical launch." I said, "What's the purpose of this launch?" He said, "I can't tell you. It's secret." I said, "Well, you're boxing me in Fred, you're telling me it's very important." He said, "Yes." He said, "If anything happens on this launch, your name and my name and Rocketdyne's name will be mud." I said, "Well, then, what is the leakage rate?" He said, "I'll check, and call you back." So, maybe a half-hour later, again, in the middle of the night, he called me back and said, "We have this many drops per minute." Fortunately, having worked on the test stand at Santa Susana, I encountered that problem. Again, there was no book you could go to that tells you what you do. I couldn't call the President of the company, nobody knew the details; I was the responsible person. Fred said to me "Well what does Rocketdyne want to do?" Rocketdyne was Bill Vietinghoff at 2:00 o'clock in the morning. I listened to him, he told me how many drops a minute they'd found using their way of measuring it. Thank goodness, I had run across that problem in my experience at Santa Susana. I thought about it, and I said, "It will be okay, Fred; you can go with it." What happens if you get too much leakage from the valve, it goes into the thrust chamber nozzle coolant tubes, and when you start the engine, there's going to be fuel there that shouldn't be there, and it's going cause a hard start. If you have a hard start, you could trigger instability, and you can blow up the engine. So, I gave him my okay to go ahead and fire the engine the way it was. The next morning I picked up the newspaper and it said the launch was called project SCORE. They launched an Atlas vehicle that released a communications satellite, the very first, that circled the Earth, and there was a Christmas greeting from president Eisenhower transmitted to the world from the satellite. So, I had sort of crossed my fingers; I said “Thanks.”

FERRY: Thank goodness that went well.

VIETINGHOFF: That was not a NASA program, but that's the kind of thing that I learned working at Santa Susana. You know, if I hadn't worked there, I wouldn't have known how to answer that question.

FERRY: Yes.

VIETINGHOFF: We might have had to cancel the launch, and the whole thing would have been a failure. So those are the things you learn on the test stand, peculiarities about the engine that don't fit neatly, as I said, in any procedure that you can write. You just have to live it, and be able to comment.

FERRY: Yes, and it was all part of the space race.

VIETINGHOFF: Right. The same thing applied to any engine that was being fired for NASA. There were all kinds of little temperamental things that an engine might exhibit. To become familiar with them you have to be there, maybe be in the control center when they test, look at the data, observe what's happening before, and during, and after the test. That was the value of Santa Susana. There were many people like myself on NASA programs that had an opportunity to learn these little peculiarities that engines exhibit. There are textbooks I can show you with equations on how to relate chamber pressure to thrust, but they don't tell you how they deal with little problems that come up like that leaking valves. You sort of have to make frequent judgment calls. For example they would run torque tests at the pump before and after a test. There's no 100 percent rule, but you had to judge whether or not the torque and the amount of engine use indicate there might be an incipient bearing failure that's coming up.

FERRY: So, you mentioned that story about hitching a ride on the ambulance.

VIETINGHOFF: Yes.

FERRY: And I was just wondering, if you had any other memorable things that used to happen out there?

VIETINGHOFF: Oh, yes, many. As I've said, the office was crowded. We had a very cramped working space in the building. There was a lot of engineers and other people, all types, not just engineers. If you have ever seen pictures, the desks were next to each other- there was just enough aisle space. We didn't have nice cubicles in those days where you had privacy. We shared a telephone, and it was on the little swivel. So when the phone rang, they'd pick it up and say, "It's for you," and they'd swing the phone over to you. Of course, we didn't make any personal phone calls on the phone. If you'd wanted to make a personal phone call, you had to go out to the phone booth, and there was one over by the gate.

FERRY: So, what building was that? That all the desks were in - that you worked in?

VIETINGHOFF: Well, there was an office building here that is now replaced by these modular rooms that Lori knows about. But there were a lot more buildings in Area I than there are now.

There were a lot of visitors that would come up to see these firings. I didn't get to meet them because, in my job, I was in the research area, in a little wooden building called the vibration shack. I had this Panoramic Sonic Analyzer, and then a tape player, an Ampex tape player, on which I would play the tapes that were recorded. They would record the tapes out at the test stand, Vertical Test Stand 1, and deliver them to me.

So, I was out of the loop; I got to miss some of the other activities going on. Charles Lindbergh came up to witness tests. James Stewart, the actor, came up to see a test. He was I guess a Colonel in the Air Force at that time. James Doolittle came up. He was the famous Air Force General that flew the B-25's that bombed Tokyo. Remember, in the movie Thirty Seconds over Tokyo; that was Doolittle, right? He came up to see tests. Von Braun used to come up there a lot. He wasn't working for Rocketdyne, but he would come up as a consultant. I never got to say hello to him, because I'm out in the boondocks.

As I said, I was trying to think of some other memorable things. It's just that it was a wonderful place to work. Lori can tell you, it has beautiful rock formations and trees.

For example, before we'd get ready to fire they'd notify us, and we'd either hitch a ride or walk down the road to the test stand. They would put up barriers so that people wouldn't just wander into the test area; the fire trucks would come up. And they'd be dropping propellant into the engine. They had to let it sit a while because of the liquid oxygen, the oxidizer that was used in most of the engines. If it gets a little warm, it may actually start to boil off. You don't want gaseous oxygen at the pump inlet, because once the pump starts, it could cavitate, and you could trigger instability. So, we'd be waiting for this, to get word. They'd watch the temperature at the pump inlet, and when they felt it was cold enough, they would announce it. Then they would clear the area. We'd either go into the control center or we'd go to an observation area. And the deer would come out and stand on the rocks. There were some herds of deer. It always amazed me. You'd think that the tremendous noise of the engine would frighten them away because it's not only the tremendous noise, but also the pressure waves. If you have ever witnessed a test – and I wish everyone in the world could witness a rocket engine test – it's an experience you never forget. We used to like to be outside, to hear, and see, and feel these pressure waves. But I always wondered why it didn't scare the deer away. We'd go to the control center, but the deer would stand up on the rocks and watch the tests. They were fascinated,

FERRY: They were interested in what's going on.

