AN INTERVIEW WITH JAN ROSKAM

Interviewer: Jewell Willhite

Oral History Project
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University of Kansas
JAN ROSKAM

B.S. and M.S., Aeronautical Engineering, Delft University of Technology, 1954
Ph.D., Aeronautical Engineering, University of Washington, 1965

Service at the University of Kansas
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Q: I am speaking with Jan Roskam, who retired in 2004 as Ackers Distinguished Professor of Aerospace Engineering at the University of Kansas. We are in Lawrence, Kansas, on October 26, 2004. Where were you born and in what year?

A: In 1930 in The Hague, the Netherlands.

Q: What were your parents’ names?

A: My dad’s name was Kommer Jan Roskam. My mother’s name was Agatha Bosman.

Q: What was your parents’ educational background?

A: They did not get any college education. My mother finished elementary school and a little high school. But she had to go out early and work because of the economic conditions in her family. My dad did finish high school. He got a college education later in life on a part-time basis. He became a certified public accountant.

Q: Was that his job when you were growing up?

A: Yes.

Q: Did you have brothers and sisters?

A: One sister and she still lives in the Netherlands.

Q: Did you grow up in the area where you were born, in The Hague?

A: Basically, yes. We lived for a while in a little town that is really a seaside resort of The Hague, called Scheveningen, impossible to pronounce for English-
speaking people. We lived there for a while, but most of the time we lived in The Hague.

Q: So you were living in the Netherlands during the war.
A: I sure was.

Q: What do you remember about that time?
A: That was a very bad experience, let’s put it that way.

Q: I’m sure.
A: A detailed account of all my war stories during the war is in my autobiography.

From Roskam’s Airplane War Stories, an Account of the Professional Life and Work of Dr. Jan Roskam, Airplane Designer and Teacher:

“For Holland, World War II began on May 10, 1940. I remember waking up that morning to a lot of noise in the sky. My bedroom was on the third floor. However, this did not afford me a good look at the sky. I rushed into my clothes, raced down the stairs and outside to look upwards. There were several air duels going on: Dutch Fokker GI and DXXI fighters in combat with German Messerschmitt Me 109, Me 110 and Junkers Ju-52 airplanes. I already knew the most important types of airplanes of that era.

“The Junkers Ju-52 transports were evidently trying to land paratroopers at the Ockenburg Airfield, southwest of The Hague. The Germans had begun their massive attack on the low countries (Holland, Belgium and Luxembourg) and none were properly prepared to defend themselves. The war against Holland lasted only five days, after which a long five-year period of Nazi occupation
began. The eventual defeat of Germany had to wait until the United States entered the war and put a stop to Nazi despotism.”

A: It’s hard to live through an occupation by a bunch of tyrants. As I point out in my book, a lesson I learned is, “If you want peace, prepare yourself for war.” Another lesson I learned is that there is no substitute for absolute air superiority in war. I guess it was that early war experience—I was only 10 years old when the war started—that drove me toward aviation and airplanes.

Q: I wondered when you first got started.

A: When I was 10 years old during the first day of the war when I saw all these Dutch Air Force fighters trying to shoot down German transport airplanes trying to drop paratroopers all over the Netherlands and German fighters who were trying to protect these transports. Those air fights convinced me that that was where I wanted to be.

Q: Were you going to school at this time during the war?

A: Oh, yes. Life basically continued. But as the war progressed there was less and less food available and less and less transportation available, less and less of everything available.

From War Stories: “By the end of 1944 the Germans had stolen virtually all food from Holland and the civilian population was left to its own devices to stay alive. The stores were mostly empty of food stuffs. Many people traded their valuables for food which they could sometimes obtain from farmers if they had bicycles and the physical ability to ride long distances. These bikes were mostly
equipped with wooden rims around the wheels because rubber tires were no longer available. The wooden rims were very, very, uncomfortable to ride on.

“Worse, there was no city gas, no electricity and no coal (used for heating by most people at that time).

“There were soup rations (one per person) served in official soup kitchens. These soups consisted of water with very little nourishing substances thrown in; we called them boiled water. One had to stand in line for hours just to get this.

“We ate tulip bulbs and cooked on little stoves using as fuel asphalt chipped from the streets and green wood sawed from live trees in the parks. My dad and I chipped a lot of asphalt and cut quite a few trees. I knew people who even used wood stripped from rooms in their homes.”

Q: Did you have family members involved in the war?
A: You mean as soldiers?
Q: Yes.
A: No. My dad was actually too old when the war broke out. When Germany invaded Holland, that part of the war lasted only five days. Then Holland was occupied. The country simply was not prepared to defend itself very well at all. Then we had to wait five years until the Americans came and liberated us.

Q: Did you have something like elementary school?
A: Yes. I went through elementary school. I did have a little more than a one and a half year interruption when we actually lived in Hamburg, Germany, during the war. That was quite an experience.
Q: How did that happen?
A: Well, my dad was working for a Dutch construction company when the war broke out. That company before the war already had contracts in Germany to build housing. They built houses for people both in Holland and in Germany and in other countries. The Dutch government after the five-day war fled to London and reestablished itself in London primarily because the Netherlands East Indies, which is now Indonesia, used to be Dutch territory and that needed to be governed. So the Dutch government did that with London as its base. Anyway, there was an agreement made between Dutch industry leaders and the Dutch government in London, despite the fact that the country was occupied, that they should try to continue economic activity as much as possible without cooperating with Germany in terms of the war effort. So building houses was considered okay.

My dad was appointed as the head person for the Hamburg job and he decided that the smart thing to do was to move the whole family there. So we lived there for a year and a half and we attended German elementary school. It took us about two and a half weeks to learn German. That went really fast. You know, when you are basically immersed in it and have no choice, you pick it up very rapidly. Then a couple of months into our stay in Hamburg the British Royal Air Force started to launch these radar-guided carpet bombardments, where they took out swaths of the city. One night they basically took out a swath of the city where we lived. We did have a bomb shelter under the house. We came out of the bomb shelter that one night, which I’ll never forget because of all the explosions around the house. When we got out of the house the next morning, my
dad and I were looking around. Most of the houses around our neighborhood were either on fire or destroyed already. We found three or four phosphorous bombs on the second and third floor of the house that had not gone off. Talk about luck!

Q: So your house did not burn.

