

Gerhard Reisig
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June 27, 1985

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Interview #2

Interviewee: Dr. Gerhard Reisig
Interviewers: Dr. David DeVorkin and Martin Collins
Place: National Air and Space Museum
Date: June 27, 1985

Dr. DeVorkin: Dr. Reisig, could you tell us a little bit about your early life? When and where you were born? What did your father do and how did you get interested in your professional career?

Dr. Reisig: I was born in Leipzig in Saxony in 1910. My father was a professor of education in Leipzig.

DeVorkin: Could you give me your father's full name, please?

Reisig: Franz Gustav Richard Reisig.

DeVorkin: He was a teacher?

Reisig: Professor of education.

DeVorkin: Was he interested in any particular type of intellectual pursuit? Was he interested in literature, physics or what?

Reisig: Well, what should I say? He was interested in literature. For instance, he wrote a book on the history of German literature for college minors in German language. But his specialty as a professor of education was in local geography. We call it "Heimat-Kunde," perhaps you could translate it. It was knowledge of the environment in the area where we were living. It's a branch of geography, and sociology.

DeVorkin: How people are affected by it? Demography?

Reisig: Yes.

DeVorkin: Would you say that you were born into an intellectual family?

Reisig: Oh, absolutely.

DeVorkin: What was your mother's background and training and her name?

Reisig: She was a teacher of French, with special training in teaching French. She never used it professionally.

DeVorkin: Did she have college training herself? Gymnasium?

Reisig: Not Gymnasium. I don't know what kind of language school it was.

DeVorkin: Were you an only child?

Reisig: No, I have two sisters.

DeVorkin: Older or younger?

Reisig: I'm the middle.

DeVorkin: Did your sisters become professionals?

Reisig: My older sister got her doctorate in sociology with Hans Freyer. I don't know if that means anything to you. He was quite an authority in sociology. A very strange coincidence: she wrote her doctorate in the early thirties, I think, about education problems of workers; the topic was: "The political meaning of the education of workers."

She was asked for permission that her dissertation be reprinted after 40 years, because she covered the field so uniquely that evidently there was no other more recent coverage.

DeVorkin: What was your family's political background? Did her sociological studies have any effect on the political climate in the thirties? Was it a product of what we call Weimar cultural thinking?

Reisig: I would say so, yes.

DeVorkin: So it was pretty much in tune with the times, a good representative study?

Reisig: Yes.

DeVorkin: What is your sister's name?

Reisig: Dr. Hildegard Fischer. Her husband was director of the state library in Oldenburg. He had a background in history of art. A very intellectual family. Their second son, Ludwig Fischer, became a professor of German literature in Hamburg.

DeVorkin: Let's identify how your interest developed as you went through school. What kind of schooling did you have? Was

it what we would call private schooling or was it public schooling?

Reisig: It was public.

DeVorkin: Regarding how you went to school, would you rate your family's social economic status as high? Could you have gone to private school? Was there any question of that?

Reisig: There was no use in Germany. In general, the private schools were even considered of minor quality. If a student didn't make the gymnasium, he would be sent to a private school. We called it the "cramming institution", you punch the stuff into the poor student's head. Of course, there are exceptions: the most distinguished private school is located in Salem (near Lake Constance), which Prince Philipp (Duke of Edinburgh) attended. Others of high reputation are the Hermann Lietz Schools which emphasize education in a country-side environment. Wernher von Braun attended the H. Lietz School on the island Spiekeroog in the North Sea. These private schools were quite expensive, particularly the exclusive Salem School.

DeVorkin: So private schools were remedial schools in many ways, for people who had trouble learning.

How did you stand in your school? Did you find that you were among the smarter people, moved through quickly and with great success?

Reisig: Well, we had a pretty tough system. At the end of each semester, in the gymnasium, we got our class rank.

DeVorkin: What was your rank?

Reisig: I was in the upper five percent.

DeVorkin: That's pretty good. Now, about your interests; what did you want to be when you grew up, when you were a kid? What did you want to do with your life? What suggestions did your father and mother have for you?

Reisig: My mother, of course, wanted me to become a teacher -- because of the safety aspect of teaching in Germany -- but I wasn't much in favor of that. Now, my grandfather on my mother's side was a physics teacher, and I think he had a fairly strong influence on me. He looked after me and gave me little gadgets to experiment with, and he was quite interested in my activities.

DeVorkin: Was your family affected at all by World War I, and if so, how? Do you have any recollection?

Reisig: Oh yes. It was typical; with this super-inflation due to the lost war, my parents lost all their assets.

DeVorkin: Did you have to leave school? Was your schooling interrupted?

Reisig: No. It just affected our standard of living, and so on.

DeVorkin: When can you recall first getting interested in physics? Was there an event? You mentioned this maternal grandfather.

Reisig: Yes. I think it was at a pretty early age. Even before I was 10, I think.

DeVorkin: Can you recall what excited you most? Did he like to show you little experiments? Inclined planes, pendulums?

Reisig: No. I think the major interest I got from my grandfather was doing things by myself, what we call in German "basteln".

DeVorkin: How would you translate this in English, or describe this activity?

Reisig: It's a kind of hobby work. Building little things.

DeVorkin: Do you remember what you built?

Reisig: The first things I built were toys, little houses, certain things for my model train, and so forth.

DeVorkin: Ever build a rocket?

Reisig: Not at that time, no.

DeVorkin: Did you have any knowledge as you were growing up as a teenager in the 1920s of Hermann Oberth's ideas?

Reisig: Oberth, yes, through the movie, "Die Frau im Mond." But I should say I didn't do any systematic studies at that time. At that time, I was even more interested in airplanes.

DeVorkin: Could you expand on how you became interested in airplanes? Was there a particular event? Did you fly in an airplane?

Reisig: Not until Dr. von Braun took me in one!

DeVorkin: That was your first flight? I see. (For the record, he nodded, yes.)

Tell me a little bit more about "Frau im Mond." Did your parents take you to see that movie?

Reisig: No. Well, I think I became aware of it from my comrades in school, by discussing such things, saw the announcement in the newspapers. By the way, the way I got interested in anything that flies was the Zeppelin. That made a very strong impression on me. I was a little boy when the first Zeppelin flew across our house. These Zeppelins intrigued me very much.

DeVorkin: You were small, was it five, six years old?

Reisig: I think I saw the first Zeppelin before the First World War. Three or four years old. I remember very much when it came across our house. Of course, to a child this made a tremendous impression; such a huge thing in the air.