VIETINGHOFF: We had, at least on the Atlas program, two shifts working because it was a very high priority program. I think it was either America's number one or number two defense priority. We had two meteorologists who worked at Santa Susana. Even though they picked Santa Susana for its remoteness, people said, "Why did they pick this area?" One, it was close to communities. It had access to people, engineers who worked, say, in the San Fernando Valley. They could have built it probably in the Mojave Desert, but who are you going to get to work there? So it had access to not only engineers and other people who they needed, other skills for all the departments, from the San Fernando or Simi Valley. Although the Simi Valley at that time wasn't as populated as it is now. And they had suppliers in the San Fernando Valley. They needed a lot of suppliers all the time, for all kinds of tasks. They felt that the Santa Susana area was perfect because it had these canyons, and they figured the structure was ideal. The formation of these canyons where all the test areas were, the Alfa, Bravo, Coca, Delta, the Canyon areas, provided a natural means by which the sound would be transferred up into the atmosphere. Those sound waves were being heard, say, in the San Fernando Valley, and people wondered, "What's that rumbling sound?" But under certain atmospheric conditions, they were even louder. So, the meteorologists that were resident at Santa Susana would tell us, in some cases, we were not allowed to fire because of the atmospheric conditions. We'd have to get the okay from them. So, that was another consideration.

Of course, a lot of people in the surrounding communities really didn't know what kind of testing was occurring. They knew that Rocketdyne that was firing at Santa Susana, but Rocketdyne at Santa Susana had what was called a Component Test Lab, CTL. They would fire just gas generators that burned propellants; they burned the kerosene and liquid oxygen at a very low mixture ratio; the mixture was very fuel rich. Now, once they had done that, they had to vent the exhaust gases into the atmosphere. And because they're very fuel rich, and they didn't want to just vent them, so they would light them off and burn them. Like a Tiki torch. You may have seen pictures of it.

But when they're running a turbine test at night on the second shift, this ignited exhaust flame would be very brilliant. It wouldn't make any noise, but it'd be a brilliant flame. People in the San Fernando Valley could see this light, especially when there was a cloud layer. It would reflect off the clouds, and here would be this very bright pulsing light. People actually thought that maybe flying saucers were landing up there. Seriously, they actually thought there was something going on there. After all, it was a secret facility. You couldn't just go in and watch. So, people were convinced that there was something going on up there, because here would be this mysterious glow. The rocket engine tests themselves produced a tremendous amount of noise, but they didn't produce much light. So, even at night you didn't see too much light, but you'd hear this rumbling. And again, more rumors; they were convinced. Some people actually thought, too, that we were launching missiles from there. There's no capability at Santa Susana to launch a missile. You can't, that takes a special structure.

But people believed that there were launches. In fact, when I was having my hair cut at a barbershop one day in Canoga Park, the barber asked me where I worked and I told him, "At Santa Susana, with the testing." He said, "Oh, yeah, I know. I see them fly over every once in a while." He thought that what he saw were launches (missiles) from Santa Susana. It was mentioned to me that people were always talking about what's going on in Area 51 out in New Mexico or somewhere? Or is it Nevada? Yeah. Well, I was told that Santa Susana is Air force Area 57. So, when you tell people that, they nod and they'll say, "Oh, yeah, now we know what's going on."

FERRY: So, a lot of mystery and curiosity?

VIETINGHOFF: Yes, right. Of course, we weren't allowed to mention the programs at Santa Susana and certainly not our program on the Atlas, but this secrecy was not required later on NASA programs. But in 1955 we were not allowed to disclose what we were working on. You were not even supposed to tell your wife. And it was a no-no to wear your badge outside of the facility. Nowadays, when you go into grocery stores, you see people wearing their badges from where they work. Maybe they work for some health organization. But we were told, "Do not wear your badge. We don't want people to know you're working here. They might start listening to your conversation, or wondering what's going on."

FERRY: Yeah. So you-

MANES: What did it feel like to work in a place that you had to keep quiet, how does that...

VIETINGHOFF: Well that's a good question, because we always were wondering to what extent conversation about the job was to be avoided. You know, it's a natural tendency to talk about your job when you leave work. Like, "Something happened today." But they discouraged that. You were told not to talk about anything you did. In fact we had periodic security briefings. Our security department would call us together, again and again, and remind us of how we were supposed to conduct ourselves, and what we could talk about.

One of the funny things was that in the Los Angeles Times, for example, there was a staff writer named Marvin Miles, and he must have had a pipeline to the Air Force. Because when we'd run a test, the next day or so in the paper, there'd be a story that the Air Force was able to achieve a 10-second test on their Atlas engine. We asked our security department "How can this be? We can't report that. Yet, we pick up the morning paper, and here is this article about the progress that they're making on this program." He said, "Well, maybe the Air Force decided to release that information, that's their business. But as far as you're concerned, if somebody walked up to you and said, 'What about that,' you neither confirm nor deny." Those were our instructions. You neither confirm nor deny.

FERRY: Yes. So, you mentioned you moved your wife over here too?

VIETINGHOFF: Well my wife knew I worked at Rocketdyne, she'd always complain, "You never tell me what you're doing."

FERRY: Were you going to say something?

MANES: Oh, I was just going to ask you, you were mentioning now you're doing all these things in the midst of the space race-

VIETINGHOFF: Yes.