A: It did not burn. It just had a couple holes in it because these bombs went through the roof and then they fizzled. They didn’t do anything, just sheer luck. At that point my dad decided that things had gotten too hot and he moved us back to Holland. German education was, shall we say, markedly inferior to the Dutch education, plus the fact that every time there was a night raid, then school the next day was cancelled. We had three or four night raids every week. So school was cancelled a lot. As a result of that, when my sister and I got back to Holland we were really out of step with the elementary school curriculum in Holland. The educators in charge made the decision to place me where I would have been if I had stayed in Holland, in other words, according to my age group. That was a big mistake. As a result of that, my academic performance just plummeted. I did terrible. I did want to get into aeronautical engineering, but it was clear that based on my academic performance I wasn’t going to be able to do that.

Then my mother did manage to get me into a sort of private preparatory school that prepped kids for admission to the Type 3 Dutch high school. There are three types of high schools in Holland. The Type 3 basically prepares you for college. She managed to get me in that prep school and all of a sudden my performance improved. I was admitted to that Type 3 high school.
Q: Was this after the war?

A: No, I started in that high school in 1948, which was one year before the war ended. This high school was a five-year school. So I was in that school four years after the war and one year during the war. Then when I graduated from high school, I went into the aeronautical engineering curriculum at the Technological University of Delft in Holland, which at that time was the only university in the Netherlands where you could get aeronautical engineering.

Q: What do you remember about when the Americans came?

A: Well, there is another interesting story associated with that. When the Germans occupied Holland, they came up with an ordinance that required all Dutch families to hand in their radios. Instead of their radios they were given radio receivers. The Germans called them People’s Receivers. They could only tune in on German propaganda stations. They were afraid because the Dutch had radios that could basically tune in the whole world, mostly because of the overseas properties. There were radio broadcasts from all over the world in Holland. We were lucky that we had two radios. So my parents handed in one and got that People’s Receiver, which we never listened to. The other one we hid in a closet. As a result of that, every evening my Dad and I, my mother and sister listened to Radio Orange, which was the official radio broadcasting from London in Dutch to the Netherlands. So we knew what was going on. My dad and I maintained maps with pins on it where the military activities were. During the last year of the war the southern part of Holland—that was during the Battle of the Bulge time in Belgium—had been liberated. When I say the southern part of Holland, Holland
has these big rivers that go right through the middle of it. The southern part is below, south of the rivers. The part where we lived was north of the rivers. The Germans stayed in control of the northern part.

From War Stories: “In late April of 1945, the Nazi general in charge of German troops in Holland apparently made a deal with the American Eighth Air Force to allow American bombers to drop food over the starving population of Holland. It was impressive to see the scores of Boeing B-17 and Consolidated-Vultee B-24 bombers flying low with crews waving and dropping canisters filled with food out of the bomb bays. This was the famous Operation Manna, which literally saved many Dutch families from starvation.”

A: There was a decision made that when the official entry of Allied troops into the northern part of Holland would take place (May 5, 1945) that that would happen by Dutch troops, which were serving under General Eisenhower. It was called the Princess Irene Brigade. It was a fairly large brigade of Dutch volunteers, who had escaped Holland and had volunteered for service in England and had gotten their training there. They were run by Dutch officers. But they were part of the Allied armies. They and some Canadian troops and a few American troops actually invaded Holland. So most of the invading troops were actually Dutch troops, which was very nice. I will never forget that. We were very lucky. North of the rivers we did not have any significant street fighting in the cities, where south of the rivers they did and that’s nasty. Street fighting is horrible. So we were very lucky that way. As a result, in my hometown the only damage that we got in The Hague was as a result of the V-2. The V-2 was the first ballistic missile that the
Germans used to fire to London. The Hague was about as close to London as they could get at that point in the war. They had put the firing stations of the V-2 rockets around The Hague. I have seen literally hundreds of those things go up. About half of them made London and did a lot of damage there. The other half failed because of technical problems and fell back on The Hague and caused a lot of destruction and killed people there. Luckily, not in our particular neighborhood but we did get quite a bit of damage from those. But we were basically very lucky.

Q: So you went to a public high school that was to prepare you for college.
A: Yes. The elementary school that I went through was a Christian school. There are public and Christian elementary schools. My parents decided to put me in one of the Christian schools. Then the high schools were all public high schools. There are three types of high schools. The type of high school that I had to go to in order to be admitted to the university was called the Type 3 high school. In that high school you get an awful lot of emphasis on mathematics and physics and mechanics, already in high school, not as elective subjects but must subjects. So that when you get to the university, all the elementary stuff that we teach here, like calculus, you have already had that in the Type 3 high school in Europe.

Q: So the Dutch Type 3 high school is much more advanced than high school here.
A: Much more. Not only that, we were required to take four languages, Dutch, German, French, and English. So when I got out of high school I was fluent in four languages and still am, which is nice. It helps.
Q: Especially living in Europe where the countries are so close together. Do you remember influential teachers from high school?

A: Yes, I have listed them all in War Stories. “I had some really superb teachers. I have never forgotten Messrs. Visser (mathematics), DeKok (physics), Taverne (chemistry), Koote (Dutch literature), Dommering (French literature), Chavonnes Vrught (English literature), Lehnen (German and Esperanto literature) and Saayes (world history). These were definitely my favorite teachers. Learning Esperanto was optional but I decided to take it anyway.

“I also remember Mr. Mulder, our school director. He ran the school firmly but fairly and was always ready to help with student projects.”

A: They were just great guys. I had a superb education. I have given detailed credit to them in my book.

Q: Did you have extracurricular activities, such as sports, the way we do?

A: I played tennis and soccer. I played a lot of chess. I was very good at chess. I became the school chess champion. Those were the three sports that I engaged in.

From War Stories: “During my high school years, I wrote letters to many aircraft manufacturers in the USA and England, requesting information and pictures and/or drawings of their airplanes. Most of these companies responded. As a result the walls of my room were full of airplane pictures. I remember that Douglas of Santa Monica, Boeing of Seattle, martin of Baltimore and DeHaviland Aircraft of Hatfield were particularly generous. I still have most of these materials in my airplane files.”

Q: Did you have jobs the way teenagers tend to do here?
A: You know, that is an interesting difference between the American school system and the Dutch school system. Even at the college level when I went through the Dutch school system, you were a full-time scholar. You were not supposed to work. There were a few exceptions to that, for example, if a professor offered you an assistantship. But that was always in association with the study work that you were doing anyway. You wouldn’t go out and help in a grocery store or things like that. That just was not done. So we were full-time students.

Q: When did you graduate from high school?

A: In May of 1949.

Q: And as you said, you had always intended to go on to college.