DeVorkin: Did your family have a similar reaction? Was everyone excited when one of these things came over?

Reisig: Oh, my father was very much interested in such things, maybe for teaching purposes.

DeVorkin: Did you ever ask him, to your knowledge, how it worked?

Reisig: Probably so. Or I asked my grandfather.

DeVorkin: Quite likely they knew how it worked!

Was the Hermann Oberth film something that caught the imagination of yourself, of your colleagues, your friends? Was it something that had a great impact on the perception of space in Germany at that time?

Reisig: Well, I think I should say that we couldn't follow up so much, in scientific terms. We didn't understand quite a few things. But of course the adventure side caught our attention. The men climbed into the rockets and they took off and that was exciting. How the thing worked wasn't so clear.

DeVorkin: Would you say that it had, comparing it to the films of today, a heightening awareness, such as "Star Wars" or "2001" possibly? Was it a positive thing? Did it excite you

in a positive way?

Reisig: Oh, by all means. And well, it's hard to judge because you have a different appraisal of things when you're so young, but honestly these modern films, with exceptions, I often have the feeling there is too much propaganda in them.

DeVorkin: The modern films have propaganda. Did you see anything in "Frau im Mond" as being propaganda also?

Reisig: At least I didn't recognize it at that time, and didn't have the feeling.

DeVorkin: Did that stimulate you to seek out any of the small rocket societies, or space interest groups, at the time? Did you read any science fiction?

Reisig: I did not read much science fiction, other than educational or technical journals, I should say. Now, you have to imagine the activities in rocketry at that time were at a very low level. One depended pretty much on the geographic location. For instance, it's surprising that the city of Breslau was a center of such rocketry activities. The first German journal, DIE RAKETE, was published in Breslau.

DeVorkin: But you were in Leipzig at this time. Did you stay in Leipzig through your entire childhood and university education?

Reisig: Up to the graduation from gymnasium.

DeVorkin: Let me ask about your education. Do you have any recollections of particular teachers in your schooling who influenced your decision for a career, or your style of looking at the world? Did you have any influential teachers?

Reisig: I think so, yes. In the gymnasium we had one teacher we were fond of. He was a teacher of geography and chemistry. He was one of the founders of this youth movement, the Jugendbewegung ("Wandervogel"). These groups were very fond of folk music and they issued a little book reviving the folk music. This book was called the ZUPFGEIGEN-HANSL. Zupfgeigen Hansl was this teacher of ours; we almost loved him. He was an excellent teacher and very much interested in youth. As a matter of fact, we went on several camping trips with him during summer vacations, for four or five weeks.

DeVorkin: What about in science or mathematics? Did you have any particular teachers?

Reisig: Well, I think I had a very good one in the lower grades, 3rd or 4th year. Remember, gymnasium starts at the age of ten.

DeVorkin: And it goes until?

Reisig: 19. In Saxony we had nine years of gymnasium. In Prussia they had only eight.

DeVorkin: What gymnasium did you go to in Leipzig, to identify it, or was there only one? There were many, weren't there?

Reisig: Oh, there were many, but there were two very famous ones. One was the Thomas gymnasium, called Thomas Schule, where Bach was the Master of Music. The parallel to that school was the Nikolai Schule.

DeVorkin: Which did you go to?

Reisig: Nikolai. It was founded in 1512.

DeVorkin: Who founded it? Did it have a particular origin?

Reisig: I think monks. It was a cloister school. The Nikolai Schule belonged to the Nikolai Church and the Thomas Schule belonged to St. Thomas Church.

DeVorkin: Did these gymnasium have specialties or were they general schools?

Reisig: Well, how should I explain that? In a certain way all these gymnasium had specialties. The oldest form was "Humanistisches Gymnasium," humanistic gymnasium, which emphasized in an extreme way languages. In a pure humanistic gymnasium one was supposed to have two classic languages, Latin by all means, and Greek. In former times it even had Hebrew, for future students of theology.

DeVorkin: That's right. How would you characterize Nikolai Schule?

Reisig: That was a very modern form of a gymnasium, which had a number of varieties or options in the higher grades. The whole group, which started together at the age of ten, stayed together for the first five years. Then it split up, into the humanistic branch and the realistic branch. In other words, the humanistic branch, of course, emphasized Latin and Greek, history and German. The realistic branch emphasized modern languages, history, of course, and natural sciences. And then for the last two years, we split again. In the realistic

branch the majority of the students stayed in the same line, modern language and history and a certain amount of natural science. But I opted for the natural science branch with emphasis on natural science and math.

DeVorkin: Can you recall what led you to that decision? Did you make this decision? Did the school make it? Or did your parents make it?

Reisig: I think I did it by myself. My father was very liberal in these things. He was once almost against my preferences, in this first split between humanistic and realistic. My classroom teacher wanted me to go into the humanistic branch because he thought always the students in the higher ranks should be humanistic. Of course, it was a prejudgment. My father almost gave in, and I protested. At that time I was really determined to go into the natural sciences.

DeVorkin: This is probably 1927, '28?

Reisig: 1926 I think.

DeVorkin: So you were 16 years old at time. Were there things happening in science that excited you at this time?

Reisig: Of course. We had older friends or brothers of our classmates who were already university students, so we had a certain connection to the university. The university was of outstanding quality in Leipzig at that time. You see, we had in physics Heisenberg there, Debye and Hund.

DeVorkin: So you were aware of quantum mechanics and what they were doing?

Reisig: Right. Not that we were in any way competent, but we had a certain feeling for what was going on.

I should mention one thing, because you asked about my teachers. I favored very much a teacher, not in the natural science, but in German and history. I think he gave us a lot. He was, I shouldn't say only intellectual, but very culturally minded. He made a great impression on me.

DeVorkin: What was his name?

Reisig: Werner Roetscher. It was fortunate we had him in German as well as in history. He was very good in cultural history.

DeVorkin: Were you politically aware at this time?

Reisig: Well, I was a member of the Boy Scouts for many years. Of course the Boy Scouts always had a little bit of a nationalistic trend. But I wasn't, I didn't care too much for that aspect.

DeVorkin: It looks like your interest is becoming physics at this time.

Reisig: Physics or medicine.

DeVorkin: Or medicine? I see. Of course the natural science track would be the one you'd take for medicine.

Reisig: Yes.

DeVorkin: As you went through gymnasium, what were your plans for the future after that? Physics or medicine? Did people talk to you about which university you might go to? Was there any question of financial support? How did you support yourself? First, let's talk about the choice of university and what you would do, and then about financial support.