MANES: at least early on. And you were working for a larger goal. You couldn't necessarily share that with people. So, how did that feel? You must have connected with the people that you work with, and talked about that? Well, what did it feel like to be working in that environment? Doing something on such a big – you mentioned it was the number one or number two defense priority at the time.

VIETINGHOFF: Yes. Correct.

MANES: How did it feel to be working on a project that was that significant?

VIETINGHOFF: I do believe that we recognized the importance of what we were doing. Of course, in spite of the fact that you may feel very dedicated, you ran up against problems that were bothersome, problems that you felt shouldn't have been there in the first place. And human beings being human, sometimes we may not have taken the right steps. For example, you're waiting for some spare hardware, and somebody dropped the ball, maybe didn't place the order soon enough. Those things happened regardless.

But again, I always felt that we operated with the understanding that this was very serious business, and we were always reminded of our goal. I remember John Tormey, who was my boss in the research department. He was the head of research when I first hired in '53. In one of the staff meetings he had said, "You know, we've got to realize the importance of the work here." He said, "Our days are punctuated by the sound of these tests." He said, "We're-in a critical business." He couldn't emphasize enough "We're in a very important period; we should not treat this work as routine. What you are doing here is a very expensive, very dangerous, and we've been chartered to do the work. We've been blessed, if you would, even though it may seem like a problem. We are fortunate to be in a position to contribute to this effort." So, again, we took everything very seriously, and tried to do the best. But at the same time we're trying to do these things, we could see that strange things happen, that are foolish, that didn't create any big problems, but were just, like I say, routine annoyances like in any job you have.

FERRY: Yeah.

VIETINGHOFF: I can't think of any other examples. We didn't do anything really goofy. But, for example, they'd bring a thrust chamber out from the pretest building after they'd put the instrumentation on. It would be brought out on a pallet using a forklift, and brought up to the test stand, and then they'd mount it to the test stand. Can you visualize that? Well, if the operator wasn't paying attention when driving the forklift, he might have the forks too high. Instead of going under the pallet maybe, he rammed the forks into the thrust chamber, and, of course, ruined it.

MANES: Yeah, wow.

VIETINGHOFF: And then we would go, "Oh, my God," because we were trying to get a test off.

MANES: Yeah.

VIETINGHOFF: We had two shifts. And we'd try to get a test off maybe on the first shift. We wanted to have the pride, the satisfaction, of getting off a good test. But sometimes problems would come up: instrumentation wasn't working right, maybe we needed to change a part. We'd keep a log of what we did during the day, and when, say, 4:42 pm came or whenever we reached the end of the shift, all this information would be there, and we'd leave it for the second shift to come in. Then they would pick it up from there, and they would of course get the glory and the credit for getting the test.

What would happen is this: I was living in Canoga Park. Let's say that we figured that they'd get a 10 or 30-second test off, as planned, on the second shift. Then we figured they're going to shoot for about 7:00 o'clock at night. So as it got close to 7 o'clock – and I was living in Canoga Park – I'd go out and I'd look at my watch, and I'd stand in front of my house. At 7 o'clock I would hear this roar, and I'd time it – seriously. I knew it was supposed to be a 30-second test. If I got 30 seconds on my watch, I knew that tomorrow morning things would be wonderful when I walked in. We'd be given the data from the test that night. But if he test went only13 seconds, you knew that there was a premature cutoff. And I knew then at 7 o'clock at night that tomorrow was going to be a bad day – seriously.

FERRY: Yes. So, you were part of the first shift?

VIETINGHOFF: I was prepared for a bad day.

FERRY: You were in the first shift though?

VIETINGHOFF: I was working the day shift. And we'd come in and we'd look at the log, and read it. "What happened?" we'd ask. Why didn't-the test go the planned duration?" We were thankful that the engine was still on the test stand. There were a lot of limits assigned to the engine measurements, a lot of what were called "red lines." The mechanics, the test engineers, and the technicians in the control center had long cords with a little button at the end. They'd be looking at a chart, many of them. And on some charts would be drawn a red line. If that measurement went either below the red line or above the red line, they would cut the test. They also had –Lori may have seen them – by the test stand, little pillboxes. They would put a test engineer or a technician in the pillbox, and he would be watching the color of the flame. If he saw anything unusual, or fire coming out from some part of the engine where it wasn't supposed to be, he would cut the test.

Also combustion instability was a major problem in those days, and it still is. We would attach accelerometers to the engine. They were connected to a very complicated logic and circuit setup whose activation depended upon the nature of the vibration. A vibration above a certain level and at a certain frequency would indicate that instability had been triggered, and the circuit would automatically shut the engine down.

So as I said, when I'm looking at my watch, and the noise stops after 13 seconds, noise that I could hear all the way in Canoga Park from Santa Susana, I knew it was one of those types of shutdowns. Somebody either pressed the button, or the rough combustion device cut it off. Eventually they overcame the instability on a given engine; they'd overcome the instability with techniques such as baffles which are used on the shuttle engine on the injector. And they also put baffles on the F-1 engine injector.

But that's how we learned what to do. The Germans did help us. Someone said that we saved 10 years in the development time by bringing the Germans over to show us what they did and tell us what we should do to avoid the mistakes they made. So, that was their value. The Germans fired the rockets in rock quarries, in. the Lehesten rock quarries in Germany. I guess von Braun and his group showed us how to build test stands in the canyons there to simulate what they did in the quarries.

FERRY: So, were you personally involved in testing rockets at all of the test stands? The Alfa, Bravo, Coca, Delta?