A: Oh, yes. And that fall I went into aeronautical engineering at Delft. That was a five-year curriculum. Again, there were very few choices. Everything was basically prescribed. Then at the end of five years you had the equivalent of what we call here a master’s degree. There is no such thing as an undergraduate education in the Netherlands. It leads directly to the master’s degree or you just quit. There is no in between.

Q: Did you write a thesis the way master’s students do here?

A: Oh, yes. You have to do that.

Q: What did you write on?

A: On the structural design of the tail surfaces of the new freighter airplanes.

Q: So you were already designing airplanes?

A: Oh, yes. I have been doing that since high school. There are British aeronautical magazines that publish cutaway drawings. Do you know what those are?
Q: No.

A: They are perspective drawings of airplanes where you can see in detail what the inside looks like. They were already doing that when I went through high school. I felt that the best way for me to really learn how airplanes are put together from the inside out was to actually copy these drawings. Using carbon paper I literally copied these drawings. I probably learned more about airplane detail design from that activity than from anything else. Besides, I thought that was fun to do.

Q: Had you ever flown in an airplane at this time?

A: Not at that time. When I was in high school, my parents gave my sister and myself an allowance. I had saved up some money. So did my sister. We decided that we would charter an airplane. So with some friends we actually chartered an airplane in 1948 or 1949 from Air Holland, which was an airline. That was our first flight. Then before I actually graduated from high school I had saved again enough money that I paid for a trip on KLM Royal Dutch Airlines and made a one-day flight back and forth. All those things further convinced me that I had made the right choice, that that’s what I wanted to do.

From War Stories: “During the summer of 1948 I also designed and built a large balsa wood model of a twin jet fighter resembling the English Electric Canberra bomber. I told my dad that real passenger jets were only a decade away. As things turned out, I was right about that! I also predicted that he and my mother would visit me in the United States by transatlantic jet. Dad thought that was absurd. Jet airplanes were considered dangerous in those days. Besides, why would I want to go to America?
“My parents actually made several trips to visit me by jet. The first one was in 1965 on the occasion of my graduation from The University of Washington with a Ph.D. in Aeronautics and Astronautics. How proud they were!”

A: Then I was lucky at the university. I qualified for Dutch government flight training.

From War Stories: “I applied and was accepted into the private pilot program (my eyesight was not adequate for the commercial pilot program). However, because I was not of legal age to make such a decision myself, I had to obtain my dad’s signature.

“One evening during our usual after dinner family discussions I asked my dad to sign the application. He refused on the grounds that flying was dangerous and he did not want to lose me in a silly flying accident. I was angry and very disappointed.

“Three evenings later my dad informed me that he had changed his mind and would sign the papers. This was a happy turn of events and I was on my way to realizing another dream: becoming a pilot. I learned to fly on Piper J-3 Cubs belonging to the National Flying School.

“Years later, my dad told me what happened. The day after he refused to sign my papers, he told one of his friends at work about it. His friend counseled him that he handled the situation all wrong. What my dad should have done was sign the papers and let me take my first flying lesson. After all, that would scare the living daylights out of me and I would never bring it up again! The advice
obviously backfired. My first flying lesson convinced me that flying was to be part of my life.

“I must say that my parents were very good sports about all this. As soon as I received my private pilot’s license my mother was my first passenger, and my father my second!”

A: So I got my flight training for free. In fact, I had my pilot’s license before I ever learned to drive a car because my parents couldn’t afford a car and I certainly couldn’t. We all used our bicycles to go where we needed to go.

Q: Most people did at that time in Holland, didn’t they?

A: Yes. So I learned to fly at the university.

Q: That must have been fun.

A: Oh, it sure was.

Q: Did you ever have any bad experiences learning to fly?

A: No. Well, I had some emergencies, but if you know what you are doing, that’s not a big deal. I have had to make emergency landings, but that is part of the job.

Q: Were you living at the university?

A: No. Maybe 10 or 15 percent of the students in those days lived in apartments that they rented in the city where the university was. But the university was only about three quarters of an hour by bicycle away from my parents' house in The Hague. So I lived with my parents all the time. I had my separate study room in our house in The Hague and used my bicycle to go back and forth every day, no matter what the weather. It was very good exercise. I had the advantage of home cooking. My mother was the best cook you could ever imagine.
I don’t think I would have taken very well to living with other people. I’m just not that kind of a person.

Q: It can be hard to study in a dorm.

A: I think it was better for me to stay at home because of my own personality. What you see here, they live in these Greek houses. I would not have liked doing that.

Q: The dorms are rather noisy.

A: That too. I am very much focused. And if things happen around me that I disagree with I tend to become extremely nasty. You can’t do that when you are living in a dorm.

Q: Do you remember influential teachers from your college days at Delft?

A: Oh, yes. Again, they are all mentioned in the book.

From War Stories: “The first two semesters I spent studying advanced calculus, mechanics, dynamics, kinematics, thermodynamics, physics, steam engines, piston engines, turbines, material science and theory and design of mechanisms. As part of the physics and thermodynamics courses many experiments had to be conducted and documented with emphasis on the calibration of any measuring equipment. We also were required to take courses in aircraft manufacturing and shop practice. As part of these courses we were taught various riveting, welding, machining and assembly techniques. I remember being in awe of my instructor in these shop courses. His name was P. A. van den Broek.

“Mr. Van den Broek was the KLM flight engineer on the first flight (1924) from Amsterdam, Holland to Batavia (now Djakarta) in the then Dutch East Indies (now Indonesia). He was fond of recounting the hair-raising events
encountered during that record breaking flight in a single-engine passenger airplane, the Fokker FVII…an early transport which could carry six passengers and a crew of three.

“The chairman of the AE department was professor H. J. Van der Maas. He was a former test pilot/engineer for the NLR (National Aeronautical Research Laboratory). His expertise was flight mechanics, stability and control. One of his claims to fame was test flying the Douglas DC-5…The DC-5 was designed under the leadership of famous Douglas designer Ed Heineman.

“Professor Van der Maas was an extremely busy man. In addition to his teaching he was instrumental in getting the Fokker Aircraft Company off the ground after WWII via some very clever political maneuvering…Professor Van der Maas also was instrumental in helping with the formation of AGARD (Advisory Group for Aeronautical Research and Development, a division of NATO).

“Because of his many outside activities, Professor Van der Maas was away from his office a lot. I still remember seeing him dash into his car (a really fast, French build Citroen) and charge around the corner with screeching tires, almost on two wheels.