Reisig: Well, our chemistry teacher took an interest in us and met with us. We discussed what schools one would go to. Now, at that time I was pretty fond not so much of physics, but engineering. We looked at the schools at that level and there was actually only a choice between Berlin and Dresden. Dresden in Saxony had a very high reputation as a technical university. Of course there was also for the boys who liked a little bit more the light side of going to the university, München. I think it was the third one in line.

You have to imagine this cultural environment. For instance, the University of Leipzig was always in ferocious competition with Berlin as the leading university in Germany. One of the reasons was that the University of Leipzig was very well endowed, so they could attract top notch professors for that.

Funny story about the salary of Debye. You know, he was from the Netherlands. He never got the German citizenship. And there was a saying: The unit of salary of a professor of physics is "one Debye". The unit is "Debye". The other professors got only a fraction of "one Debye".

DeVorkin: Did he make more than Heisenberg? I see. I think he was senior.

Reisig: Oh yes, quite a bit senior. Heisenberg was 26 when he got the full professorship in theoretical physics in Leipzig.

DeVorkin: Schroedinger's wave mechanics was coming out just at that time, '26, '27.

I just want to recap, then. You were interested in engineering. You might be going into medicine. You were looking at these different schools. Leipzig of course was very prestigious as was Berlin. Where did you end up going?

Reisig: To Dresden, because I wanted to go to a technical university.

DeVorkin: You still hadn't chosen between medicine and physics?

Reisig: I don't know what your experience was but as a youngster it was always a kind of shady, what my future would be. I don't clearly remember, if it was after the second semester, when for a certain reason, I was depressed, and decided I would change to medicine.

DeVorkin: Did that last long?

Reisig: No, that was the point where my parents interfered and said, dear boy, you've lost already two semesters and you want to start over again? No, you finish what you started and let's see later on.

DeVorkin: I'm still not fully clear. You were going into an engineering curriculum?

Rwisig: Not exactly. I started out with electrical engineering, and at the first semester break, I was so fed up with the work that was done in the engineering curriculum that I changed back to engineering physics. I had a real enlightenment on what my way in life would be, and never regretted it.

DeVorkin: What was the enlightenment? What caused the enlightenment, the courses you were taking in engineering that you didn't like?

Reisig: Well, I had the feeling that the engineering education was too narrow-minded. See, engineering is engineering, nothing else. But physics is such a broad field. You can apply yourself to so many things. It was much more challenging.

DeVorkin: But the key word is still, apply. You were interested in applying physics to the world?

Reisig: Right.

DeVorkin: Would you characterize yourself at this point as not being particularly interested in theoretical physics or pure physics for itself, or were you still interested in that, without application?

Reisig: Well, of course it depended on the curricula you had to cover. You see, I was always a little bit inclined to work with my hands, so I considered myself an experimental physicist.

DeVorkin: Did you ever build yourself a radio?

Reisig: Oh sure! More than one.

DeVorkin: When was your first radio?

Reisig: I think it was in '24

DeVorkin: Were you a ham, did you communicate using short wave?

Reisig: Oh, we were not allowed to do that! What do you think of German governmental policies? You see, telecommunication was under the direction of the German post ministry, and at that time they didn't even allow you to use an electronic tube.

DeVorkin: Could you have gotten one? They just didn't let you use one?

Reisig: Well, the first radio I built with remnants of old tin boxes and what not. I flattened them to produce a variable capacitor. You could move the plates in and out. It was with a crystal detector; that's all we were allowed to have at the time.

DeVorkin: Were you in the gymnasium at this time?

Reisig: Oh yes.

DeVorkin: So it was before the university; you were 14, 15 years old.

Reisig: Yes, I think I was 13 when I built the first one.

DeVorkin: Did you have friends who built them too?

Reisig: Oh yes. But then I had almost a kind of, I wouldn't say a factory, but a workshop to do radios for other people! For friends!

DeVorkin: Did you think of going into business?

Reisig: No, I'm absolutely incapable of doing business.

DeVorkin: Did you build any other electrical or electromechanical devices before you went into the electrical engineering courses?

Reisig: I tried to build an electrostatic generator. But that was kind of disappointing. I don't think I was too fit in the technology to make it really work.

DeVorkin: Did you use books?

Reisig: Oh yes.

DeVorkin: They were readily available?

Reisig: Oh yes.

DeVorkin: If you'd been allowed to, would you have been able to build a sending and receiving ham setup?

Reisig: I think so, yes.

DeVorkin: Did you know that electron tubes were in existence but you couldn't get them?

Reisig: Yes.

DeVorkin: Would you have had the money to buy one if they had been available?

Reisig: Yes, I was a tutor for younger students, so I made a little money.

DeVorkin: Let's go back to the university then. You tried electrical engineering. You decided to go back into physics.

Reisig: Engineering physics.

DeVorkin: Now, I still don't fully understand the German educational system.

Reisig: It is a bit complicated.

DeVorkin: I know there are gymnasium and technical Hochschulen.

Reisig: That's what we call technical universities.

DeVorkin: That is a technical university? So that's where you were going in Dresden.

Reisig: Then there were intermediate technical schools which more or less correspond to a technical college here.

DeVorkin: But you were at the university level?

Reisig: Right.

DeVorkin: This is a four year curriculum?

Reisig: Basically, yes.

DeVorkin: You ended up with a doctorate in engineering.

Reisig: No.

DeVorkin: Your title is doctor, though?

Reisig: Yes, that's a long story!

DeVorkin: Let's finish talking about your university career: how your interests developed, any particular courses or projects, especially projects or work that you undertook, possibly as a teaching assistant or something; anything you feel important to discuss to understand your own career.

Reisig: Well, to explain the system further, after two years you have to pass the first examination. In the first two years you cover the basic subjects, with emphasis on basic math and physics, not so much applied courses or specialized courses. You had to cover basic mechanics, for instance, and basic electronics. Then after the first examination you would be a graduate student, in US terms. At that time I thought, well, you have a basic background, you should benefit from this excellent situation in Leipzig. So I went for two semesters back to Leipzig and studied with Debye, Heisenberg and Hund. With Debye I took what we called the pre-doctorate laboratory. You got a certain scientific assignment -- I worked on Raman spectra -- and if you passed these two semesters, this important "preparatory laboratory", they called it, and if the professor considered you advanced enough, then you could take a topic for your thesis.

But at that time the economical situation was terrifically bad. It was 1932, the worst year we had in Germany. My parent said, you first go back to the technical university and get your degree, and dream about a doctorate later on.

