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Otto Peter Morgensen Jr.: The Cold War Aerospace Technology History Project (Interview 3)

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Otto Peter Morgensen, Jr.
Interview 3
Cold War Aerospace Technology History Project

Interview Conducted by Lynda Kachurek
Special Collections and Archives
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Kachurek: Last time you were here, we finished our conversation talking about your work in the Aeronautical Research Laboratory. Why did you decide to leave the Aeronautical Research Laboratory?

Morgensen: Primarily because I could not see the research being used to produce better aircraft or make them easier to build or anything that was, had a real tangible value. And there was a position opening at that time in the KC-135 System Program Office, and I thought that would be a much more interesting assignment. So I asked for a transfer, which was granted.

Kachurek: Okay. And what was your position in the KC-135 office?

Morgensen: I was Assistant Chief, but we had a materiel command side and a research and development side, and I was Assistant Chief to the research and development chief of the office. So, I did administrative duties and some, very, a little technical work, but not much.

Kachurek: Can you describe your responsibilities for us a little bit?

Morgensen: Well, the main thing was to be sure that the design and construction was the best possible one. That meant working with the laboratories at the
Field—the Power Plant Laboratory, the Aircraft Laboratory, the old Equipment Laboratory, places like that—and be sure that all the details were scrutinized by our experts in the laboratory and that any controversy with the contractor was resolved. And we had them. We had several. And be sure the arrangement was made for flight testing and the qualification tests on various items of equipment. Everything to assure that the design and construction was the best possible. And then the business side, we had contract changes and primarily when things, we saw changes were necessary, we changed the design and specification a little so there was a change to the overall concept, and I assured that that was taken care of.

00:03:42 Kachurek: Okay. Can you tell us a little bit about some of the controversies that you mentioned with the contractors?

00:03:50 Morgensen: Well, let me think of some of the biggest ones. Well, I guess maybe controversy was not quite the right word. We had difficulties with the self-sealing fuel tanks and with starters. And I think in connection with the self-sealing fuel tanks, we weren’t too happy with the way the work was being done. So we had to send our people to the contractor’s plant, and they had to work together and be sure that the procedure being used to provide the sealant was properly applied, things of that nature.

00:04:49 Kachurek: Did you travel to the contractor’s plants?

00:04:52 Morgensen: Did I travel to- Yes, but not too often. That was, Seattle was quite a long ways away, and we didn’t go too often, but I’d say we’d go maybe a couple of times a year. And when we had, first off, we had to have a mock-up inspection. Well, that took a big crew went out there. Then when the airplane was built, to when the first airplane rolled out the factory door, we had to have a safety inspection to be sure all the little items, everything was safe and ready to go. And that was usually quite a big show, because we’d probably take a dozen people out there, experts in various fields.

00:05:45 Kachurek: Can you tell us a little bit about the KC-135 itself?

00:05:51 Morgensen: Well, yes. It was a modification of the first Boeing airliner. They built a, an aircraft called “Project 87,” and they tested out the various systems for the 707, which was going to be their airliner. Well, that was also the basis of the KC-135. The KC-135 had a vastly different fuel system, and of course, it had the boom for delivering fuel to the bombers. And I don’t think we had any fighters at that time that was capable of being refueled with the boom. But it was for the B-52. The B-52 / KC-135 was a system that had great range, and it permitted us to deliver—accurately deliver—a nuclear weapon anyplace on Earth, which we thought was quite an achievement. And of course they were being delivered to the Strategic Air Command that was then headed by Cur- General Curtis LeMay, and we thought that was a powerful military institution.
Kachurek: Did you ever get to fly in a KC-135?

Morgensen: Yes. One time at, in eastern Washington, at a base called Moses Lake. And I do not know the reason why I flew but it had something to do with the, the refueling boom. And we were up well above fifty thousand feet. It was an experience. I had never been that high before, or since. And those great big mountains in the Pacific Northwest looked like little molehills, and a very, very unusual experience. And when the B-52 crawled up under the belly of the KC-135, and here we were up there and these two big monsters were coming together, well, I was scared to death. [laughter]

But the boom operator, he was right there, and he, he inserted the boom where it was supposed to go, and the fuel rushed in and refueled the bomber, so everything went well. But I was glad when they disconnected and we took off our way and the bomber went his way. [laughter]

Kachurek: Did you have to, um, receive any special training or clothing for your flight?

Morgensen: I don’t think much, because it had a good environmental control system. And that’s what we got when we got the jet engines. Up to that time, we didn’t, we didn’t have a decent heater. All those years of flying, we didn’t have a decent heater. The thing that worked was dangerous. But when we got the jet engine, we took bleed air off the turbine and used it to operate a very effective and a very efficient environmental control system, so we were reasonably comfortable with oh, ordinary clothing. But outside it was surely, surely cold. It must have been minus forty or whatever the temperature is up there. [laughter]

Kachurek: So you were back watching the boom operator?

Morgensen: Yeah, I was laying alongside the bloom, boom operator, seeing everything that went on. [laughter]

Kachurek: That must have been quite an experience.

Morgensen: It was quite an experience.

Kachurek: How long did you stay with the KC-135 office?

Morgensen: I would say just about five years. I think from about 1955 until about 1960.

Kachurek: And was this, um, the first time that they used the Joint System Program Offices?

Morgensen: As far as I know, I would say yes. I don’t know of anything that preceded it. And it was a tremendous improvement.
Kachurek: How do you think it made the system better?

Morgensen: Well, there was representatives of the Air Materiel Command and the Research and Development Command, and it assured that a lot of things—support, primarily support—for the aircraft was available when the first aircraft arrived at the using command bases. But actually there was one more step needed, and that was the System Program Office, where we had all institutions that was in any way concerned with the development of a new aircraft. All of them were in the office. We had the using command, like in the case of the C-141, we even had the old CAA, or maybe it was called the FAA in those days, even had them in the office. We had the using command, we had the Air Materiel Command, Research and Development Command, Training Command. We had everybody that was in any way involved sitting in the office so they’d monitor day-to-day progress, and anything that wasn’t being done to accomplish their needs was modified so their, it was assured that their requirements would be met. For instance, paratroops, just the deployment of paratroopers takes a lot of special equipment. The aerial delivery of cargo, cargo equipment it had to be watched by the using command.

Kachurek: Okay. And how did they work together? How did the office, the System Program Office, function?