VIETINGHOFF: Well, as I said, I was personally involved on the Atlas engine, and the Atlas test stands. I was personally involved as a development engineer, day-to-day, right up there. The development group did not actually work on the engine. We were not allowed to touch it, as much as I would have liked to take a wrench and torque a bolt.

The test group engineers and mechanics were the only ones who could work on an engine. They were trained to assemble and disassemble. What we did is specify, as I said, the configuration, the duration, and the nature of the tests. We were up there every day, all day, if we weren't in the office looking at the records. That was our involvement. We were very, very concerned about any burning, any suspicious symptoms, loose fittings, and things like that. That was our problem; we had to find a way to cure it. The test group would take our directions, but it was not their problem to fix and make the engine work. They would step back and say, “You have a problem.” The exhaust duct from the turbine on the Atlas was held together with a band called a Marman clamp, and it would always be vibrating loose. The test engineer said, “What you want us to do?” Maybe we would have it changed, or we could say, “Tighten it up.”

One of the things we could do was make small changes to the way we set up the engine, or make little hardware changes. We might be able to change the type of igniter. One of the hardest things in those days was starting the engine. When you open the main valves, you have a tremendous flow of liquid oxygen and RP-1, the kerosene, into the combustion chamber. You’d better have a very strong source of ignition. In the early days we were using pyrotechnic igniters, like a firework of some kind. It would fire, and then we’d open the valves. But if it failed to fire, or didn't fire properly, you had a problem. Because now you have tremendous quantity of a combustible, explosive mixture coming into a chamber, and nothing to light it off. And if there's any spark anywhere else, it will ignite that mixture and it’ll blow it up.

So, one of the concerns was that we didn't want the test to continue if there wasn't good ignition. One of the suggestions was “Well, let’s string a wire across the bottom of the thrust chamber. If the wire burns, we know that there's ignition, and we'll let it proceed. If the wire doesn’t burn after a millisecond, we'll cut it off.” And we tried things like that for a while. And of course my supervisor, when it was suggested, said, “Well, remember, fellas, a wire is a problem connected to two other problems.” And he was right. In other words, any time you add something you create another problem.

Another example: on the engine sometimes the main liquid oxygen valve would not open when we started. We'd have to cut the test. Well, the main valve didn't open because the seal around the bearings was not that perfect; moisture would get in and freeze. After cutoff on every test on the engine they turned on what was called a Firex system. It shot a tremendous spray over the engine from shower heads all around the test stand. Gallons and gallons of water would pour out in a shower to make sure that any fire that might occur would be extinguished. Well, that extremely wet environment allowed a little bit of water to get into the bearings of the main liquid oxygen valve on the engine. When the liquid oxygen came down for the next test, that water would freeze into ice crystals, and that valve would be frozen shut. We said, "What are we going to do?" We didn't have the ability to redesign a valve up at Santa Susana. We had to use whatever they shipped us from, say the Canoga Park facility or the Slauson Facility. So the test group said "Well, maybe we can warm up the valve a little bit." They'd take a garden hose and hook it up so that the water poured over the valve. Before they started the test, they'd turn on the water, and now the water's splashing on the valve, warming it up a little bit. And sure enough, it worked great. So when they started the engine, the valve bearing was not frozen and the valve opened, and allowed perfect tests. We would do this each time because it worked great. Of course one day the program engineer came up, from Canoga Park and sat down with us. He said "Gentlemen. We're building an operational missile. If a missile is fired against the United States we have to launch our missile in 15 minutes." He said, "It is not practical to require a garden hose on your missile." Right?

FERRY: Right.

VIETINGHOFF: Because we've got to correct the problem. In other words, that was the kind of thing we dealt with every day. And that's a typical answer the original question of the nature of the work in those days as compared to say now. Our job was to fire engines; try to meet the specification requirements like thrust, mixture ratio, specific impulse. The name of the game was to get the engine to fire so we can get the data and find out: Does it work? Do we have problems? Do we have pump performance? Does everything work? We did everything in our power to try to make that engine run successfully from day to day. As I said, as a result we were trying different little things to make it work, which in the long run you don't want to use. But it was a different situation in those days. It was fire, get data, and find out what's happening. I'm not, of course, familiar with day-to-day testing nowadays, so there may be different priorities. But that's what our priority was back then in the 1950s. Do what you have to do to get the engine to run, to get the data, so that we could improve on it.

FERRY: Did you guys feel a lot of pressure? To-

VIETINGHOFF: Well, not in the sense that people would call up and say, "Why aren't doing better?" I mean, we knew were answerable to upper management. Once Canoga Park opened in 1955 we'd be on the phone with our managers all the time, going over what our problems were, describing what happened in the last test. It wasn't a random choice of actions and we weren't running loose and free. There was a chain of command, and everybody knew what was going on.

So, in that sense you were accountable, and you had to account for any action you took. If you wrote a test request and you specified a change to valve timing, you'd better darn well have a reason why you did that. But on the other hand, there was no pressure in the sense that management would call you in and say “You didn't have enough tests yesterday. Shape up or ship out.” type of thing. There was not that kind of pressure. On the other hand, the Test Group was graded on their ability to conduct tests efficiently and quickly. So the Test Manager in our area would be on top of us constantly to complete and submit a test request. I do believe the pressure was self-induced because we knew our responsibilities. As I said, working up there you could recognize the scope of the work and the long range goals. Just the atmosphere of the place was overwhelming.