DeVorkin: How were your parents doing ? Was your father continuously employed?

Reisig: Up to the Nazi times. Then he was kicked out.

Devorkin: But that was soon to come.

Reisig: I went back to Dresden. In a certain way I liked it there. For the graduate work in engineering physics you had to select a particular field or topic, and I took electronics because we had an outstanding professor in electronics, Barkhausen. I don't know whether you've heard about the "Barkhausen effect", the flipping over of elementary magnets in magnetic material? I think he made quite a name with these things. He also developed the first theory of electronic tubes and their integration into circuits. He wrote a series of famous books on these topics.

DeVorkin: That certainly identifies him quite well. He was your advisor?

Reisig: Yes, and I got what we called the diploma, which corresponds to the master's here.

DeVorkin: What was your research topic?

Reisig: Acoustics. Very funny; you see of course we had to cover again a very extended advanced laboratory with Barkhausen. I think it was three semesters. And after the lab, I went up to the student union with a friend of mine to play in the student orchestra, and they saw us carrying our violin cases. The professor said, "Oh, you're musical, you'll work on an acoustical topic."

And it was a very interesting one. It was about hearing testing. Audiometry, an absolutely new field at that time.

DeVorkin: Did you develop devices for testing noise levels, decibels that sort of thing?

Reisig: The audiologists at that time still used a set of tuning forks for determining the hearing levels of a patient. The first thing I had to do was to investigate the physical properties of a tuning fork in acoustical terms. You see, a tuning fork is a very directional transmitter of sound. If the audiologist turns the tuning fork a little bit in front of your ear, you get an entirely wrong intensity level. There was very little available in the literature about the physics of tuning forks, at least at that time. I was the first one who traced the radiation diagrams of tuning forks.

DeVorkin: I'll be darned -- the wave fronts?

Reisig: Yes.

DeVorkin: I know that James Jeans wrote a book on the physics of music, but I think that actually came after your work. That was maybe in the late thirties. Were you aware of that at all?

Reisig: No.

DeVorkin: Did you read literature in English at this time?

Reisig: Oh yes, that was typical. For instance, in Leipzig with Debye and Heisenberg, it was understood that you could read English. There was no question: you had to read it. I remember very well in the library of the Institute of Physics one of the assistant professors showed me, "Here's the PHYSICAL REVIEW. It's all yours!"

DeVorkin: Well, you worked on your thesis in acoustics, and then you received your diploma. What year was that?

Reisig: 1934. Now you asked about gadgets. I built an electronic audiometer, measuring the sound field, with a loud speaker as the source, and a microphone in a dummy head, and things like that. The assistant professor who was in charge of my thesis -- the professor couldn't supervise all of his students so he had assistant professors -- said, "Well, we have to try it out practically, with a medical case." So we went to the ear clinic at one of the big hospitals in Dresden, and there was a famous professor there, Tonndorff. His son is now a professor in a medical school in New York.

DeVorkin: Columbia-Presbyterian?

Tape 1, Side 2

Reisig: That's probably it. There, the younger Tonndorff works in medical acoustics. Anyway, we went to the clinic in Dresden and took all our gadgets along to where he had clients under treatment in his clinic. It was a very depressing experience. You see, it was Nazi times and we had these inheritance laws, or what would you call it?

DeVorkin: Inheritance? You mean, your genetic testing?

Reisig: Yes. In medical terms.

DeVorkin: Inheritance tests and studies of genetics, characteristics acquired through the blood line; is this what you mean? I don't know what the actual term is.

Reisig: Yes. Now, the bad story was that there were certain laws by which the state could intervene in genetically defective families. For instance, that people wouldn't have more children. There was a client, a woman, who had a very severe hearing problem, and her first child had it too. She was pregnant, but they didn't have the means to check the nature of this type of hearing damage, either in the mother or the first child. Unfortunately they could do this with my instrument. We got exactly the same, pattern on the hearing deficiency of these two members of the same family. So they concluded the second child could be expected to inherit the same hearing deficiency. And what do they say? Professor Tonndorff had to report this finding to the Nazi authorities, and this baby was aborted on the grounds of my measurements.

DeVorkin: Was this eugenics? "Improving the breed"?

Reisig: Probably so, yes. You can imagine, I was a young fellow then and it made a terrific impression on me.

DeVorkin: Were you happy that you were not in medicine at that time?

Reisig: In a certain way, yes. There was another thing which I learned in connection with this hearing testing: that the background in physics of these young doctors was so poor, that medicine did not appeal to me so much in terms of an "exact science", as physics did.

DeVorkin: That was not a world you wanted to be in.

Well, we should move along here. You were in engineering physics. You were getting your master's degree, your diploma.

Reisig: I even made money on that!

DeVorkin: On your thesis? How did you make money on that?

Reisig: Each year the German Association of Otolaryngologists had invited authors for a prize essay. So, together with the assistant professor, we wrote our prize essay on this hearing gadget I had built and the experiences we had had, and we won the prize! It was 1000 marks! It was a lot of money at that time.

DeVorkin: 1000 marks, and these were Reichmarks?

Reisig: Reichmarks.

Devorkin: How long could you live on that?

Reisig: I put it in the bank for later purposes.

DeVorkin: What were your immediate plans?

Reisig: Of course I wanted to go ahead with the doctorate, but because of the economic circumstances and the beginning of the Nazi Reich, our Professor Barkhausen said, "I won't let you work on your doctorate. Go into industry and see if you can get your feet on the ground. Nobody knows how long this boom will last. You'd better be in there."

So I left the university and went to Siemens.

DeVorkin: Was it safer to be in industry than in the university?

Reisig: Oh yes. Industry at that time made money and universities didn't.

DeVorkin: It wasn't a question of war production?

Reisig: Not at that time.

DeVorkin: Were you being looked at for the army? Was there any pressure?

Reisig: Not at that time, no. We were even lucky. Of course, students were more or less pressed into these Nazi student organizations, but since we were in the status of getting the final examination, we were exempted. So I got around this bad business.

DeVorkin: I see, just barely. How did you go to Siemens? Was that the only choice? Was that the choice of Barkhausen for you?

Reisig: Essentially I had been for one year at Siemens, when I interrupted my university studies. For our examination we were required to work for one year in an industrial environment.

DeVorkin: That's an apprenticeship of some kind?

Reisig: Yes, you may call it that. And by good circumstances, I could go to Siemens for that year, which was very beneficial for my training. So it was more or less natural that I went back to Siemens thereafter.