Morgensen: Well, the contractor would send in drawings, and they would be reviewed by our people in the SPO. I’m talking now about the one step after the KC-135 / B-52. I’m talking primarily C-141. The, our technical people would review it. If it had anything to do with say the paratroopers, well, the Army had a representative there, who was an expert on the requirements of paratroopers. He would review it, and if he saw something that he didn’t like, well, he’d write to the contractor and say “change this” or “change that” because it won’t work for this or that reason. So, day to day, the design and construction was monitored from day to day by everybody concerned.

Kachurek: Okay. So after you left the KC-135 project, you went to the C-141?

Morgensen: Yeah.

Kachurek: Okay.

Morgensen: Well, there was one intermediate step, excuse me, in there. There was an organization where we had engineers in the program offices that worked with the laboratories, and I was supervising four or five of those engineers working in the four or five program offices.

Kachurek: Okay. Were there, what kinds of projects were they working on that you supervised?
Morgensen: They were largely, I guess, cargo, C-130 and some helicopters. Helicopters and cargo, I’d say primarily. Maybe some trainers, but I forget.

Kachurek: Okay. Can you tell us what, for example, what they were working with, with cargo?

Morgensen: Yes. Well, it was the same thing but the so-called chief engineer in the program office, he just worked with the laboratories around the base whereas in the, later in the KC-135 we had our own engineers right in the program office. That was the SPO, super, System Program Office. We had our engineers right there, most of them. Once or in a few cases, there was only one, like aero-elastic effects, there was only man on the base who was truly an expert in that field. Well, we all relied on him. But in most of the other areas, we had our own people right in the System Program Office. Power plant experts, aerodynamic experts, structural experts, instrument navigation experts, all those people were right there.

Kachurek: Okay. And they were working on problems with cargo loading?

Morgensen: Well, sometimes there were problems, but they were just monitoring what the contractor was doing, and if something was being done that didn’t appear to meet all the requirements of the using command, well, they said “change it, make it like this” so it would, will meet the requirement.

Kachurek: Okay. Were there special issues, um, with heavy cargo as well?

Morgensen: Heavy cargo?

Kachurek: Um-hmm.

Morgensen: Yes, the case of the C-141 handled very heavy cargo. And, well the aircraft before that, I think the first real military aircraft was the C-82s. They had cargo doors and a structure that would carry some of the heaviest ordnance items that existed at that time. And then I guess after that I guess maybe the, what do I want to, I forget where the C-130 fit. I, I, but the C-130 and then the C-141, all cargo aircraft, all had cargo doors and structures, a structure capable of handling some of the heaviest ordinance items that the Army would want us to haul.

Kachurek: Okay. And they had problems with how to load that heavy cargo?

Morgensen: Yes. As a matter of fact, in connection with the C-82, I had issued a technical order which later became the Cargo Loading Handbook that told the people in handling cargo exactly how it should be positioned in the aircraft so the structural integrity would be maintained and also the balance, the center of gravity of the aircraft, would be maintained in the, what we called the stable range. And just providing a, a GI with the tie-down equipment and a weapon to tie down on. He needed more than that. He needs specific instructions, because if a thing
wasn’t loaded, it wouldn’t withstand the flight and landing loads, especially what we had in those days which was a 16g forward load factor, so if the aircraft made a belly landing, all the cargo wouldn’t wind up on the pilot’s neck. So it took real, it had to be tied down in just a particular way to withstand the flight and landing load. And that needed, that dictated detailed instructions.

00:19:40 Kachurek: And you wrote those instructions in a technical order?

00:19:43 Morgensen: Uh, no, I didn’t write them. I caused them to be written. I visited the contractor, which was Fairchild, and we talked about restraining these heavy cargo loads. And we had some good tie-down equipment, but that it had, they had to be instructed exactly how to be used, so we issued a contract change where the contractor, in this case Fairchild, wrote the instructions, and then we published them as technical orders, and I think they were published over at Area A and distributed to all the using commands. So, that was the start of the so-called Cargo Loading Handbook. I realized that the average GI needed detailed instructions, not some general instructions.

00:20:55 Kachurek: Okay. Were there other issues like that, um, with the aircraft that you helped resolve in your work? Issues like maybe—

00:21:07 Morgensen: Yes, I understand the question, Lynda. I’m trying to think of the answer. I don’t, I can’t think any, of any that, of that magnitude, because here was a case where we were spending hundreds of millions of dollars on an aircraft program and if it, if you couldn’t tie down the heavy items of cargo, which the aircraft was being built especially to carry, what were we getting for all our hundreds of millions of dollars? And we had the aircraft, the aircraft had to be capable of hauling this cargo, and people loading it had to load it in a particular way, so it could be hauled safely. I don’t know if that answers the question.

00:22:05 Kachurek: Um-hmm. It sure does. It sure does. With the C-141 that you talked about, what were your responsibilities in that Systems Program Office?

00:22:16 Morgensen: Well, we had several branches. We had the Aircraft Branch, which worried about aircraft performance and structural integrity and then we had a Power Plant group and an Instrument Navigation group. And we also had a group that worried about spare parts and handbooks and stuff like that. And over and above all that, we had an outfit called plans and programs, which I headed up, and that was concerned with maintainability and reliability and with cargo handling. And there again I think that maybe I was given that duty because of my experience with the C-, the old C-82 and to some extent the C-130. And cargo handling, parachute, whatever parachute, paratroopers need.

00:23:21 Kachurek: Okay. Can you tell us a little bit about when you talk about reliability and maintainability of the aircraft—
Morgensen: Yes. Well, they wanted a statistical approach to determine at least to some extent the probability that an aircraft would complete its mission, or maybe I should say that it wouldn’t complete its mission. And to do that, they wanted to identify the unreliable parts of the aircraft, usually equipment—generators and motors, automatic pilots, things that had to work. And we’d try to make it, if they appeared unreliable, we’d try to do additional laboratory testing and we’d try to do additional flight testing and we monitored the tests carefully to try to determine that we were producing the best equipment possible. And statistics were great, but they don’t make a thing more reliable. Testing does that. So we did some additional bench, called bench testing, and we did some additional flight testing on some of the more unreliable items of equipment. And I can’t think of anything in with the aerodynamics or the structure, that’s rather well established for years, that was unreliable. It was largely things, equipment, that caused the greatest concern.

Kachurek: Okay. And how would you use the information that you gathered during the bench tests and the flight tests?