“Another internationally know faculty member was Professor Van der Neut. He was an expert in structural analysis and design. He and Assistant Professor Van Buuren, a former Fokker and Koolhoven designer, really motivated me toward airplane structural design.”
A: Van der Maas and Van der Neut were probably the most influential guys in my university education. Those guys were really good.

Q: When did you graduate from this university?

A: In 1954. Again, it was a five-year curriculum. Then Professor Van der Neut, without me knowing that, had gotten a request—I had heard that later—from a small Dutch aircraft manufacturer for a top-notch guy in structural aircraft design. He said, “Hire Roskam.” So one day I got this job offer from this Dutch company before I even had my official degree. I accepted the job. I was immediately put in charge of the design of a military drone system, an unmanned vehicle. It was just an incredible experience to be given that kind of responsibility right after college.

Anyway, when I accepted the job I knew that, like every Dutchman, military service was obligatory. You could get a postponement until you graduated, but then the services would grab you. So I told them that they would probably grab me within a couple of months. And they sure did. I got a call from the Dutch air force to show up at boot camp somewhere. I showed it to my boss and he said, “Don’t worry about that. We will take care of that.” The next thing I knew I got a change in orders to show up at officer candidate school for a four-week short course in how to become a second lieutenant in the Royal Netherlands Air Force. Then they put me right back in uniform on my job designing that military airplane. How lucky can you be! I didn’t have anything to do with it. My parents didn’t have any influence. I guess I was there at the right place at the right time.
Q: They must have needed somebody to design airplanes.

From *War Stories*: A one time interesting side duty, which I remember vividly, was dropping flowers on members of the Dutch Royal House. I believe the year was 1955. There was to be a big air show at Ypenburg Airport and many members of the House of Orange were invited as guests of honor. A RNAF colonel was in charge of organizing the air show.

“The colonel asked me to drop flowers over the grandstand from a height of 1500 feet from a Piper J-3 owned by the National Flying School…At the proper time my Piper Cub was loaded with hundreds of flower heads. My passenger was to drop them over the side at my signal. We latched the side window in the down position and took off for Ypenburg where we managed to unload the flowers right over the target: the Dutch Queen Juliana, her husband, Prince Bernhard, and their children. After dropping our flowers, we landed to the applause of the crowd.”

A: Now during high school, Jewell, I had made up my mind that eventually in my career I would want to go to the United States and immigrate and become a U. S. citizen.

Q: How did you happen to figure that out?

A: All the details are in my book. In high school I was lucky enough that we had an aunt and an uncle in the northern part of Holland. They had kids about our age. We were with them a lot. They had a subscription to the *Saturday Evening Post*. You know what I’m talking about?

Q: Of course.
A: I read that magazine every week. And that magazine is what turned me on toward the United States. I just wanted to become an American. The other thing was that right after the war the Americans established the American Forces Network radio station in Germany. They played all this big band music. I just loved that. I just absolutely loved that. So those experiences plus the fact that for flying, flying, flying, what better country than the United States of America? All of these things are combined in my mind to “Hey, Roskam, that’s what you really want to do eventually.” When I told my parents about that already in high school they sort of scoffed at that. They said, “That’s just a teenage fad. He’s going to grow out of that.” But I didn’t.

But getting back, so now I was in the air force but I still had my civilian job assignment designing military airplanes. It was a two-year assignment and then they let you go. Then I had the choice to stay on at that Dutch company or actually go to the United States. I did quite a bit of research. And I had figured out that Cessna Aircraft Company of Wichita, Kansas, and the attack version of the D-37 military jet trainer, which they had announced, was the airplane I wanted to work on. So about two months before my official military service discharge I wrote a letter to Cessna explaining who I was and what I wanted to do for them, what project I wanted to work on and how I could contribute. And they hired me by return mail. They took care of all the immigration problems and even bought my ticket. And that’s how I ended up in Wichita, Kansas. Again, sheer luck, being there at the right place at the right time, I guess.

Q: What year was this?
A: 1956. I graduated in 1954 and served two years in the Royal Netherlands Air Force. But that was really sort of hokum, because I actually was an aircraft designer. I wore a uniform but I did no different than what I would have done if I had remained a civilian. Plus, I got all that experience as a result of that, which turned out to be very valuable. So then I went to work for Cessna Aircraft Company. That’s how I got started in the United States.

Q: Were you designing for Cessna?

A: Oh, yes. In fact, my first project was the AT-37, which was a ground attack version of the air force. And the airplanes are still flying in various air forces around the world, including the United States Air Force. That was a neat little airplane.

Because I already had a pilot’s license, I was lucky that I could join the Cessna employees’ Flying Club right away. At that time they had an unbelievable program for their employees. All you had to do was pay for fuel and oil. You didn’t even have to pay hourly charges. You could fly airplanes as much as you wanted to. And I took advantage of that.

Q: Were you married at this time?

A: Yes, and that is probably one of the biggest mistakes I made early in my life. I really don’t want to talk about that. After about 38 years of a very unhappy marriage I decided to get a divorce. I’m very happily married now.

Q: Did you have children?

A: No. My current wife does from a previous marriage, stepchildren.

Q: How long were you with Cessna in Wichita?
A: I was with Cessna for two years. I loved working. I still have fond memories. I still have several friends there. What happened to me—and this also explains how I eventually switched to the university—was that I was working at Cessna for about three months when the fellow who was running the propulsion part of the company, Norman Bauer, approached me and said, “Jan, I have a problem. I am supposed to teach a course in aircraft propulsion at The University of Wichita this fall, but because of a family problem I can’t do that. I would like to tell the chairman of the department, if you are willing, that you will take on that course. I don’t want to just quit without suggesting a replacement, and I thought that you could do that. Would you be willing to do that?”

I said, “Of course.” So that fall I taught evening school at the University of Wichita. In those days most of the aeronautical engineering courses were taught in the evening, because all these young folks were working in the aircraft companies and they couldn’t go to school during the day.

So I taught aircraft propulsion that first semester and when November rolled around, the chairman of the aero department approached me and said, “Jan, I’m getting good reports from your teaching. I need someone to teach fluid mechanics this spring. Would you be willing to do that?”

“Sure.” I agreed every semester including the summer semesters. I taught evening school while working full time during the day at Cessna. As a result of that experience there was a fellow from Boeing, Wichita, who was head of their aerodynamics department. He was also teaching evening school there. John Aydelotte was his name. One evening he approached me and said, “Jan we have
heard quite a bit about you. What we would like to do is put you in charge of a
new Boeing design in Wichita. Here’s what we would like to offer you. Are you
interested?’