DeVorkin: What did you do during the summers? Did you have summer vacations during your years at university?

Reisig: Well you were supposed to work pretty much on your own during the univeristy vacations. There were three months in the summer time when we worked on what we were studying during the past semester.

DeVorkin: So you continued reading and continued doing experimentation?

Reisig: Not so much experimentation as paperwork. I'd like to mention, because you asked the question whether I was on the practical side or theoretical, that I had six semesters of theoretical physics.

DeVorkin: You mentioned Heisenberg, Debye, people like that.

Reisig: Toepler, in Dresden, I don't know whether that means anything to you?

DeVorkin: No.

Reisig: The father of Toepler was also a professor of physics, in Dresden, and he became famous with his electrostatic experiments. He invented also the Schlieren optics, which we use un the modern wind tunnels.

DeVorkin: Early van de Graaff type generators, studying static charge?

Reisig: No, the younger Toepler, our teacher, particularly studied electrical discharges. They were called Toepler patterns in the old physics books. But see, there was quite a bit required for studies in theoretical physics, particularly for electronics electives.

DeVorkin: What were your duties at Siemens?

Reisig: I wanted to go into the acoustic laboratory, but I didn't make it for certain reasons. I was assigned to a laboratory for measuring-gadgets, particularly for telecommunications. It's a very interesting field.

DeVorkin: Was the official name "Laboratory for Measuring-gadgets"?

Reisig: In German we distinguish between Mess-Instrument and Mess-Gerät.

Collins: One's a measuring instrument and what's the second one?

Reisig: The measuring instrument is, for instance, a voltmeter, ammeter, ohmmeter. The Gerät, let's say, a circuitry. For instance, we measured the capacity of telecommunication cables, and you needed a certain kind of a bridge, a so-called Wien bridge. We built things like that. But we also built much more sophisticated things, for instance, I worked on a "landing feeler" for airplanes, based on electrical bridge circuits.

DeVorkin: I see, sophisticated test equipment that was designed to test systems.

Reisig: Right. That was very educational for me.

DeVorkin: What year was this?

Reisig: I started in January of '35 at Siemens.

DeVorkin: How long did you work with them?

Reisig: Well, we had internal reorganizations at that time, and we had very bad luck. It was a time when they were building up the German air force, and three of the top engineers of the laboratories died in an airplane crash testing out Messgeräte on board the airplane. Then we had internal problems finding proper replacements. I was transferred to another laboratory to replace one of the guys who died. It was in multiplexing telegraphy. I got acquainted with entirely different aspects of electronics, like electronic filter design, filter theory, receiver designs, things like that.

DeVorkin: In this system, was this actually telemetry type material? Was this radio or was this all multiplexing by wire?

Reisig: Essentially wire. But my first encounter with telemetry was that I had to make a design for a telemetric system for the power plants in Morocco.

DeVorkin: How did that come about?

Reisig: Well, of course Morocco is an area of long distances. They had power plants in all directions of the wind and they wanted to have a central control on the production of energy, so they needed a telemetering system. That tied in to our multiplexing telegraphy. We could use elements of the multiplexing telegraphy for this telemetering system.

DeVorkin: That's really interesting. Was this when Morocco was under German occupation?

Reisig: No, I think it was the French at that time.

DeVorkin: So this was a commercial venture with Siemens?

Reisig: Right.

Devorkin: Fine. Was Siemens becoming more and more a military contractor while you were working there?

Reisig: Of course. Another thing we were working on was the remote control of a battleship for target practice for naval artillery. See, it was an unmanned old battleship, and everything on board was automated.

Devorkin: You were getting familiar with servo control mechanisms and feedback?

Reisig: Of course I was essentially concerned with the electronic part of it: signal transmitting, command transmitting and things like that.

DeVorkin: How extensive did that become? Did these ships become quite controllable by remote control? Could you really make the ships behave as you wanted them to?

Reisig: Oh yes! And then we had the feedback from the shell impacts; which elements of the ship were hit.

DeVorkin: Was that interesting work for you?

Reisig: Oh my goodness! Now, all this stuff helped me very much for my job in Peenemünde.

DeVorkin: Is it the right time to identify how you got to Peenemünde?

Reisig: Yes, see, I stayed at Siemens for not quite three years.

DeVorkin: That would bring you up to about 1938?

Reisig: '37.

ReVorkin: The reason why I'm trying to identify a date is that a very important date in Regener's life was his signing of the Heisenberg-Wien-Geiger memorandum. Did you have any knowledge of the problems that were going on in Aryan physics?

Reisig: No, not that much. I could have, probably, because a friend of mine, a schoolmate, stayed with Heisenberg and got

his doctorate with Heisenberg. He was very close to Karl Friedrich von Weizsäcker. I met the latter at Heisenberg's institute. We all were upset by the Nazistic polemics of Lenard against the cosmopolitan leading physicists. We despised Lenard's silly concept of "German Physics".

DeVorkin: But that was not in your experiences; you weren't involved in that problem?

Reisig: No.

DeVorkin: You mentioned your father lost his job at this time.

Reisig: Yes.

DeVorkin: Why was that? Was he political?

Reisig: Because he wasn't a Nazi! Of course, this institute where he was professor at was known to be very liberal.

DeVorkin: Did he suffer personally?

Reisig: Oh yes. My mother almost more than my father.

DeVorkin: Physically?

Reisig: No, mentally.

DeVorkin: Did they survive the war?

Reisig: Yes. As a substitution my father was offered a position to be a principal of a school, but he declined. He had had "enough."

DeVorkin: What did he do when he lost his professorship?

Reisig: He went into retirement. I mean, he wasn't very far from retirement, anyway.

DeVorkin: The retirement was enough income?

Reisig: Yes.

DeVorkin: He was therefore secure, you didn't have to support him?

Reisig: No; the retirement pay was pretty good in Germany.

DeVorkin: So he maintained his retirement, he wasn't ostracized completely.

Well, let's identify the process through which you came under the Peenemünde work. Did you go directly to Peenemünde? It sounds like you came on just as Peenemünde was being built?

Reisig: I was for a very short time in Kummersdorf Proving Ground (about 50 km south of Berlin), which was the first installation for the rocketry work of the German Army, directed by (then) Captain Dornberger with Wernher von Braun being his chief engineer.

DeVorkin: What was the actual process? How did you get onto the Peenemünde team? Did you know any of these people? How did you know them?