Morgensen: Well, for the most part, we would transmit it to the people building the equipment, and if it had to do with installation, we would transmit the information to the aircraft, the contractor. But it would get back to the people who could do something about it. And sometimes, and very often, it would be a matter of inspection and maintenance. Some items were inspected after every flight, sometimes after every five hours, ten hours, a hundred hours, various times we’d inspect certain items. Well, that would have to go to the using command. And we had an inspection and maintenance manual, and they’d inspect these things at these various times, in these various time frames, and if something was discovered that wasn’t functioning properly, well they’d change it, and then we would try to, if it, we weren’t getting reasonable service time out of the item, we would try to improve the item in some way. Go back to the people who built it and say “Help us build a better one.”

Kachurek: What do you think the contributions of the System Program Office were to the process at Wright Field?

Morgensen: Would you repeat that, Lynda?

Kachurek: Sure. What do you think the, the significance or the contributions of the Sys-, the System Program Office was to the process of developing aircraft, or research and development?

Morgensen: Well, it’s some of the things I’ve already mentioned, but surely we had experts there in every part of the aircraft, much more so than did the contractor. Because all the using commands was like a gigantic laboratory where our people sitting out at Wright Field knew what was going on, what was failing, what was, what was working well, what wasn’t working so well. And they had
that exper-, they had that knowledge about aircraft operating all over the world. And the contractors doesn’t, didn’t have, never had any people that with such knowledge. So we brought that expertise to bear on the development of the program, that was one thing.

Now let’s see. Oh, and then the timeliness of certain actions. I think I mentioned in one of our other interviews that we would deliver aircraft to the using command without maintenance handbooks, without spare parts, without, without trained maintenance personnel. Oh there was always flight personnel. Oh, when the aircraft showed up at a, at a base, everybody wanted to fly it, oh that was great. But they couldn’t support it. As soon as some little thing went wrong, and it needed a spare part or it needed some special maintenance, they didn’t have any maintenance handbooks, they didn’t have any trained maintenance crews. They just had a pretty airplane, but you couldn’t support it. So they’d fly it for a few hours and then it would sit on the ground until they got all the handbooks and the trained personnel that they needed. So the SPO cured that. I remember the C-141, the first ones I think went to McCord Air Force Base, in Tacoma, Washington. We visited them, and we told them “Here’s you, here’s when your airplanes arrive, and here’s when your spare parts and your handbooks will arrive. And you’re going to be missing these four or five items, but here’s how you can live without them.” So we went into great detail, so when the airplane arrived, let alone they could fly it, but they could maintain it and keep it flying, instead of just sitting on the ground like a big multi-million dollar ornament. It was actually a functional, a functioning item for the Air Force.

Kachurek: Okay. And that was a direct product of the System Program Office?

Morgensen: Correct. That was a major contribution, and I think I paint, pointed out during one of our interviews that before they did anything, they prepared what was called a Project Development Plan. And it spelled out everything—what organi-, each organization was going to do, what they were going to get, a schedule for doing it, and how much it was going to cost. And how much additional personnel was needed, how much additional office space was needed, how much additional ramp space and hanger space was needed for, to house and support all these aircraft. Everything. What the total program costs was going to be, even additions to officers’ clubs and stuff like that. Sounds kind of ridiculous, but it was a direct, it was a cost being incurred as a result of introducing this new weapon. Before that, we just bought something, and there were cost overrun, cost overrun, and I don’t know what it was, some I would say it was several times the original estimated cost, when you added up everything. So we defined who was going to what, when they were going to do it, and how much it was going to cost. And once that plan was approved, then the budget was automatically approved, so there was none of this business of going back and arguing for more money every year. That was the, the budget was spelled out in there. And of course in return for that, the SPO was expected to deliver so many aircraft to the using command in accordance with the approved schedule. And the SPO chief was responsible for that. It was his job to assure that was done, and his effectiveness rating,
probably his promotion, everything else, was dependent upon how well he did his job.

00:32:43 Kachurek: And in your experience, it, the development plan and the SPO was effective in meeting those production goals and costs?

00:32:53 Morgensen: Uh, yes. They did a pretty good job. And it was a lot of extensive study, a very extensive study. They had input from like people like the training command, the, especially, the Air Materiel Command and all their maintenance facility, so all the Air Force activities that were in any way involved contributed to the development plan. And they said the part they were playing, when they were going to do it, and how they were going to do it, and how much additional personnel they needed, how much it was going to cost, everything. So we knew exactly what we were getting into before we went out and started to buy a new weapon or a new transport, or a new item of equipment. It was a tremendous improvement.

00:33:56 Kachurek: Did you go through a security clearance procedure while you were-

00:34:00 Morgensen: Say that again, Lynda.

00:34:01 Kachurek: Did you go through a security clearance procedure while you were working at the base?

00:34:05 Morgensen: Yes, but that was long before that. I don’t know when. I think, yeah, I think all the time at the base we had to have a security clearance, because you didn’t know when you would be involved with some top secret material. And when the atomic energy came along, that was another special clearance that I think we had. And we all had to have that. I don’t think I was ever involved with any nuclear, information about nuclear items, but I had to have it just in case. I remember a couple times where they wanted to give me some material that was involved in some of that. And I said doesn’t pertain to anything I’m doing and I wouldn’t accept it. I didn’t want to be involved with something that I knew nothing about or cared nothing about and have “top secret” material in my possession.

00:35:17 Kachurek: During the years that you were involved with the KC-135 project, um, the Russians were working on projects of their own, and in fact, launched Sputnik.

00:35:27 Morgensen: Yes.

00:35:28 Kachurek: How did that, did that have any effect on your work at the base, or, or effects that you saw at the base?
Morgensen: No, I don’t think so. The, it, we were developing missiles, too. And surely the Strategic Air Command had missile sites that they were managing. But I wasn’t familiar with that. But I knew one thing for sure, that our old B-52s and our KC-135s could do precision bombing. And I wasn’t sure the missiles could be quite so accurate as we could. We could have selected targets, and we could destroy them. Of course, we’d lose some aircraft and crews, but some of it, some of them would surely be successful. And there were some, because no doubt the Russians knew it. Because we’d fly it right up to the Russian air space, and I think sometimes we’d actually penetrate the Russian air space, just to test, and see what was going on.

Morgensen: I’m sure they were aware of some of it. I don’t know how effective their intelligence was, but it’s difficult to keep everything secret. Those that know what was going on at the various contractors plants and, if you, for instance, in aircraft, an expert in aircraft construction, you see a few items, well you can guess pretty well what’s going on.