I was really fortunate to get the job. I remember I was going to Northwestern. I was getting a degree in chemical engineering. It was then in the winter of ’52, or maybe in the early spring of ’53 when a representative of the personnel department from North American Aviation came to the campus. And you could tell he was from California. It was cold, and sleety, and icy that evening, and he was not properly dressed. He had a little plastic cover he had bought to put over his hat, and he didn't have a warm enough coat. We were sitting in a room on the campus, and it was late. The sun had gone down; it was dark I remember. He said to me, “We have a contract to build rocket engines at North American.” He asked, “Would you be interested in that kind of a job?” I said, “Yes.” It was the most irresponsible thing I had I ever done in my life, because other fellows in the program, if they were being interviewed to work somewhere, might be invited to the plant by the company, maybe even taken out to lunch, shown around the facility to sell them on the idea of working there, and introduced to whom they would be working for.

In my case, I didn't know a single thing about Santa Susana. I didn't know that it existed. I didn't know what I would be doing if I got there or whom I would be working for. I didn't know beans. They simply said, “Would you like a job at North American?” and I foolishly said yes.

And then just before the graduation, all the guys in the class were asking, “Where are you going to work? Where are you going to go?” Some thought maybe we’d have to go to Brazil or someplace overseas to get a job. I got my telegram from North American Aviation, I still have it. I could show it to you. It says, "We are pleased to offer you a position at our Aerophysics laboratory as a research analyst.” I think the starting salary was $350 a month. It said, “Do you want that job?” That's all it said and so I answered, “Yes, I'll take it.”

I got married when I was in college. And North American paid our train-fare to get to California although we drove. And they paid for moving our furniture, which was a bedroom set. That was our wedding present. And when I got to California we rented a motel. I was in Canoga Park driving up and down Sherman Way – maybe you’re familiar with that? I would stop people on the street, strangers, and show them the telegram. I said, “Where is this place, the Aerophysics laboratory at Santa Susana?” I think it said Santa Susana in the telegram. And they’d say, “I don't know.” Nobody in Canoga Park knew where Santa Susana was. Finally, one person said, “It’s in Simi Valley.” He meant Santa Susana Knolls, and I drove there with my wife. There was a gas station and a real estate office. And I turned to my wife and I said, “I don't think this is it.” Then I went back to Canoga Park and I stopped more people. I’d just grab up anybody, and I asked, “Where is this place?” One man said, “Oh you go Valley Circle and there’s a Canyon Road.” He may have called it Woolsey Canyon, but they didn’t have a sign on it at the time. He said, “Go up that road and go to the top of the mountain, and that's where it is.” I said, “Okay,” so my wife and I got in my car – this was sometime around July fifth, because I was supposed to start on the seventh and I was panicking. I didn't know how to get to Santa Susana, you could imagine. And there were no houses there at the time.

MANES: Right.

VIETINGHOFF: So we drove to Valley Circle and I saw this canyon road. And I said, "I think this is it." And as I said, there were no houses there. When you drive up now, there are lots of houses. I was driving up Woolsey Canyon with my wife, and it kept curving and curving, and all I saw were rocks. I said to my wife, "Maybe I made a mistake. Maybe I shouldn't have accepted this job," because I didn't know what I was going to encounter. But eventually I got up there, and there was the gate, and it said North American Aviation and I knew that was where it was. So I came back home, and then on July seventh I drove back up again and I said, "Here I am."

I had been reading one book by George Sutton, who worked at Rocketdyne, called Rocket Propulsion elements. In the book he mentioned problems with heat transfer. I talked to a fellow named Larry Weber in the research department, where I was hired in. I said, "What are we doing? What's our big problem?" I said, "I understand it is heat transfer." And he said, "We don't have any heat transfer problems, we have instability problems," and sure enough we did. It was a like a cancer, as I said. You could fire an engine one day and it would run smooth as silk. And without changing a single thing in the pressures or the valve timing, you could run it again. And if there was the least disturbance in the combustion chamber, it would trigger this instability in the engine. And if you didn't shut it off, it could burn through the injector and blow up the engine in a spectacular ball of flame and smoke. And that knowledge is what tempered our work from day to day. The knowledge that if you weren't super careful, you could trigger instability in the engine. And so that's where all the focus was. They hired a lot of high-priced people, scientists, who were combustion experts to try to figure it out. They would, day to day, just shake their heads and wonder, "What do we do?" We could only keep trying. It was a mysterious problem.

FERRY: So you were young, you were straight out of college-

VIETINGHOFF: Right, right.

FERRY: -and you started straight at the Santa Susana Field Laboratory?

VIETINGHOFF: It was amazing. Because they said to me, "Here, this is what you are going to be doing." It's not like I was working with somebody who knew already what to tell me. You know, like a mentor, or somebody to say, "Well here's what we have to do. Oh, here it is; this is the problem. Go take care of it. Good luck." That's what we were doing. And as I said, we obviously did well because all the programs at Rocketdyne were very successful. You know it yourself, the history – the use of the engines in the Atlas or the Saturn V. They were just tremendous successes.

But that's because a lot of attention was paid to all of the little details, and it paid off. For example, I've sat in a lot of design reviews, and these questions would get asked: "Has this been considered?" And you always wanted to hear an answer to that question. Some people might want to say "That's not a problem," but you're not allowed to do that. You have to show that it's not a problem; otherwise you've got to take care of it. That's the way it's always been. And the slightest change was subject to this scrutiny. You don't make a change without a lot of people approving it. Sometimes you might think, "Why do we have to spend this much time?" But that's the nature of the game: accountability, record-keeping, for every little thing you do.

FERRY: So yes. So when you were first starting there, and you were young, were you really aware you of the bigger goal and the larger context? And we kind of look back on that time in history as very exciting, fast-paced-

VIETINGHOFF: Oh, yes. As I said, I wish could go back and do it again. I was later transferred to doing desk work involving more program things. Because once you get the experience, they want that experience put to use when you’re involved in these other things like systems engineering. So the enjoyment I had was working close with the engine, that's what got me interested.