Reisig: Through a friend of ours from school, Dr. Hermann, who was the chief aerodynamicist in Peenemünde. He was a number of years older than I was. His father was my music teacher at the gymnasium, and we had some connection through the youth movement, that sort of thing. We stayed in contact.

DeVorkin: How did he come to choose you?

Reisig: Of course they were looking for personnel during this building up phase, and he knew that I was interested in measuring techniques, from my diploma work and Siemens work. They needed a chairman or chief for the measuring department at Peenemünde, so he suggested me to Wernher von Braun. But von Braun didn't take me right away. He sent me to a physics professor in the Technical University of Hannover who was already working for Peenemünde under contract, and I had a day's "screening", you know.

DeVorkin: Was he examining you?

Reisig: In a very elegant way, yes.

DeVorkin: Sort of talking with you?

Reisig: He took me through all his laboratories, very interesting. I remember he said, "You are coming from Barkhausen, so the only thing you know is electronics. How about physics?" Then we discussed his physical experiments. "Oh, you do know about physics!" referring to my experimental work with Debye in Leipzig.

And so I made it!

DeVorkin: Well, after that, was it a long time before you knew or did you find out immediately?

Reisig: It was days, a week or so.

DeVorkin: So how did you move to Kummersdorf, was that a great distance? Did you have a family by then? You were still pretty young.

Reisig: I had just married at that time. I was assigned to Kummersdorf because they were still building concrete block houses and things like that in Peenemünde so I couldn't do much there. The concrete was still wet and we couldn't put our instrumentation in. So I was assigned to Kummersdorf to the old installation for a couple of months, something like that.

DeVorkin: You were to be chief of measuring devices?

Reisig: Right.

DeVorkin: Measuring devices to measure the behavior of the missiles? Reconnaissance?

Reisig: At that time we essentially were concerned with the development of the rocket power plant (rocket motor and auxiliary equipment).

DeVorkin: Let me ask you a few questions from Frank Winter's list. The first question, I think, relates to rocket motors and other things. At Peenemünde, or any time before you came to Peenemünde, did you know if any of Robert H. Goddard's patents or writings were ever examined by you or used at Peenemünde towards the V-2 or other rocket development?

Reisig: It's a very strange thing. We knew of the existence of Goddard, but we hadn't the slightest idea what he did. We didn't get ahold of any of his papers. After we came over here, we found out that we had done a few things in parallel.

DeVorkin: But you never saw Goddard's technical papers at this time?

Reisig: No.

DeVorkin: So how would you characterize Goddard's influence or input to German rocket development in the early years?

Reisig: It was about nil. We esteemed him very highly, had a very good impression of his work and his ideas.

DeVorkin: Of course you've probably read American histories of rocketry that say that the Germans were very interested in

Goddard's work and the Russians were very interested in Goddard's work and read his papers, that sort of thing. What is your general comment about American writing on the influence of Goddard in rocketry, the history of rocketry? Do you have any personal comments or opinions?

Reisig: Nothing except that we didn't know in Germany what he did.

DeVorkin: I think that's pretty straightforward.

Reisig: It was just a lack of awareness.

DeVorkin: Ok. Let's go back then to your specific duties. Were you briefed by Wernher von Braun? How much contact did you have with Dornberger? What kinds of circles did you run in and what were your initial duties and responsibilities?

Reisig: It was to set up the measuring system for the rocket motor tests. This was in certain ways unique because the instrumentation you could buy from industry didn't suffice in many cases for our requirements. As chief of the measuring branch I was in almost daily contact with W. von Braun. We had to give periodic status reports about our area of work to Dornberger.

DeVorkin: Because of the conditions of operation of a rocket motor?

Reisig: For instance, flow measurements: measuring the rate of flow of the propellants. There were no instruments available which could take such large rates. We had to initiate development in industry.

DeVorkin: Did you go directly to industry and offer money, or were you liaison for contract work?

Reisig: We were everything at the same time!

DeVorkin: Did you have specialists working for you who were contract people, grants and risks type people, as we have here, and then technical officers who could maintain some vigil, some contact with industry to make sure they were doing things to specifications?

Reisig: Of course I had a staff. I don't remember how large my group was at that time, from academic personnel down to workmen; possibly 65 people maximum.

DeVorkin: Were you the hiring agent?

Reisig: Oh yes, for my group at least.

DeVorkin: How did you recruit?

Reisig: It was very difficult, because there was at that time already such a shortage of technical personnel. You really had to go around and look and sometimes sneak people away from their employers; for instance, from Siemens.

DeVorkin: You conducted periodic manpower raids!

Reisig: More or less!

DeVorkin: Was a shortage of manpower very common in all German research and development areas?

Reisig: Particularly in applied research and development. You did anything you could do.

DeVorkin: Did you feel you were being given support by the military? Was this project a favored project or did you have to really scrounge?

Reisig: No, that was the pleasant thing at Peenemünde. We never had to talk about money. The most difficult problem was to get the manpower together.

Collins: When you joined von Braun and Dornberger, at Kummersdorf, did you have to become a member of the army or a member of the party at that time?

Reisig: Not of the army. We were civilian employees of the German government. Later on in Peenemünde we were more or less forced to become party members.

Collins: About when? Was that in the forties?

Reisig: In '38.

Collins: So you knew you had to sign up. How did you feel about that? How did your colleagues feel about that?

Reisig: Well, we more or less neglected it. You see, we were kind of protected by the military organization there. At that time the party didn't have any say over army affairs or military affairs. It was more or less a formality.

DeVorkin: Yet you had to sign up. To require that was an indication of the power of the party.

Can you describe which rocket engines you were working on? The A-5 I know was built in the late thirties.

Reisig: The very first one was the A-3. It was my first assignment -- the concrete was still wet in the test stands -- von Braun wanted to make good use of me and one day he telephoned me from Berlin. You see, Dornberger was actually located in Berlin in the ordnance department. He came on a regular schedule to Peenemünde to look after us. So von Braun called me on the telephone, "You know, we are scheduled to have the first rocket firing of the A-3 missile." I don't know whether these missiles mean anything to you?

Devorkin: I know a little bit about them. Dr. Reisig has brought out a blue binder with a manuscript in it. Could you identify the manuscript?

Reisig: It's the first part of my Salzburg presentation on the occasion of the celebration of Professor Oberth's 90th birthday. The title is: The Development of the Apollo Rocket with the Peenemünde concepts.

DeVorkin: Yes, we have a copy of this. I believe you already gave us part of this, didn't you?

Reisig: Yes. This is the outline of the paper.