Morgensen: I, I think we were always aware of it. But, I don’t think we were particularly concerned about it. In other words, I don’t think we feared we would be sitting there and be bombed by a Russian missile or something like that. We, yes, we knew that they had missiles and if necessary they’d use them, but I don’t think they wanted a war any more than we did.

Morgensen: Well, my personal opinion is, the Russians had suffered tremendously during World War II. And I think any Russian politician that showed any weakness could not have retained his position. In other words, they were invaded, lost I don’t know how many million people, and any Russian politician would have to at least act like he was not going to permit anything like that to happen again. So they got into Eastern Europe and they were going to stay there for a while, until there was no more threat of being invaded again. And they might not have known our intentions or what we were going to do, but surely they had no more liking for another war than we did. We’d lost enough people our,
ourselves, but nothing like they lost. So, really, I think a lot of us understood that the behavior of the Russian politician was just what we would expect considering what they had experienced. They always had to have a strong man there, and he couldn’t permit anybody threaten, threatening them in any way. That’s what I think.

Kachurek: Okay. What were your opinions on American policy during this time?

Morgensen: Well, I think we did well, the best we could, and I think our diplomatic corps was adequate, did the best we could, but, and we must have done all right, because we avoided a third World War. And we finally, they got people and we finally got people that could work and talk together, work together, you know, and resolve some of these things. Let them know what our intentions were, and they let us know what their intentions were, you know, and I think it worked as well as you could expect because there were a lot of problems to be settled. I think, yeah, I think fortunately everything worked out quite well.

Kachurek: Did you have a sense that the work you were doing was contributing to American efforts against the Soviets?

Morgensen: Well, I think the answer is yes. I think that we couldn’t show any weakness either. And I think that that was maybe a necessary thing, that our, our people were strong too. We had certain positions, and we had a certain view of the world, and we weren’t going to exhibit any weakness anyplace about anything, especially military.

Kachurek: Some historians, um, suggest that there was a change in research and development because the government contributed, the government partnered more with research and development after World War II than before it. Do you, um, how do you, how do you think science changed during the Cold War because of that relationship?

Morgensen: Lynda, I’m not quite sure I understand that question. Would you repeat it?

Kachurek: Sure. Um, some historians have, have pointed to the fact that science changed after World War II—

Morgensen: Yes.

Kachurek: --in part because the government became a big benefactor. They contributed millions of dollars to research and development.

Morgensen: Yes.
Kachurek: How do you think, um, that changed research and development during the Cold War?

Morgensen: Well, I think that we did more of it. The developments of computers, a tremendous thing, changed everything as we experience it now. If you’re not computer competent, you just, you’re, you’re just not with it. And that surely was developed during the Cold War. And to a very large extent, I think, here at Wright Field. We had a computer lab, and we worked with the people who started it, and it started with the old Norden bombsight, which was super, super secret, but this whole business of digital technology, I think, had its beginning with old bombsight. I think, because we were working with Von Neumann at Princeton, E.P. Little up at Harvard, Ragizini at Columbia and IBM, and they were sort of the fathers of this whole digital technology, as I remember. And that was Cold War research and development. And we had great big warehouses over at Wright here, all air conditioned and millions of vacuum tubes, or little transistors now, and a little thing you can put on a desk here did more than those great big air conditioned warehouses were doing, were doing. So the development in computers and in that, on this digital technology is just changed the way we live and do things, all having its, all being started during the Cold War.

Kachurek: What do you think the most significant technology to come out of Wright Field was, in your opinion?

Morgensen: Well, you know the thing changed and not much technology came out of Wright Field, it was more or less they were sitting there monitoring contracts. That’s what’s changed during the period that I was associated with the base, some thirty-four, –five years. I can think of one thing, very clever, and that was solving the nose-wheel shimmy problem. The nose-wheel on aircraft would be a very complex, dynamic phenomena, would shimmy and break, losing airplanes, sometimes a crew. Well, one of the people, a man by the name of Professor William J. Moreland from Rensselaer Polytechnic Institute, solved that problem. And there had been dozens of technical reports written on the subject, all of which were wrong. But he pointed out where they were wrong, and he pointed out what would work, and he made a little device to demonstrate it. He had a little stationary wheel and a belt running by, and they would simulated an airplane running down the runway, and he would show what you could do, what would, would, could happen and make it shimmy, and he showed how you could fix it. And that solved that problem once and for all. I could, that’s one thing that I can think of, came. But I think there was some work done in, in some chemistry and some metallurgy, but I wasn’t too familiar with it. It didn’t have an immediate application like the thing that I just described.

But, yes, over the years, when I first arrived at the base, we did a lot of testing, we did a lot of designing. We had draftsmen. We had engineers like I was one. We had a shop where we, we designed things. We drew them up, made drawings, sent them over to the shop and had them built, and tested them, and let
them out in contract, and produce them in quantity and ship them out to using commands. But that all seemed to disappear, we just called in the contractor and tell them what we wanted, and he’d submit a proposal and we liked it, we’d buy it. So it became more a, of a contracting function there.

00:48:33 Kachurek: Okay. One of the, the other areas that I know you talked a little bit about is, um, aeromedicine-

00:48:41 Morgensen: Yes.

00:48:42 Kachurek: -and Dr. Harry Armstrong.

00:48:43 Morgensen: Yes.

00:48:44 Kachurek: You knew Dr. Armstrong, didn’t you?

00:48:45 Morgensen: Yes. Very well, yes.

00:48:48 Kachurek: Can you tell us a little bit about him and your relationship with him?

00:48:52 Morgensen: Well, first off, he was a gorgeous individual, somebody that you’d be very proud to know. He was gracious, very knowledgeable, very humble, and he understood aviation medicine like nobody else in the world. And he recruited a young Ph.D. from Harvard, a John W. Heim, I think it was John W., John Heim anyway, Dr. Heim. And they did some of the first real work on aviation medicine--acceleration, high altitude, breathing oxygen for a long period of time—and they spent much time—I think I pointed this out once someplace—that they spent a lot of time disposing of silly ideas that flight crews had. For instance, before we had oxygen masks, we breathed oxygen by holding a pipe stem in our mouth and having a little bottle to provide oxygen, and the pilots thought that made, that made their, some pilots thought that made their teeth fall out. So they had to do a lot of work to prove or demonstrate that was not a fact. And they experienced much well almost ridicule because of their work testing goats on the centrifuge and things like that, and the pi-, the most of the officers were interested in bigger and faster airplanes, more comfortable cockpits, oh, better instruments, flight instruments, and things of that nature. They cared nothing about the life sciences in general, and, and aeromedicine in particular. But he was a very gracious, likeable man. And I guess they named an institution down in Texas in his honor, and I think there’s a Harry G. Armstrong Institute for something down in San Antonio. But they, I’m glad they did it, because he was a delightful person in every respect.
Kachurek: Okay. I’d like to change course a little bit and have you tell some stories for me, if you would, about some famous events and famous people that you’ve encountered in your life, if that’s okay.