And the salary offer, Jewell, was incredible. I could not say no to that. So
I switched to Boeing. It was an unsolicited offer. I couldn’t afford to say no to
that. I hated leaving Cessna, particularly the Cessna Employees’ Flying Club.

Q: Boeing didn’t have anything like that?

A: No, Boeing didn’t have anything like that. But anyway I made that change and I
think that was a good thing that I did. I got a lot of project exposure at Boeing
that I would never have had a Cessna, although at the time I didn’t know that that
would happen. So I switched to Boeing. Then I was given the opportunity to
work on a new military aircraft proposal. And it turned out that what Boeing had
done was they had put the Wichita design group and the Seattle design group in
competition with each other to hopefully come up with the best possible design to
propose to the Air Force and the Navy. It was for a new fighter airplane. When
they won the preliminary competition, they wanted to combine these two groups.
And there was a lot of discussion at the management level whether it should be
done in Wichita or Seattle. It was ultimately decided to move everybody to
Seattle. So I ended up in Seattle for five years. I worked three years in Wichita
for Boeing after two years at Cessna and then five years at Boeing in Seattle.
Since I was used to teaching in the evening, I heard by the grapevine that Seattle
University wanted an evening teacher. I taught there evening school as well.

Q: Were you teaching the same kinds of things you were teaching in Wichita?
A: Oh, yes. Then another one of these lucky things happened to me. One day I was called into my boss’s office and it was explained to me that they wanted me to go the Sloan School of Management at MIT, get an MBA and then come back and be groomed for divisional management, if I was interested in that. I said no, because I never viewed myself as a people person. And I think as a manager in a big company you have to be a people person. I thought I would be very unhappy making nontechnical decisions. So I told them no. At that point it was explained that was fine, whatever you want to, but you will never make as much money as an engineer. So as long as you know that, your decision is fine. Well, it so happened that that same evening I got a call from Dr. David Coleman—I don’t know whether you know Dave Coleman. Dave had worked for me as an engineer at Boeing Wichita. He had left Boeing Wichita to go back to MIT to get his Ph.D. in aero engineering. Then from there he became a professor at KU. That evening that I got a call from him he had just been appointed chairman of the Department of Aerospace Engineering here at KU. He called me and said, “Jan, we would like to ask you to join the faculty. Are you interested?” I said yes and that was that. In those days hiring a new faculty member was a hell of a lot easier than it is today.

Q: Oh, yes.

A: One call from the chairman and that was it. I think that was the right decision for me to make at that point. I had accumulated enough industrial experience. I had gotten a Ph.D. while working at Boeing.
Q: I was going to ask you about that, because mostly you have to have a Ph.D. to teach.
A: Right.
Q: Where did you go to school to get your Ph.D?
A: At the University of Washington in Seattle. They have an aero department. I did that part time. And the reason that I did that, Jewell, was to prove to myself that I could do it. For no other reason. It was sort of a fortuitous thing. I wanted to prove to myself that I could do it. I didn’t do it because it is a meal ticket at a university, so to speak.
Q: And you didn’t need it for your job.
A: I certainly didn’t need it for my job. But it was very fortuitous that I did that. Anyway, that’s how I ended up at KU. That’s been the best decision I have made because I spent 36 years teaching here and I loved every bit of that.
Q: What did you write your dissertation on for your Ph.D.?
A: It was on nonlinear aircraft dynamics and control, at that time, a very esoteric topic.
Q: It must have taken you quite a while to get a Ph.D. going just in the evening.
A: You know, I was lucky again. I had encountered a number of mulinear dynamical problems working on these advanced fighters at Boeing and came up with approaches to solving those problems. So, basically, a lot of the work I had already done at Boeing. That became my dissertation. So I actually got my Ph.D. in two years.
Q: What year did you get your Ph.D.?
A: 1965. Then I stayed two more years at Boeing and then in the fall of 1967 I came to KU.

Q: You came just a little before we did. We came in 1969.

A: Is Paul retired?

Q: No.

A: I wasn’t sure. When I got the call from you I thought, wait a minute. Is Paul retired?

Q: I’ve been doing this for some time. So you came to KU just a year or two before a lot happened here regarding the Vietnam War, the burning of the Union and all that.

A: I noticed on those notes that you were going to ask some comments about that time. I have some choice comments about that in the book, particularly about Chancellor Chalmers. That guy did more to hurt the reputation of KU than any chancellor ever has. It has taken KU many, many years after he left to recover, particularly in regard to our friends in Wichita. They didn’t have much good to say about KU as a result of what happened during that time.

Q: Did the things that were going on affect you, your family or your students?

A: It didn’t affect my family. What made me absolutely mad was all these idiots who were arguing against the military and against ROTC. How short-sighted can you get? Can’t they read history? I was involved in a lot of committee activities to try to save our ROTC program, which we were successful in doing. The students that I had at that time, many of them were military students. They were in the ROTC program. I do remember that one point two of my students came to
see me. They said, “Dr. Roskam, your next lecture is going to deal with weapons integration. There are going to be protesters to put a halt to that.” So I had a discussion with my class. We all agreed that we would spread the word that any such protests or attempts to stop my class would be met by force. We never got any protesters. I still remember that. We never got real problems. And I think the university would not have either if Chalmers had shown more spine, which he didn’t. That was part of the problem. He didn’t show any spine at all.

Q: What classes have you taught at KU?

A: Aircraft Stability and Control, Aircraft Automatic Flight Control Systems, Aircraft Design. Those are the three primary subjects, both at the graduate and undergraduate level. And V/STOL Aircraft, meaning vertical and short takeoff and landing.

Q: Did you originate any of these courses?

A: Yes, the V/STOL course I certainly did and the Automatic Flight Control course and the Aircraft Design course. I also ended up writing the textbooks on those topics. They are still used all over the world.

From *War Stories*: “In 1976 the American Institute of Aeronautics and Astronautics (AIAA), with sponsorship from Bendix Corporation, launched the first national team aircraft design competitions for students.

“Several aircraft manufacturers also were interested in promoting such competitions. Therefore, in 1980, AIAA launched individual student aircraft design competitions. In 1986 they added undergraduate and graduate team
aircraft design competitions, and in 1988, engine and spacecraft design competitions.

“Participation in at least one of these competitions was a class requirement in my design classes….

“In the classroom I always insisted that students;

1) Be on time for class;

2) Hand in assignments on time or, suffer significant grade penalties;

3) Deliver professional work in content and appearance;

4) Remove hats and/or baseball caps when they are in my class or office.