DeVorkin: This is the A-3?

Reisig: The A-3, shown with its long fins here.

DeVorkin: Picture No. 2, Versuchs-Rakete "A-3," Peenemünde, 1937. Yes, I've seen photographs of this being launched.

Reisig: This one is on a test stand at Kummersdorf.

DeVorkin: That's picture 4, in 1937. Do you have the original prints of these pictures? Are these your own pictures?

Reisig: No, the originals are in the Deutsches Museum.

DeVorkin: Fine.

Reisig: Von Braun made me the manager of this first missile firing exercise.

DeVorkin: Was that part of your general assignment? You were chief of the measuring branch; was this an add-on assignment or did it go along with your regular duties?

Reisig: That was a special assignment, and it wasn't even at Peenemünde. It was on a little island.

DeVorkin: On the Greifswalder Oie?

Reisig: Yes.

DeVorkin: This is Dornberger's book, "V-2". I'm just saying it for the tape.

Reisig: Here's the same picture.

DeVorkin: This photograph is in the very beginning of the book just after the foreword on page xvi (16).

So the test stand on that small island must have been very very new. Was that the main Peenemünde launch site?

Reisig: In the beginning, yes. See that little dot? that's the Greifswalder Oie. Peenemünde is here on the tip of this island.

DeVorkin: We're looking at a map facing page 3, at a little inset called Ruegen.

Reisig: Ruegen is this island here. Just this little dot here is the Greifswalder Oie.

DeVorkin: A very small island. Now, did all the launches take place there?

Reisig: No. At least these four firings during 1937. Later on, we launched the "A5"-Program from the Greifswalder Oie, and several "A4" vertical shots.

Devorkin: Because I know that later on the rocket that Regener was to have his instruments on and the vertical firings that von Braun did were launched from the Greifswalder Oie.

Reisig: You couldn't imagine how primitive it was there.

DeVorkin: How did you like living up there? How did your wife like living up there?

Reisig: She stayed for a week, I think, with me and then she gave up. It was winter time, December. You can imagine.

DeVorkin: And went back to the Leipzig area?

Reisig: No, to our house in Peenemünde.

DeVorkin: Peenemünde was okay but the island was really raw.

You became the project manager in a way for launching the A-3s. Did that include evaluation and testing?

Reisig: Certainly evaluation, yes.

DeVorkin: You mentioned to me in some of the earlier letters that you flew scientific instruments for measuring height and that sort of thing; thermographs, barographs.

Reisig: I have some documents on that.

DeVorkin: Excellent. Who designed those? Did you have a part in designing them?

Reisig: No. See, when I came to Peenemünde from Kummerdorf, these things were already more or less ready for firings. I didn't participate in the development of any of the gadgets.

DeVorkin: How high up did these go?

Reisig: Well, we had very bad luck with these firings. It was the first rocket with a fully automatic control system, and this control fizzled.

DeVorkin: Right. This is the stabilization system?

Reisig: Right.

DeVorkin: Was it fin stabilized or did it have a little rudder feedback system?

Reisig: You can see it here. There were molybdenum rudders in the exhaust jet.

DeVorkin: Ok, so there were these little vanes here, and there was a stabilization system controlling those vanes. You say it fizzled?

Reisig: Yes.

DeVorkin: Do you know why?

Reisig: Well, it had several reasons. The basic physics concept was wrong. It's a very interesting story, by the way. I'm writing the second part of my Salzburg presentation about

this topic. The first part is propulsion, and the second part is control.

DeVorkin: We don't want to duplicate in the interview what you've already written. What we want to do is fill in the human aspects, things that you may not include, or that we would like to flesh out. In other words, what was the working spirit, the atmosphere for research? What did you do in your spare time? What was it like working at Peenemünde?

Reisig: It was always exciting. As I said in another speech already I can't remember a single day at Peenemünde that was not exciting or at least interesting, because something always was up. This was particularly due to the spirit or mentality of von Braun. He generated ideas!

DeVorkin: What about the military? How evident was the German army there?

Reisig: Very little.

DeVorkin: It changed with regard to the SS, but not actually with regard to the army.

Let me also ask a few of the particular questions that Frank Winter has prepared, that at this point I think are appropriate. Were you a member of the wartime GFW spaceflight advocate groups, as was Krafft Ehrlicke?

Reisig: No that was not wartime.

DeVorkin: Was that pre-war? Were you involved in it at all?

Reisig: No.

DeVorkin: For the record, that's a no for question No. 3. Well, I'll go back. We've identified that you had some awareness of spaceflight through Oberth, but did you increase this awareness or interest at all in the thirties before you went to Peenemünde?

Reisig: Well, in a certain way. Of course it was almost top secret, but friends talked together. I got some idea of what was going on.

DeVorkin: Was it exciting because it was the way to go to the moon?

Reisig: Of course. By that time we were pretty quickly caught by the idea of going into space. Doing work on it was a tremendous impetus.

DeVorkin: But there was no question that you were developing a military capability?

Reisig: None at all.

DeVorkin: What do you mean, none at all?

Reisig: I didn't even know that it was supposed to be employed as a weapon. We all thought, that's so far away that it ever can be used as a weapon.

DeVorkin: Did you ever ask yourself why the German army was supporting this?

Reisig: As a long range proposition, yes, but not immediately. There were so many basic problems to be solved, that the military aspect was second or third priority.

DeVorkin: Were you comfortable in the fact that Germany was at war, it was to be a Thousand Year Empire, and that there would be plenty of time for experimentation to bring these things up to operation?

Reisig: When we started, there was no war; it was two years before the war.

DeVorkin: So it was a purely experimental blue sky sort of operation, in your mind? Long range, as far as time was concerned, nothing specific, nothing about the Versailles Treaty or anything like that came into your mind?

Reisig: No.

DeVorkin: Did you have any knowlege of Karl Otto Altvater, and could you tell us anything of his role as a link between the old BFR and Peenemünde? Question No. 5.

Reisig: Karl Otto Altvater, of course I knew Altvater. He was one of the Siemens managers, fairly high up. He was a former navy captain. I met him at Peenemünde. I didn't know him before.

DeVorkin: Was he there as a consultant, or in what capacity, do you know?

Reisig: We had a Siemens team with us in Peenemünde for the development of the improved control system. He came sporadically to Peenemünde to look after these people and to talk with us.

DeVorkin: Would you say that he made a major contribution to the Peenemünde effort?

Reisig: Well, he did in that he was very supportive toward us. Favorable. We had quite a number of people who said, "Oh, these guys are crazy." But he took us seriously.