Morgensen: Well, shall I restrict it to aviation people [laughter] or should I talk about people in general?

Kachurek: You can talk about people in general. I, whatever, whatever you’d like to.

Morgensen: Well, I think about three people stand out. One, the first one, was I. J., standing for Ignacy Jan, Paderewski. He was at the time considered the greatest pianist in the world. He write, he wrote Paderewski’s Minuet in G. He was President of Poland after World War I. He was later President of Steinway Piano Company, and at his death during the time of Roosevelt, Franklin D. Roosevelt was President, the President decreed that he should be buried in Arlington Cemetery until Poland got, was free of the Russians, and then the body should be returned, except his heart, and that was supposed to remain buried in some little chapel over in Pennsylvania. But my dad ran some of his properties in California, and in early 1920s, and he must have exited Poland with wealth, because he had his own private car on the railroad. Before we traveled by air we traveled by rail, and he had his own private car. And that would park in my little hometown while he visited the ranch and visited the big old spa that was there, and I would say he, he stood out. People would stand in awe in his presence.

And the other one I would say it was probably Donald Douglas, Sr. He must have been some kind of a child genius, because I think he was born in 1892, and I worked for him in 1925, that’s when he would be about thirty-three years old. But before that time, he’d been to Annapolis. He’d been up to MIT as an associate professor. He’d been chief engineer for Glenn L. Martin. He had his own company and had built the first aircraft to fly around the world. All before he was say thirty-three years old. And I think that was quite of a genius, and if you talk to him, you realized that he was a very unusual person. He seemed to have all the answers about everything—technical, financial, everything. He seemed to be well aware of everything that was going on.

And the other that stands out was Igor Sikorsky, the father of the helicopter. He was just a little more saintly, kinder and gentler than anybody else that I ever knew. Maybe not any more so than the other two people I mentioned, but surely a very, very gracious and good person. And I, I’ll never forget when our general asked him what he foresaw as the most important use of the helicopter. And his reply, I think, shows the foresight and the brilliance mind that he possessed. And they asked, “What, what do you see as the most important use of the helicopter?” And he says, “Well, General, we can all think of many uses for the helicopter, but two weeks ago, I put a flotiant, flotation gear on our flying model called the VS-300, the Sikorsky 300, and I operated off a lake covered with thin, a thin ice, where the ice would break under the weight of the machine. Now,” he says, “what does that tell you? It tells you every open space is a
potential base of operations. Nobody can predict the ultimate or the most important use of a machine that’ll perform in such a radical manner as that. That will have to be pro-, determined by future generations.” And later, when we came out with the helicopter gun ship, I thought, “My God, now there was a, there was a brilliant man.” Nobody ever thought of the helicopter gun ship or many other uses for the helicopter. What is its most important use? We don’t know, yet, but maybe in uses we haven’t even discovered yet. Surely picking up injured people along the highway and flying them into the hospital is an important use, but militarily, I don’t know, maybe we haven’t discovered the ultimate use yet.

Those were the three, and the other one I would think where people stood in awe was a movie actress that worked for, for Howard Hughes in *Hell’s Angels*, Jean Harlow, the one that caused women to bleach their hair. Well, she’d come in a little bar near the studio. I lived in Santa Monica, she’d, in Santa Monica, she would frequent some of the places where I’d visit. And when she’d bust into a place, well, people would stand in awe, with their mouth open, wouldn’t say a word, listen and everything she said. And actually I mentioned Paderewski, he was the same way, even in the barber shop, go absolutely silent, listen to everything he said. And they were just, I don’t know, there’s some quality that those people had that I never saw in anybody else. They seemed like they were just talking to everybody, they were just part of everybody, you know, in the whole room, and I don’t know what it is, but something very unusual. But, Jean Harlow was a brilliant star, and she of course died very young. I forget what were the details or whatever. Seemingly it was some little basic illness that was neglected for some reason. But I would say those were some of the three people that I could say that just stand out that I met in my life. [laughs]

00:07:16 Kachurek: Did you have the opportunity to talk directly with Jean Harlow?

00:07:21 Morgensen: Uh, no. I may have said “Hello.” I only talked to Howard Hughes once, I think. I may have said “Hi” or something like that a few times, but they made part of the picture *Hell’s Angels* in the San Francisco Bay area, and I was building aircraft then for a little company in San Leandro, that’s a little town across the bay from San Francisco. And we repaired some of the aircraft, and he came by a few times to see how repair jobs were going because those influenced the scheduling of certain, shooting certain scenes for his movie. But then I maybe saw him once in southern California, but I’m not sure. Those were some of the people that stand out.

00:08:27 Kachurek: How did you meet Igor Sikorsky?

00:08:29 Morgensen: I beg your pardon?

00:08:30 Kachurek: How did you meet Igor Sikorsky?

00:08:32 Morgensen: Well, I was project officer on the first helicopter. And when the XR-4, that was the first helicopter, came in, well that was a big, or minor celebration,
because we had never seen anything like it. We’d never seen an aircraft stand still in the air, back up and stuff like that, and we were amazed. We couldn’t hardly believe what we were seeing. And Sikorsky came in. Oh I’m not sure whether he came in, flew in with the helicopter or not. I don’t think he did. But anyway he had a pilot, and my boss was, had experience up at the plant so he flew the XR-4, too, and we spent some time with him. And we had Orville Wright out, and he and Orville Wright had a little conversation. We were all in on that little party, too. Let’s see, I don’t know if that answered the question.

00:09:41 Kachurek: Um-hmm. How you met-

00:09:42 Morgensen: Yes. But for instance I never, typical Sikorsky, I handled, handed him his contract for the XR-4 and asked him to read it at his hotel during the evening, and we’d discuss it the next day. So when he came in the next day, I asked him if he had read his contract, and he says, “Yes, I did.” And I, kind of jokingly, I said, “Well, do you agree with it?” And he says, “Every word of it.” [laughter] Most of the people when you’d ask them that question, they’d start to grow out, out through the-- because all the fine print, the rights of the government, and what we can do and what you can’t do, and all those things like that, you know. But old man Sikorsky, “Every word of it.” [laughs]

00:10:39 Kachurek: And you mentioned that you got to meet Orville Wright?