Ever since I was a small boy I was tremendously fascinated by rockets; that's what got me into this work. I use to pick up and save every scrap of information I could about rocket engines. And here I'm having a chance to work on them. It was beyond belief that they’d let me actually do something I dreamed about all my life. The fact that a rocket engine could lift itself off the ground fascinated me. And here I was doing it. So as I said, every day at work was exciting for me. I think about people with other jobs. I'm sure it's just a paycheck for them. But to me it was a fulfillment of a dream that I’d had ever since I was a little boy.

Keep in mind that working on rocket engines was not considered a sensible type of career. Because most of the world believed it was a foolish pursuit. Goddard was working on rocket engines for America, small rockets, and they laughed at him. The New York Times wrote, “It’s not going to work,” it said, “because the rocket has to push against air. When it gets into space, there is no air.”

When I was in high school in 1941, when I started as a freshman, they called an assembly of all the new students. There was a talk given by, I think, a physics teacher. I don't remember his name, but he was very authoritative. I remember his words. He said, "You know, there is a lot of talk about space travel." He said, "But consider this, if you're in a boat, like a rowboat, and you want to change the direction of the boat, you either put an oar on the water or move the tiller. The force of the water against the oar or the tiller will change the direction of the boat." He said, "If you're in an aircraft, and you wish to change the direction of the aircraft, you move an airfoil, and the pressure of the air against the airfoil will move the plane in the direction you want to go." He said, "But in space there is no air." He said, "There is no way that you can direct the vehicle to change its course." He said, "That's why all this talk about space travel is nonsense." And here I am, a 14-year-old boy. He's a voice of authority. What am I going to do? Shout out and say, "You're wrong."

But that was the attitude at that time. When people would ask me, "What do you want to do when you grow up, Billy?" I would say, "I think I want to be a motorcycle policeman," or something like that. I'd make up something. I would never, never, say, "I want to work on rocket engines" because they'd think I was strange. They'd probably say to my parents, "Maybe you'd better take him to the doctor and have him examined." In fact, that's another story. In fact, when I was little, my friends at school were drawing pictures of World War I airplanes shooting machine gun bullets at each other – dogfights in the sky. But I'd be drawing pictures of space vehicles, like the Atlas, like this. I'd be drawing pictures. And that bothered my mother. In fact she said to me years later, "I mentioned to our doctor that I was worried about you, Bill, that you spend all your time drawing these pictures." She said the doctor said, "Don't worry, it's just his imagination. It will go away." Well, you're hearing about my life. And that's what got me into this.

That's why I said it was an unbelievable set of circumstances that I was here, in 1953, working on something that most people never believed possible. And I'm allowed to contribute. As the time went on, sure enough, I did things that affected how these engines operated. I made design changes for the space shuttle main engine, for the Peacekeeper Missile, and for the other engines I worked on. I actually contributed to the program success. I'd see them fly; I knew my part in those efforts.

FERRY: So do you still follow the space program pretty closely?

VIETINGHOFF: Yes and no. I do try to follow the current aerospace events. I pick up the newspaper and read about what's doing with SpaceX, things like that. Or how Rocketdyne is doing as far as getting contracts. But there is a lot more going on that NASA is involved with than I am able to research. I see the headlines and I just don't have the time. I subscribe to this Air and Space Magazine, not this one here. Where is it? This one here. I get this every month or so, and I read about the space programs. This is the article I wrote about the space shuttle main engine, the Incredible Facts about its performance.

FERRY: The space shuttle engine, just the stats?

VIETINGHOFF: It's about where the incredible facts came from.

FERRY: How about you tell us some of the incredible facts?

VIETINGHOFF: Yes. There's many - I didn't write all of the incredible facts, but when you go on – line, you can find them. Some of them have dropped off the Internet, but if you put "Space Shuttle Main Engine, 23 Hoover Dams," in quotes in a search engine, you're going to get a lot of hits. A page will come up and say, "The space shuttle engine is very powerful. The three engines produce more power than 23 Hoover Dams." Actually the number that I calculated was 22.966. I mentioned that in the article. But I rounded it off to 23; so now you know.

And then there was a woman – I mentioned her in the article – Joyce Lincoln, who has since retired and passed away, bless her heart. She said, "We want to try and create an image for the people of how powerful the engine is, but in terms that they can think about." She said "It doesn't mean anything to tell them it has this much chamber pressure or these big-sized turbine blades." She said, "Can you put it in terms that the average person can understand?" So I wrote things like "The three engines have more power than so many 747's." But the one that became the most popular was the "23 Hoover Dams."

One day I walked by this woman at work named Dorothy Rowlands. She was the secretary to Ed Larson, one of the Advanced Design group guys. I said, "Dorothy, do you have a swimming pool?" She said, "Yes." I didn't have a swimming pool. I asked, -"How many gallons are in it?" she told me the exact number. I said, "How do you know that?" She said, "Well, in case I ever have to refill my pool, I want to know what it's going to cost me." So, I took that volume for her pool and I figured out that the flow rate of the three engines, at the 109 percent power level – that's the full power level on the shuttle – would drain her swimming pool in 25 seconds. So I used that one. And everybody copied it. For example, you can go into certain swimming pool websites, companies that make swimming pools, and they will say, “Interesting swimming pool facts: space shuttle main engine can drain a swimming pool in 25 seconds.”

MANES: Yeah.