“I have been known to send students home to “get dressed” properly before talking to them in my office. In dealing with students I have always tried to be fair, to be responsive to questions, and to help students overcome problems.”

Q: So what did you think of Lawrence when you came, compared to some of the other places you’ve lived?

A: Oh, I’ve always loved Lawrence. I think it is a neat city to work and live in. It’s got a little bit of everything. I think it is a very pleasant town.

Q: How does KU or the students compare the university you attended in the Netherlands?

A: Well, there is a big difference. Delft University of Technology was sort of like MIT, if you will. You get only technology students there. There are no liberal arts students, there are no nursing students, there are no education students. It is just technology, mechanical engineering, chemical engineering, petroleum
engineering. It is all engineering. So there is a big difference in the type of students and the type of faculty members you see at Delft and at MIT, for that matter, compared with KU. I don’t think a comparison is even fair because of that. They are just different.

Q: Do you think your aeronautical students are different from such students in the Netherlands?

A: The one thing that I have always noticed, Jewell, is that graduates of American high schools are very poorly prepared in mathematics and physics and certainly in international knowledge, knowledge about other countries, political systems, really pathetic. And I don’t think there is anything wrong with American genes. I think the problem is American high school education. That’s where the problem is. It has been that way ever since I came to KU and I haven’t seen any changes. It is still that way. Students who are good in mathematics and physics tend to be foreign students, I’m sorry to say. But that’s the way it is.

Q: Do you have quite a few foreign students?

A: Oh, yes.

Q: Both undergraduate and graduate?

A: When I came here there were no foreign students at the undergraduate level. But that over the years has changed. Now there is a significant number of foreign students at the undergraduate level. At the graduate level the foreign students are by far the majority. Long-term, I don’t think that is a good thing for the United States of America. I think long term we need to grow our own talent. I think it will require radical surgery, when it comes to changing our high school
educational system, which does need to be changed. I’m sure that is true in Paul’s department as well. It requires a fair amount of expertise in mathematics and physics. As a result of that, when a professor is looking for a student in some area, that student better be prepared in those areas. So the likelihood that he picks a foreign student is great. It is not discrimination. It is just that certain skills are required. Therefore, a large fraction of my students have always been foreign students as well.

Q: Of your graduate students?
A: Yes.

Q: Do they tend to come from certain countries?
A: Well, because of my familiarity with the Dutch educational system, you might expect that a lot of my students come from the Delft University of Technology. And they have. Most of them, like I did, decided to stay in this country and they are now working in the United States and many of them have become citizens.

Yes, I have recruited a lot of students from the Netherlands.

From War Stories: …At one time I was the KU soccer coach…In 1968 I was approached by several liberal arts students from South America. They asked me to be their soccer coach. They had heard from one of my students that I had an interest in soccer and had actually played on soccer teams. These students wanted to form a KU soccer team to play in an intercollegiate league. However, to play in a league they had to have a faculty sponsor and coach. In those days the KU Athletics Association was not interested in supporting soccer activities. So I agreed to help the students out. As a result, for two years I actually served as the
pro-bono KU soccer coach. I even paid for the shoes and uniforms of the team because no support was forthcoming from the Athletics Association. I remember having quite a time keeping up with these much younger students, as they ran around the field to keep in condition.”

Q: What building is aerospace in? Has its location changed?

A: Learned Hall. That hasn’t changed. A year or so before I came Learned Hall was under construction and they were in this Quonset hut. I don’t know if you have heard of that term.

Q: Yes.

A: But that was already gone when I came here. I have always been on the second floor of Learned Hall.

Q: Have you held administrative positions at KU?

From War Stories: “For me, 1972 was an important year because I was promoted to the rank of full professor. I also became department chairman and served in that capacity for four years. In 1976 professor Vincent Muirhead became the chairman. I remember feeling very relieved when the transition occurred. I never did like a management role and the chairmanship experience re-convinced me that this was not for me.”

Q: What have your research interests been?

A: Airplane design, airplane stability control, automatic flight controls. I have always been interested in those three areas and my research very much focused on those areas. Particularly, the first 15 years after I came here NASA had a lot of discretionary money in the area of aircraft design and flight test research. We
tapped into that very successfully. We ran major research programs and actually had airplanes built and flown for NASA. We did that in cooperation with the Wichita aircraft industry. So it was good for a number of reasons. It established a good rapport with the Wichita companies and the students who worked on those projects were immediately hired by the Wichita companies as a result of that. So I think it was very beneficial all ways.

Q: But now and in some past years the aircraft industry in Wichita has not been very good.

A: Although it is picking up now. But you are right. It has been fairly poor and NASA has basically gone out of that business. So for the last 12, 13, 14 years there has been very little money forthcoming in the area of aircraft design. Things are beginning to change a little bit now because of the military emphasis on unmanned vehicles. You may have heard that the guy we hired to replace me is a UAV person, an unmanned aircraft person.

Q: I didn’t know that.

A: And that’s a good thing, because that is where the opportunities are in the future. Manned aircraft, as a lot of people say, are sort of a “done” thing. We now know how to do that. There isn’t a heck of a lot of new research required. So that switch is now being made, and I think we hired the right guy for that. Time will tell. I’m glad that they found the right person. And also, by the way, we hired him from industry, from Lockheed. He had experience in that field at Lockheed. I think it will be good for the department.

Q: Do you think that airplanes have become safer?
A: Oh, very definitely. I don’t think there is any question about that. Aircraft—we are talking about commercial aircraft—are far safer than cars by almost any statistical comparison. There has been a tremendous improvement in air safety. That doesn’t mean we shouldn’t improve more. I’m working on a book now called, Lessons Learned in Aircraft Design. In that book I start in 1945 and recount some very nasty accidents that have happened since 1945 all the way up to last year where we aircraft designers really goofed. If we had thought a little better, these accidents would not have happened.

Q: Do you think these accidents happened because of a design flaw?

A: No. When you look at the causes of aircraft accidents, about 40 percent of them are due to crew stupidities, such as a pilot flying a perfectly good airplane into a mountain. That happens. But it turns out that a lot of accidents, although they are officially attributed to crew error, I call them design induced. If the designers had not done certain things or had done certain things differently, the crew would not have made that mistake.

Q: I see.

A: I would say that about a third of the 40 percent of the accidents that are caused by crew stupidity are really design induced. Then over the years as the result of accidents, we have learned the lessons and the regulations have changed. Aircraft design is probably the most heavily federally regulated field. And the reason is safety. Every time there is a crash, we learn from that and we say, “Oh, we need to change this regulation to make sure that that doesn’t happen again.” Yes, I
think we have reached an enviable record of safety, certainly in the United States of America. But that doesn’t mean we can’t improve on it, and we should.