00:10:43 Morgensen: Well, my conversation with him, I don’t think was more than ten or twenty words or so. I didn’t have any extensive. But he was a very modest, very gentle person, very modest I would say. But no extensive conversation with him.

00:11:09 Kachurek: Tell me a little bit about Charlie Nungesser.

00:11:11 Morgensen: About who?

00:11:13 Kachurek: Charlie Nungesser.

00:11:15 Morgensen: Oh. Well, let’s see now. He was a great showman. He was very proud of the fact that he was the first man on record, and I think the first, surely the first man in the world to have flown, authenticated, ten thousand hours in the air. And he made a big point of that. We had him, let’s see, it was in the summer of 1925, he visited us in Santa Monica at the old Douglas plant. And that evening we had him down at old KNX in Hollywood, and he said, “For ten thousand hours, I fly like zee bird!” [laughs] And he had a beautiful uniform, oh my goodness, only the French could come up with something like that. Every little braid, they use a lot of gold braid where we use little metal buttons and things, but they used a lot of gold, and it was gorgeous. I was thinking I was, see, I was at that time, I was twenty years old. And I thought, “Gee, what can I do to get a uniform like, wear a uniform like that.” Because I’m sure all the girls would look at me if I dressed up like that. [laughs]
So, and he was nice, and he asked a lot of sensible questions. He was looking for an aircraft to fly from Paris to New York to win the so-called Orteg Prize, which Charlie Lindbergh eventually won. And he was seeing what was available. And finally he wound up by having the French build a very special airplane for him and to provide the best navigator they could find. And, but he was a very, I would say a little bit on the egotistical side, but fun, and a good person, too, you know. You could have some fun with him. He had all sorts of little wisecracks in his broken English, about the factory and the people and all that sort of thing. But, see that is lost at sea, he got lost at sea trying to fly from Paris to New York, and we had all the navies who had boats at sea searching the Atlantic for Nungesser, because he was the ace, the French ace of aces. Actually I think he had more time than the German ace, I forget who that was now, but anyway Nungesser was the great French ace. And having been lost at sea, it made us sort of feel that the Atlantic, there was something about the Atlantic that just wasn’t supposed to fly over it. Because all the big names in aviation with unlimited financial backing were trying to get off the ground, and they were failing, killing themselves. René Fonck, another Frenchman, had Sikorsky build a big aircraft especially for that flight from New York to Paris. Well that crashed on take-off and killed part of the crew. And, uh, somebody was backing another famous aviator in an old Blanca that we had, and it wasn’t getting off the ground. And all these bad things were happening, when out of the west comes a big, boyish looking man with a crazy-looking airplane was going to fly the Atlantic, and we thought, “Just another guy going to commit suicide.” When he was sited over Ireland, and then over the Channel, and then landed in Paris, it was a world event. And the loss of Nungesser helped set the stage for so it could become a world event.

Kachurek: Did you ever have the opportunity to meet Charles Lindbergh?

Morgensen: I beg your pardon?

Kachurek: Did you ever have the opportunity to meet Charles Lindbergh?

Morgensen: Oh, one time, because my old bosses at Douglas in 1925 was involved in modifying the old Ryan mono-, monoplane so it would be suitable for that flight—a little more strength in the landing gear because of the heavy load at take-off, and a little more wing area, a few feet on each tip—and what they were doing there, they were making the cheapest airplane they could make that had any chance of flying from New York to Paris. And that was it, modify an old Ryan monoplane. That was the cheapest thing they could come up with. I think the total bill was like six thousand dollars.

But the other thing that happened, it was, these people that supplied the money were from St. Louis, and they called the aircraft the Spirit of St. Louis. Well, every Frenchman, if his name isn’t Louis, he surely has an uncle or a brother or somebody named Louis, Louis being the patron saint of France, and that helped on landing made this thing a world event. And then, now that I’m
talking about Lindberg and his flight, I think that it’s well to point out the part Dayton, Ohio, played in it. The man who owned the Dayton newspaper before it was sold out to the Cox interest was Charlie Herrick, and he was ambassador to France. Well, being a newspaper man, he knew the significance of this, all this publicity, so he managed Mr. Lindbergh and prevented him from doing some things that would upset the French. In other words, he realized Lindbergh didn’t know anything about diplomacy, especially as the French understood diplomacy, so he managed him and wouldn’t let Lindbergh out of his sight. And when it came time, the day after the flight, only had, Lindbergh was dressed up in his clothes, ill-fitting, had him out on the balcony and they’re presenting him this Orteg prize, and I forget whether it was one hundred thousand francs or a hundred thousand dollars, I think it was only a hundred thousand francs, which was about twenty-five thousand dollars in those days. Herrick says, “Give it back to them. Endorse the check. Give it back to them.” Which Lindbergh had to do. It wasn’t easy, because he was in debt, poor boy never saw probably over five hundred dollars at one time in his whole life. “But give it back to them and tell them this is for the society that provides for orphans and widows of aviators who got killed during World War I.” Then the French really did go crazy. This great hero and giving back his money, you know, and his prize and all, it really went over great, and made a reasonable, interesting event into a world event. So all those things added up to that Lindbergh flight.

00:19:11 Kachurek: Tell me how you met Jack Northrop.

00:19:14 Morgensen: Jack, yes. Tell them about it? Jack was a little bit on the nervous side, a hard worker, an original thinker. And Donald Douglas had great respect for him. And he made major contributions, one of which was what we call the monocoque construction, a smooth skin, a metal aircraft with smooth skin and reinforced little stringers inside of it. He made the first one out of plywood, molded plywood, made a concrete mold, molded the shape, and built up layers of plywood to make a strong fuselage and strengthen it with stringers, but actually it’s very close to marine construction. If you’re going to build a battleship or a merchant ship or even floats, you would use very much that same type of construction. You have to have a smooth outer skin and some reinforced, reinforcements, largely stringers and bulkheads in the inside to provide the strength, because a boat can ride on two way, two waves, where like a beam supported at two points, or else it can be supported be one way with overhangs, which is like cantilever beams. So the hull on a boat has to take bending and the type of construction used is pretty much like Jack copied when he built his plywood aircraft, beautiful looking aircraft, the old Lockheed Vega. And then when we came out all metal, well we did essentially the same thing with all metal, when we got good metal to work with, aluminum alloys and the right strength-weight ratio that we were interested in. And we adopted the same, same type of construction.