VIETINGHOFF: But sometimes they didn’t copy correctly. One person put in that it can drain an Olympic-sized swimming pool in 25 seconds, and that's not true. Or they misquote. Instead of 23 Hoover Dams, somebody put in 37. That's because the horsepower is 37 million. And in fact, that brings up a question that was often asked. One day, I got a call from Joyce Lincoln She’d get calls from newspapers and magazines. They were asking Rocketdyne, “Tell us more about the space shuttle main engine. Tell us more.” And she would refer the calls to me if she didn't know the answer. On one occasion Time Magazine called up, and wanted to know the horsepower of the shuttle engine. Horsepower – I have to say this – to a rocket engineer has no meaning. You can convert engine performance to that number, but you don't sell rocket engines on the basis of horsepower. You sell them on the basis of thrust, mixture ratio, specific impulse, and thrust vector position. That's what we had to demonstrate anytime we’d sell an engine either to NASA or to the Air Force, whoever. We’d do an acceptance test at Santa Susana. And I was involved in that. You’d run the engine, and you’d look at the data, and you say, "Yes. We got the thrust, and we got the mixture ratio.” And then NASA would sign a piece of paper and we’d give them the engine.

Well, Time Magazine wanted to know “What’s the horsepower of the space shuttle main engine?” So, I just took my piece of paper and I did some calculations; in fact I went to Bob Bakes, who really got involved with the space shuttle engine. In fact he wrote a whole book on it. And he did the calculations his way and our numbers agreed, so I said “Good.” So, I gave the value to Joyce, and I said, "Joyce, tell them this is the horsepower." Well actually I said, “It is 37 million brake horsepower.” Next day, Joyce got a call back from this guy at Time Magazine, and Joyce called me. She said, “Bill I have a question from Time Magazine. Can I have this gentleman call you?" "Okay." So, he did – I'm talking to some staff writer on Time. He said, “Your data says that the space shuttle main engine has 37 million brake horsepower.” He said, “How can that be when the shuttle doesn’t have any brakes?” I explained why the term “brake horsepower” is used, it’s an engineering term; it comes from the use of what’s called a “Prony brake.” They apply the Prony brake to a running an engine. The braking force measures the horsepower. So, it's termed brake horsepower. It doesn’t refer to braking the vehicle, you know? So, I explained that to him. But that's one of the things that came up.

FERRY: And when was that, the Time Magazine article?

VIETINGHOFF: That was in 1978 when that occurred.

FERRY: 1978?

VIETINGHOFF: That’s-when that happened. Yes, I wrote these Space Shuttle Main Engine Incredible Facts in 1977, and Joyce sent them out in press kits to the newspapers, television, and radio stations. And then, of course, when the Internet came about, the Incredible Facts began appearing on-line. NASA has it on their website, and Rocketdyne had it on their website. Various aerospace websites quote these figures. But that’s in the article from that issue of Air and Space magazine.

FERRY: You know, I didn't ask yet, how did things change – did the general feeling of secrecy around everything change after we successfully launched rockets and man was on the moon, and was there more publicity…

VIETINGHOFF: Well, yes. The information about things like the NASA programs was available, there's no secrecy there, as far as that goes. I think any information anybody wanted was readily provided. It's just that we were working at Santa Susana in a classified environment. In fact, until just recently when we started the bus tours no visitors were allowed. The bus tours will probably start up again in the summer. They have me go on the bus tour to explain how we did testing in the Alfa area. Actually, a couple of years ago, I first took the bus tour myself, and I noticed they didn't have any engineers or anybody that had worked there in the early days. All the people that work at Santa Susana now are Environment, Health and Safety people, and the contractors. And I said to Paul Costa, whom I met there, "You know, I used to work here. Would you like me to come on a tour and tell people about the testing?" They could have had me free, but they hired me as a contract employee. So now I go on the bus tours, and I tell people when we get off at the Alfa area how we did things back then.

MANES: Yes.

FERRY: So-

VIETINGHOFF: Go ahead.

FERRY: Oh, you can-

VIETINGHOFF: I don’t know if I answered. I think I may have drifted away from your question.

FERRY: That's fine, yeah. And then you worked in that small building with all those other guys, Are you guys still pretty close or have you kept in touch?

VIETINGHOFF: You are asking how we dealt with work in the office.

FERRY: Yes.

VIETINGHOFF: Well the nice thing was we were close to each other, and if we had a question we’d run over and talk to each other. Nowadays I guess you’d call somebody up, but there weren’t that many phones so we would just get together frequently and look at the data. And of course that was the thing that took time. Everybody, based on their own experience, had opinions on how you fix a problem, and there were many, many arguments as to which way we should go on things. That was one of the things that detracted from progress, the engineering disagreement. Let me put it this way, if you were running an automobile and it wasn’t operating correctly, you might say, “Well, maybe if we re-set carburetor, it will correct the problem. You could try it, and there’s no penalty. But you can't do that with a rocket engine. Once you press ignition start you're committed, and your decision has to be right; you can't change it as you observe it.

FERRY: Yes, right.

VIETINGHOFF: So, we've been discussing how we did things, because different people, based on their experience, would say, “I don't think that's what we should do.” If it were some other device, some other piece of hardware, you could say, "Well let's try it." But "Let's try it" on a rocket engine could be disastrous. So that's the tone of how it was during the day.

FERRY: But did your work together in such close quarters at Santa Susana Field Laboratory – did you guys form friendships outside of work, or…

VIETINGHOFF: Well yes, that affected our relationships. We were in close quarters and we could make contact easily. There was only one building. And we could talk to each other quickly. Now, the test group was out at the test site, out at the Alfa area, and we would talk to them on their phone. Or maybe just go out there and sit down with them, and say, "Can we do this? Do you think we could change this? Do we have a better instrument? Or something similar. But as far as at the office, we would be talking to each other constantly – more so than even nowadays. You have cubicles at work and you have to stand up and walk to find someone. People are called into meetings a lot. If you try to find somebody because you want to ask them a question, you're told, "Oh, he's in a meeting," or "He's talking to someone else."