Q: Do you still fly?
A: No, I sold my airplane.

Q: Oh, you had an airplane of your own?
A: Yes.

Q: When you were here?
A: Yes, a Cessna Skyhawk, basically the same airplane that I used to fly in the Cessna Flying Club. But I sold it because I found myself not flying enough. You know, you have to fly frequently to stay safe. And I noticed that I was not spending an adequate amount of time flying, so I said, “Roskam, make up your damn mind, one way or the other. Get out or fly more.” I decided to get out. Sometimes I regret that I did that.

Q: You mentioned that you had written some books. What are the titles of books you have written?
A: *Flight Dynamics of Rigid and Elastic Airplanes, Airplane Flight Dynamics and Automatic Flight Controls, Airplane Aerodynamics and Performance*, and an eight-volume text on aircraft design, literally eight volumes, sort of like an encyclopedia. Most of these are still in print and are used all over the world.

Q: And these are textbooks.
A: Correct.

Q: That must be very difficult to write while you are teaching and doing all the things a university demands.
A: Well, you know, one of things is publish or perish. This certainly helps. One of the things I’ve found, Jewell, when I came here from Boeing and had to pick a textbook for my Aircraft Civilian Control class, was that the existing textbooks, from my point of view, were way too theoretical. There was very little practical experience reflected in the books. They were all written by very clever university professors with Ph.D.s but these guys had never designed an airplane. And I got very antsy about using those books because they didn’t teach it the way we actually do things. So I decided to write my own. I had my first book ready at the end of 1969. I sent copies of the manuscript to all the big publishing houses, McGraw-Hill and Wiley. I got very polite letters back from them, “Roskam, this is a great textbook. There is no market for that. No market at all, so thanks, but no thanks.” At that point I decided to form my own company and publish it myself. And that’s what I have been doing all these years.

Q: Oh, you publish your own books?

A: I have my own company and it publishes my books.

Q: Do you publish other people’s books?

A: We also sell other people’s books, you bet. Go to the website, Dar Corporation website, right here in town at Wakarusa and Bob Billings Parkway at the corner is where we are. Literally every aeronautical engineering textbook that is on the market is sold through my company.

Q: Do you publish these books that you sell or do you just distribute them?

A: We distribute them.

Q: And you publish your own.
A: Correct. When you go to airplane companies all over the world, literally, you can see them sitting there. They are all over. Another thing that happened as a result of the NASA-sponsored research program that we did here, we developed several new technologies in the area of automatic flight controls and, obviously, because several people in Wichita collaborated with that, they said, “Roskam, what we would really like for you to do is to teach a short course so that more people hear about that.” That was actually the start of the Aerospace Engineering Short Course Program. The very first course was taught at the request of Cessna. It was financed by NASA, interestingly enough. As a result of that the now internationally famous KU Aerospace Engineering Short Course Program began at that time. That was in 1970. It is now the biggest short course program in the world. But I don’t have anything to do with it. I am just an instructor.

Q: I see. This course teaches people who work for Cessna, Boeing, etc. Do they send them to KU or is the course taught in Wichita?

A: The courses are taught in San Diego, Williamsburg, in Orlando, in Seattle, in Wichita, at KU. But most of them, the great majority, are taught off campus. Then they also have so-called on-site courses. If the company wants to have its own employees take a specific KU course, then they will invite the instructor with a coordinator to their company. Then they teach only to the employees of that company. So they do both public courses and on-site courses. I have participated in all of those all over the world. I have conducted these courses for companies in England, Germany, The Netherlands, France, Brazil, Singapore, Australia, everywhere.
Q: That must be fun.

A: That was fun. And I still teach short courses. I have not retired from the short course program. I do four of those per year.

Q: You were on University committees, I suppose.

A: Lots of committees. You can’t get away from that. It is part of the job. You have to do that.

Q: Any you particularly remember?

A: That’s never been my big interest, as you can probably tell. No. Right now I can’t think of any memorable ones, Jewell.

Q: Did you have sabbaticals?

A: Yes, I had a couple of those. They were all spent in The Netherlands at the University of Delft. That also helped me recruit Delft students.

Q: Were you teaching at Delft while you were on sabbatical?

A: Yes, and doing research at the same time, things that helped my publications in general. By the way, the other thing that I failed to mention—all of these things are highly synergistic. I told you about that company that I started. The company basically does two things and now we are in the aircraft design software business. All of my books have been softwarized, if you will. That aircraft design software is also used all over the world. But we also perform detailed aircraft design studies for other companies. So I have had the good fortune to be involved, even as a university professor, in many different airplane programs, where I have actually helped design airplanes. I wouldn’t have had it any other way. I love the teaching but I still love making aircraft design decisions. And I’m still doing it.
Q: Were you doing that for the Wichita companies, Boeing and Cessna?
A: Yes, and in many cases simultaneously. I’ve also done a lot of design work for Italian companies, (unclear) and particularly Piaggio. In fact, the Piaggio Avanti airplane is currently in production in Italy. It is the world’s fastest triple propeller airplane and I had a big hand in that one, a very successful airplane. Most of them are flying in the United States, by the way, but they are built in Italy.

Q: Do you fly in some of these planes that you have designed?
A: No, I stopped flying 12 years ago.

Q: Do you remember former students who have gone on to greater things?
A: Oh, yes. In fact, the most memorable one, undoubtedly, was Alan Mulalwy, the chief executive of Boeing. He was my first graduate student. He was a Lawrence boy and one of the sharpest students I have ever had. He was really good. He did his master’s thesis under my guidance. When Alan graduated he defended his thesis. I congratulated him. I had gotten him a job at Boeing in Seattle because I knew all the people there. I said, “Alan, within 25 years I expect you to be president of the Boeing Company.” He was. He was that good. He was not only a good engineer, he was a good people person, as I never was. He was just very good, and now he is running the Boeing Company.

James Thiele is another guy who comes to mind. James Thiele is president of American Blimp Corporation, the world’s largest airship manufacturer. When Jim was a student, he was already into lighter than air machines. One day he came into my office and showed me a picture of a big balloon that he had just sold to Dairy Queen. What it was was a huge ice cream
cone, but in the form of a balloon. He sold that to Dairy Queen. Jim and I started to talk a little bit about that. He said, “Dr. Roskam, you know, I never told you but what I want to do is I want to start the world’s largest airship company.” He did, from scratch. He is running it. It is a company in Oregon and that’s what they are making, airships, mostly for advertising, like these Blockbuster things that you see flying around at football games. They are made by James Thiele’s company.