00:21:41 Kachurek: How did you meet Jack Northrop?
Morgensen: Well we worked together at Douglas, on the same big drawing board in 1925. There’s only eight men in the engineering department that year. When I left to come to Wright Field, eleven years later, there was three hundred in the engineering department. [laughs] Yeah, there was only eight of us. And one of the two of my bosses was a man named Art Mankey, well, he was the one I mentioned that was concerned with modifying an old Ryan airplane for Lindbergh’s flight, and Donald Hall was our chief of structures. He was, also helped with, modify the old Ryan monoplane for Lindbergh’s flight. So that’s when visiting them when I talked to Lindbergh one, on one occasion.

Kachurek: Did you work with Jack Northrop just that first summer you were at Douglas?

Morgensen: Yeah. Yeah. But he remembered me, because in about 1950, I visited his factory. There was a problem with auto-pilots, installation of auto-pilots, and my boss, who was a colonel, later General Leighton I. Davis, and Bob Siemens, who was later became Secretary of the Air Force, and I visited the contractors to explain this problem and tell them what they had to do in order to properly install an auto-pilot. So one of the contractors we called on was Jack Northrop, and I hadn’t seen him, I don’t think, from 1925 to 1950. If I’d seen him in between times, I don’t think I had. So I thought, “What, what am I going to say when I meet this guy? Am I going to play that I don’t know him? Or going to say ‘Remember me?’ you know, or what are we going, am I going to say?” We were, arrived in the office, signing in, and while we’re standing there, he was escorting some visitor out the door saying good-bye to him and he came by me. And he looked and he says, “Why hello, Morgey! Where have you been all this time?” [laughter] Oh God, I was relieved, because I didn’t know what I was going to say. Here I was a little civil servant. Here he was a big manufacturer with the name on the roof and probably a thousand people on the payroll, you know. But, yeah, he’s a, he was good people. And there at that, in before Lindbergh’s flight, all the engineers knew one another, all over the country. If we didn’t know one another personally, we knew of one another, and we felt like we knew them, because we knew the problem somebody was having on the east coast and the problem somebody was having in various places around the country. But after that, the thing got so big we lost all that camaraderie that we had before. We had old Aviation Week, and everything was important going on was written up in there, so we knew pretty well what. The people I knew on the west coast knew what was going on in the east coast, and people back here, they knew what was going on in the west coast.

Kachurek: You also, once upon a time, flew with Wrong-Way Corrigan.

Morgensen: Oh, yes.

Kachurek: Can you tell us about that?
Morgensen: Well, Douglas “Wrong-Way” Corrigan had a brother Harry, who shared an apartment with me in Santa Monica. And he visited of course every week or two, and he just, he had an old Curtiss Robin with the World War I engine. It, the old engine, was called an OX-5, water-cooled, unreliable. But he just loved to fly that old Curtiss Robin. Buy him gasoline, and he’d fly anyplace that old airplane would go. And we used to fly over the desert, and the word conservation had not yet been invaded, so we’d take our shotgun, kill all the birds and everything that moved you know, that was big sport. And we did a lot of that, flying various places. And when I was coming back up here, coming here, I thought I should fly, say, go up and say good-bye my parents because up in the town where I was born, because I didn’t know when I would be getting back out there again. So, Wrong-Way’s brother, Harry, said, “Well, why don’t you get Doug to fly you. Buy him the gasoline, he’ll be glad to fly you up.” Well, that seemed like a good idea. So I talked to him. Oh sure, he’d be ready at a certain time. So we flew up and that was all right going up, and going back we, coming back we had engine failure and had to make a forced landing. And you know, he was an excellent mechanic. He was an excellent workman, you know, metal and wood and everything like that. Well he pulled that old engine apart and fixed it, and we got back. But we just barely got back just in time for me to get down in Los Angeles, which was a good hour away from Santa Monica, and get on a train for Dayton. And we also ran into bad weather, and we came in over the fog, and I don’t, I think we were only fifty feet above the ground, getting into old Clover Field in Santa Monica, where, close to where we lived.

But that was the last time I saw Wrong-Way Corrigan, but oh, and I, when he was, made the flight in 1937 to Ireland, well there was a big fuss about him coming to Dayton and doing a lot of things, you know. And I was living at the YMCA, so I wrote a little essay on him for the YMCA paper, oh, and the newspaper people got it, and oh they came, when I came home from work, and there was photographers and newspaper people of all varieties there to write up a story. And I had to give them a story, and they published it in, right on the front page of the paper. I went down to breakfast and went to buy a paper, and there was, I found myself looking at myself. [laughter]
the factory better than most of the engineers because I handled drawing changes, which is the easiest, simplest part of being a draftsman. And I’d go out and, when I’d make a drawing change, I’d have to go out in the factory and tell the foreman of a particular department, “Change it, and make it like this. Throw away all the stuff you’ve made, and make it like this,” you know. They hated to see me coming. [laughs] But anyway, I knew them and was friends with all of them. And so that was, so I had the job of escorting these dignitaries around through the factory and showed them what was going on, how we made everything, how well we were doing.

So, Billy Mitchell was one. And let’s see now, that was just a few months, I think, before he caused all that controversy down in Washington. And as I recall, it had to do with how they were going to spend their money on military, on weapons. He had demonstrated that you could sink a battleship with an airplane, and he gave a little testimony and the title of which was “The Horrible Truth Has Been Demonstrated.” And incidentally, I read it all in a British magazine, I never did read it any American publication, but the British aviation magazine published it. And I’m telling you if you ever read a classical testimony, that was surely it. He said, “No longer can we live here under the protection of the British Empire, where they can park a few battleships in all the harbors around the world and make everybody behave like they want them to behave. And we live here with 125,000 people in our Army and Navy. That day has disappeared. Everybody can build an airplane, but not everybody can build a battleship.” And he says, “An airplane can be, can sink a battleship, I’ve demonstrated it. So,” he says, “the horrible truth has been demonstrated. The world is going to change.” And it sure was a classical testimony. I hope that a lot of people read that, because you can see how well he had an anticipated the events that was going to follow. Yeah, Billy Mitchell was something. But he just didn’t see spending all this money on battleships when a ten thousand dollar airplane could sink it. And of course the big steel interests, the big poli-, supporters of politicians, they wanted to sell a lot of steel, they wanted to see you build battleships. Yeah, well, Billy Mitchell, if he didn’t do anything else, that testimony before Congress was surely a classic.