But we had the benefit of close cooperation, and were able to point things out on the data very easily. That was the good thing; that moved things along. As I said, the problem was that your opinion on how to solve the problem may be different than his opinion. When it comes to engineering data like flow rate or how to size an orifice, there's no argument there. Say we want to change the flow rate in the liquid oxygen duct; we want to cut down on the pressure. So we'd put in orifices plates with holes in them, and there wasn't any argument about that. Anybody could do the same thing. The question is, though, do you really want to install an orifice in the first place? Maybe we should do something else, slow the pump down. And that's the kind of discussion that took place. As I said, you'd better be careful because you don't get a second chance if you pick the wrong method.

FERRY: Yeah. Did you have any question that wanted to ask?

VIETINGHOFF: Did I digress, maybe from your topic?

FERRY: No.

MANES: No. I think you had some great stories, and some good experiences, and you still remember very well details about-

VIETINGHOFF: Yeah, that's the funny thing; why do I remember some events so well? It seems like the memories of the early days are fresher in my mind. Because of the work I had done in some of the program assignments – like systems engineering for example, later on – they wanted me to help write procedures. When I retired in January of 1998. I had put in my time, and my wife was going to have hip surgery. I was planning to stay home and take care of her. They said to me "Bill, would you help write the engineering procedures so Rocketdyne can become ISO 9001 certified?" In order to be ISO 9001 certified – that's a quality standard – they needed a lot of procedures, because they are going to be asked, "Do you have procedures to do what you're doing? And are they approved? And show them to me." Rocketdyne didn't have enough procedures. So they said, "Bill, would you stick around for a couple of months and write procedures?" And I said "Okay." Well that lasted eleven years. Later on they finally ran out of money and said, "We can't hire you anymore, so go home," and then I came home.

MANES: Well, do you have anything else to add? I mean, any...

VIETINGHOFF: Well I really appreciate your giving me an opportunity to talk about all the things that went on.

FERRY: Yes, it's great to hear about.

MANES: Yeah, pretty amazing stuff that you've been part of.

VIETINGHOFF: What got me to move away from the testing activities was desire to know more about the development of the concept for the engines., I suppose I could've tried to express interest and be more involved in the day-to-day problems, but I was very interested in where our requirements came from. I wanted to know who decided to do this, and why are we doing it this way. And I got involved in what's called Systems Engineering where you look at the overall picture of why you're designing a piece of equipment the way you are. And that fascinated me, and I drifted more into that discipline and became involved in other elements of the program where you ask those questions and you document the process.

MANES: Well, fascinating. That's all very important work. I mean I think that it's good that you seem to look back and are grateful for the opportunity. It seems like you are – I mean you know when you were young and in college, they took you out – or they took a chance, and it sounded like it was a very good decision that you now are glad you made.

VIETINGHOFF: Well, as I said, it has been unbelievable experience I've had. It came to pass that I was able to get into a line of work that I'd thought about when I was a young person, The general feeling of the population when I was young was that this line of work was not a practical pursuit. Rocket engineering is only somebody's idea, dream, or an experiment, but it's not practical. And here I find myself years later doing that. And the nice thing too, I was able to contribute. I probably, in fact, should've been more insistent with my ideas, because I could sometimes see something that should be done, but somebody else didn't agree. We had to work together, so I didn't make a big thing about it.

I was trying to think if there was something else you were asking. What was the last question you were asking me? I thought I'd be sure I answered all your questions about how I got into the work or how things were back then as they compare to now.

FERRY: I think I was trying to you ask about how it affected your personal life, and if you remained friends with the people you worked with, and-

VIETINGHOFF: Oh, my personal life.

FERRY: Yes. So, if you and the other people who were working on the program became close friends, or if you just went home ever at the end of every day and you...

VIETINGHOFF: Well as a matter of fact, there were some people that I got to know very well. And maybe my wife and I would visit them or they would visit us. I don't know that the nature of my work had much effect on my personal life, other than the fact that I didn't talk about it with anybody. But other than that, my personal life was just, I would say, as normal as anybody else's. Rocketdyne in those days was hiring a lot of people. They came from all professions. They really needed people to come to work there. They'd hire any kind of engineer, and there were a lot of people who came there from the movie business. Maybe because it was a better job, or maybe the movie studios were laying off.

One of the men I'd ride pool with worked in the prop department at the 20th Century Fox studio and he ended up working in the stockroom up at Santa Susana. Some of the mechanics had been connected with the movie industry. One mechanic worked as a projectionist in a movie theatre. Now he was working on the test stand. There was a woman working up there who worked at the studios, and she used to – believe it or not – autograph photos on behalf of the actors. She'd copy their signature. If somebody wrote to the movie studio and said, "I'd like an autographed picture of Joan Crawford." She said, "I would do that." I said, "Really? Show me." Eqwrf13She'd write it. I asked, "Did they have photographs of Bette Davis?" She said, "Oh, Bette Davis? Sure. Here's Bette Davis." She showed me how she wrote Bette's signature. Apparently Bette Davis really didn't autograph her own pictures.

MANES: Right.

VIETINGHOFF: They hired this woman to autograph the photos and send them out. And now she worked at Santa Susana. And they had a fellow that worked at Disney Studios. He'd draw Donald Duck and Mickey Mouse if you asked him. So they had people from all over doing that kind of work at Santa Susana. And again, we were all excited about it. And we knew NASA was involved, but we always assumed NASA, in its wisdom, knew exactly what had to be done, and we didn't question it. We were only told that this is a NASA project, and we were doing this for NASA. And we were glad there was a NASA, to take control, and make sure everything went as planned. Otherwise these space achievements wouldn't have ever happened.

MANES: All right. Well.

(End of interview)