I have a number of them who are professors now, several of them. It is very satisfying to see your students grow up to do those things.

Q: Sure.
A: Their names are all in my autobiography. The reason I came to write that was—you noticed the title of the book, Roskam’s Airplane War Stories. I have from the beginning illustrated my lectures. Every lecture I tell two or three things that happened to airplanes, where designers really made a dumb mistake. They should have done things differently. I call those war stories, although they don’t have anything to do with the war necessarily.

Q: I understand.
A: In fact, I’ve become famous for my war stories. About five years ago, in the short courses in particular, the students said, “You need to write these things down so they don’t get lost.” So at some point I decided, well, I’m going to combine them with my autobiography and put all my war stories in there. So they are all in there.

Q: That must be an interesting book.
A:  For airplane people it is. It was published through my own company. By the way, that’s the Italian airplane, kind of a revolutionary airplane. I’ve always been kind of a renegade. It has a front wing called the canar, a regular wing and a (unclear) tail.

Q:  Oh, my. I’ve never seen one with a front wing.

A:  Right, and two pusher propellers. Like I said, it is the world’s fastest turbo propeller airplane. Really neat to see.

Q:  I know you’ve had honors. You are a distinguished professor. Any other honors?

A:  Well, I became a fellow in the American Institute for Aeronautics and Astronautics and the Society of Automotive Engineers. I’ve had a lot of awards, obviously. They are all in the book. I have so many plaques I don’t know what to do with them. The ones that I have mostly cherished are the ones given to me by my students for just plain good teaching. I always enjoyed getting that. Among the other awards listed in War Stories are:

1983 SAE Forrest R. McFarland Award
1986 University of Kansas Irvin Youngberg Award in Applied Sciences
1986 University of Kansas Higuchi Research Achievement Award
1987 John L. Atwood Award for Aerospace Education
1992  University of Kansas Ned Fleming outstanding Classroom Teaching Award.

1993  Kansas Governor’s General Aviation Award

1998  Excellence in Teaching Award, KU Center for Excellence in Teaching.

1999  Mortarboard Outstanding Educator Award

Q:  You belong to professional organizations, I suppose.

A:  Oh, yes.  AAA and SAE and the Royal Aeronautics Society and the Royal Netherlands Society for Engineers and the US Air Force Association and the US Naval Institute and several more.

Q:  Have you held offices in any of these?

A:  I’ve been vice president in AAA and I’ve done a lot of committee work in all of them.

Q:  Have you been involved in community activities in Lawrence?

A:  In the Chamber of Commerce, yes.

Q:  Oh, really?

A:  Particularly with the early development of the Lawrence Airport.  For a while a lived on a small ranch south of here near Ottawa.  And I was involved in a number of school committee projects for the city of Ottawa.

Q:  You mentioned the short course that you were going to continue to teach.  Will you have any other continuing involvement with KU?

A:  Well, they call me in as an aircraft design advisor every now and then to help with students projects and I do that.  So far they have asked me to give every semester
a talk on some airplane design topic. In fact, I just gave one last week. So I’ll probably continue that as long as they want me to.

Q: Anything else you plan to do in retirement?

A: Well, for a while I will continue with my own company. I have also always wanted to build my own model railroad. I’ve always been interested in the railroads. But I’ve never had the time to do anything until I retired. So I built I nice, very credible model railroad at home, which I love playing with. What I have found, Jewell, although it’s fun running these trains, the real fun is in building the whole thing. So my current plan is maybe in another year I’ll tear that whole thing down and start from scratch and build another model railroad because that’s what I really enjoy doing. So I’ll do that and I will probably write yet another book. I don’t know yet what. I’m almost done with the design lessons workbook that I am working on now. I’ll probably think of something else.

Q: What is your assessment of KU or aerospace engineering, past, present, hopes for the future, that kind of thing?

A: Well, at the undergraduate level we are one of the top aircraft design departments in the country. So I think KU placed very well in that. I’ve enjoyed my association with KU. I think it is a very good university. There is a lot of variety here. As far as the future is concerned, particularly in the military, there are going to be almost revolutionary changes in aeronautics. People who predict things in the future are almost always wrong. But I think 20 years from now 80 percent of all airplanes in the United States Air Force and the United States Navy will be
automatically controlled, unmanned airplanes. If you just think about what it is
going to take to make that happen, there will be a lot of engineering activity
required to make that happen. And I think that will happen. In civil aeronautics,
particularly in the light aircraft industry, the FAA just announced its new light
aircraft, sport aircraft category. I think we are going to see a lot of activity there
and a revival of the smaller companies to make flying more affordable for the
average person. Right now it is very expensive. I think there will be a lot of
opportunities for young people to get into that. A statistic which I always like to
quote is that when you look at the world cargo, what you find is that one tenth of
one percent of the world’s cargo today moves by air. In other words, 99.9 percent
of the world’s cargo doesn’t move by air.

Q: It moves by trucks and trains and ships.

A: Exactly. Can you imagine the growth opportunity that exists for cargo airplanes?
Because even if we drive that 99.9 to 99 percent, it is not going to hurt anybody
currently in the ground shipping business. But it is going to mean more than a
ten-fold increase of air cargo and that is going to require new airplanes.

Q: Isn’t it a lot more expensive to ship by air?

A: Well, it depends. There are certain articles where the answer is no. It is actually
cheaper to go by air. For example, if you ship articles that spoil rapidly, then
what we do with ground transportation, we have all these cooling warehouses and
cooling trucks and cooling trains and cooling ships. Can you imagine the cost
associated with that? If you could ship these things when needed by air, that’s not
necessary. When you look at the overall system cost of getting a perishable
article from A to B, it turns out to be cheaper by air. Now there are other goods, like cars, for example, that could actually be shipped cheaper by air with dedicated freighters, rather than what we do today. So I think there will be an enormous growth in cargo aircraft. I believe we are going to see some very large cargo airplanes, like nothing we have ever seen, airplanes that are three or four times the size of what we see today. And they are on the drawing boards already, obviously. But they require huge capital investments. But I think that will happen.

Q: Is there anything else I’ve forgotten to ask that you would like to add?

A: It is your show. Any of the details in terms of calendar time and names and what not, they are all in my book, if you would like to refer to that.

Q: Yes, I would. Thank you very much.