00:33:36 Kachurek: You also, um, were acquainted with Hans von Ohain?

Morgensen: Oh, yes. He was a dear friend. Yeah. Well, Hans, it was another tremendously kind, gracious man. And he saw the feasibility of using a jet turbine for aircraft propulsion. Jet turbines were not new. They had been built for some number of years by a Swiss firm known as Brown Bulvari, but those gas turbines were used for generating electricity. They had a turbine that drove a, had a compressor. It had a hot section. It had a turbine that removed all the energy that could be removed from the compressed air, the turbine compressing air then it being heated, then flying out the tail end. They tried to remove all the energy from that with the turbine to drive a generator to generate electricity.

Well von Ohain said let’s just take enough of that energy to drive the compressor and use the rest for, let it fly out the rear end for propulsion, because
Newton’s laws tells us you integrate the momentum worked from the engine, integrate the momentum over the tailpipe, subtract the momentum from the front of the engine from that of the tail, and that’s your thrust. And you could prove thermodynamically that it should work. And von Ohain was at Göttingen, that’s the German MIT, working on his doctor’s degree when his professor liked his idea, and they brought it to the attention of one Heinkel, who was a famous old German aircraft builder. And he decided that it was worth trying, so he took von Ohain over there, and they built a little engine and it performed just like the calculations said it would. And then he gave more money to build a big engine, and they flew it. Well, I think the first aircraft really was, that was operational I think was the Messerschmitt, I think it was the 263. It was not a Heinkel that, Heinkel was the first to fly, I think, but I think the first one that saw was really operational was the Messerschmitt. But after Ger-, Hitler went out of business, we got oh about a hundred German scientists over and about a quarter of them were top-notch scientists. The others were their support. And von Ohain was one of him, them. And he was a very dear friend of mine. And my wife painted his picture. [laughs] And his widow lives over there where I live now. And I see her from time to time. But he gave us the jet engine.

Actually, Whittle in England started to work on a jet engine before he did, but von Ohain knew much more about compressors than Whittle, so Whittle’s engine never really worked. It worked, but not, nothing like von Ohain’s engine. And that changed the whole way we operate aircraft. [laughs] When you see an aircraft that looks about that big and a vapor trail, way, way up there, you can thank Hans von Ohain. I should say Hanks, Hans Pabst Joachim von Ohain, with a Dr. in front of it. [laughs] But I can’t think much else that to say except he described the first flight test, how they all watched with anticipation what was going to happen when the thing took off in an airplane. And a man by the name of Marx was the test-pilot, and after he took off and disappeared from sight, well bad weather set in, and when he came in to land, well, the field was closed with fog and everything else. He had trouble getting in, but he did, got down in one piece, and everybody was happy. That launched the jet engine era. And a great change, great change, in air travel. I don’t think we could fly or even try to fly from San Francisco to Hong Kong or Shanghai like my son is doing without the jet engines. It’s a fourteen-hour flight sometimes, from San Francisco to Shanghai, and I don’t know what it would be with the old propeller-driven aircraft. In fact, the range might not be sufficient to get you there.

00:39:32 Kachurek: Well that covers my questions for today—

00:39:26 Morgensen: Thank you very much.

00:39:28 Kachurek: --is there anything else that you’d like to, to add to our conversation before we close?

00:39:33 Morgensen: Well, there’s much to say about the history of aircraft and maybe we’ll think of some more things. But I think we’ve said a lot about the Cold War.
And there was lots to say about it. And I’m surely glad that we diplomatically settled any differences we had with the Russians. And I think we’ve set a precedent where that sort of thing will prevail. And maybe we’ll think of some more, but I can’t think of anything much more important than that. And the SPO, the System Program Office, the establishment of the Strategic Air Command and our weapons systems—I think were all very important developments.

But I might say that I was told with the, at the outbreak of World War II, President Roosevelt ordered a meeting to be held with our best brains, military, industrialists, and everybody else that could contribute anything, to decide how we were going to prosecute, conduct the war. And it seems to me that’s when they decided on strategic bombing. And among people who attended was my old boss, Donald Douglas, and he begged them to build heavy bombers. Said he didn’t care whether he built them or not, but for, please, and for heaven’s sake, build heavy bombers, and we’ll destroy their infrastructure. We’ll destroy their big factories. We’ll upset their transportation. We’ll upset their communications system. Destroy their railroads, for instance. Destroy their oil refineries, their storage facilities. And they’ll be unable to support an army in the field. They’ll be unable to support an air force or anything else. We’ll destroy their infrastructure. And as far as I can see, we’re the only ones that understood that. You’d think the Europeans would think of war all the time, especially the Germans, march around with shiny boots, emphasizing military being the big thing. Even von Ohain’s dad was a general. You’d think that some of them with all their strategic bombing, but they didn’t. And, but we did. And on that course, I think that’s what won the war.

I talked to a GI that came back, oh this was about the next day after the World War II ended, how he got back so quick, they started moving people back just immediately, right now, and I asked him what Germany looked like. And he asked me if I had ever seen a, the New York City dump. Well, I said, no I hadn’t, but I’d seen city dumps in other big cities, so I know what he was talking about. Well, he says, that’s what Germany looks like. It’s just a pile of junk, a pile of rubble. It was anything that he was with Patton, he says anything that stood up above the ground what the Air Force hadn’t knocked down, we did. We converted it into a pile of rubble. And of course they did just what our best, smartest industrialists foresaw. We had destroyed the infrastructure so they couldn’t support their armies or do anything. They didn’t have any steel. They didn’t have anything. Even von Ohain when he was trying to build his engine, I don’t know what nails has to do with building a jet engine, but he said how hopeless it was try, it was to try to do anything without nails. They were so short of, everything little thing was rationed. So I think that might be an interesting facet of the World War II that wasn’t maybe known or understood. But as I understand it, we were the only ones that really emphasized heavy bombers. And the old B-17 or later the B-29, they made a tremendous difference on how the war was won, if there is such a thing as winning a war. I think it was General Arnold that said there wasn’t any such a thing as winning a war. Winning a war was like trying to win a fire. If a fire breaks out, the thing to do is try to stop it. If a war breaks out, the thing to try to do is stop it, too—utter destruction, death,
everything bad. When the war breaks out, get it stopped as quickly as you can, and get some kind of a diplomatic solution. But, anyway, we prevailed. [laughs] Does that, that’s all I can think of, Lynda.

00:45:00 Kachurek: That’s good. I think we’re done for today, then. [laughs]