DeVorkin: Who thought you were ccrazy? Anybody we know?

Reisig: Well, essentially the army circles.

Tape 2, Side 1

DeVorkin: Could you describe how, if at all, the atmosphere at Peenemünde changed as the war started after '39?

Reisig: Well, of course, the work schedule was very much intensified.

DeVorkin: You said you never had a really successful flight with the A3. What was next, the A5?

Reisig: The A5, which was a small scale A4.

DeVorkin: It was meant as a test of the A4?

Reisig: A test carrier, I don't know what you would call it.

DeVorkin: The A3 was already designed and you were testing it but the A5 was still undergoing design when you came to Peenemünde?

Reisig: It was started after the A3 firings.

DeVorkin: So what role did you have in the A5?

Reisig: Well, my activity changed somewhat, because we needed measuring gadgets to fly with the rockets. I shifted gradually away from the test stand measurements into the missile measurements. For instance, we needed a recording of the behavior of the control system during flight. Since we didn't have a telemetering system yet, we developed an oscillograph which flew with our rockets in a very heavy case which we could recover after the rocket landed in water. In fact one of the reasons to fire from Greifswalder Oie was that the rocket came

down and dived into the water rather than hitting solid ground. So there you see how it came down, with a parachute.

DeVorkin This is picture No. 6, a photograph of the A5 rocket with two parachutes.

Reisig:: That's the so-called brake parachute. It breaks the speed of your rocket. After the speed was reduced, the carrying parachute came out.

DeVorkin: If you deployed the big parachute first it would have ripped?

Reisig: Yes.

Devorkin: It was in 1938 you had these parachute retrievals?

Reisig: Yes, we started in '38.

DeVorkin: So parachute retrievals of small rockets and of the A5 were common techniques for you at that time?

Reisig: No.

DeVorkin: They were not common?

Reisig: We developed the parachutes ourselves for the A5, in connection with the companies who were manufacturing parachutes anyway. I think this combination of a brake parachute and the load parachute was ours.

DeVorkin: Certainly the conditions under which it was needed were unique to re-entering rockets.

Reisig: Yes, and there was the whole ejection mechanism for the parachute itself.

DeVorkin: Did you say in your comments of my own research that it was this design for the A5 that was intended to be used to eject the Regener-Tonne? Not for the A4?

Reisig: Maybe I misread your text. I got the impression that you said the whole A4 was lowered on a parachute. That was never done like that.

DeVorkin: So in the early A4 tests the rockets were never retrieved?

Reisig: No.

Reisig-33-

DeVorkin: So if the Regener-Tonne were to be ejected by parachute as was planned, the system that it was developed from was the A5?

Reisig: Essentially. I don't know whether it was exactly the same type of parachute. Maybe a bigger one or a different one.

DeVorkin: I know that they were discussing, as we'll talk about in a minute, a parachute that would start out partially deployed and then later fully deployed. It had restraining ropes of different lengths and that sort of thing. It was being designed for the Regener-Tonne, not for the A5.

Reisig: But the final version of this load parachute was not a solid hull but a parachute consisting of bands. You had the possibility that the air between the bands could escape, as a means of reducing the shock of putting the load on this parachute.

DeVorkin: I understand, that makes sense. Was this a successful design for the A5?

Reisig: Very much so.

DeVorkin: How many flights of A5s were you involved in?

Reisig: I tried to re-establish that. It's the hardest thing in the world!

DeVorkin: Many dozens?

Reisig: The best I could make out was that we had about 25 firings. But we used some of the A5 rockets for several flights. We recovered them from the water and refitted them and fired them again.

DeVorkin: So there was very little damage to them. They were reusable. These were the first reusable rockets, not the Space Shuttle!

Reisig: I'd say so!

DeVorkin: What did you learn from the A5 that was important for building the A4?

Reisig: The A5 was essentially designed for testing and developing the control system. The A5 in comparison to the A3 had an entirely different control system. And then, we started the development of two radio links. One link was for cutting off the propulsion from the ground. The second link was for

tracking the missile, by means of a radio link.

DeVorkin: Was that a Doppler?

Reisig: Yes, that was a Doppler system, also known as the Wolman system. Wolman was a professor at the Technical University of Dresden.

Devorkin: You also had another name for the large parachute?

Reisig: Bänder-Fallschirm? Or do you mean load? This is the brake.

DeVorkin: Oh, brake and load, fine. Was the control system that was designed and tested on the A5 the control system that was eventually used on the A4?

Reisig: No.

DeVorkin: So you found it wasn't successful?

Reisig: It was successful but it didn't suffice for the specifications of the A4. We learned quite important facts for the design of rocket control systems, and developed the proper control theory from the A5 Test results.

DeVorkin: By the time you were working with the A5, did the prospect of using rockets for ordnance, military missions, become more obvious?

Reisig: Yes, it was the beginning of the war.

DeVorkin: So we're talking '40, '41 now?

Reisig: No, it was still '39.

DeVorkin: Were you involved in plans to begin designing and building the A4?

Reisig: Yes, as far as instrumentation is concerned.

DeVorkin: What were your feelings now that you knew you were designing what was going to be an operational system?

Reisig: Well, there was not much choice. It was war!

DeVorkin: No, it's not a question of choice. But see, I'm going back to some of the comments that we were talking about from David Irving, Beyerchen, and others, where they said that scientists became reluctant to work for the war effort in

Germany. I'm wondering -- you wanted to talk about that period -- is this an appropriate place to start talking about that?

Reisig: If you step into a war, voluntarily or involuntarily, you are more or less obligated to cooperate. I don't know that there would be any difference in any other country in such a situation.

DeVorkin: You wanted to talk about those pages in my article that in the rough draft go from page 16 to page 18 or 19, where I talk about one of those problems. We may be jumping ahead, because I want to talk more how you came to be assigned to work with the Regener group. What shall we talk about first? Shall we talk about how you came to that?

Reisig: It doesn't matter. The Regener work more or less fell in my field, because it was concerned with on-board measuring systems.

DeVorkin: That's very important: It was your experience. But who made the decision that you would work on the Regener research? Did you ask for it?

Reisig: No. I didn't even know that there was already a contact made with Regener. I think it was essentially Wernher von Braun himself who assigned me that project.

DeVorkin: Could you expand on Wernher von Braun's interests in these measurements? What were the relative roles of the military need to gain data on the high atmosphere for ballistics and frictional heating and things like that, as opposed to the purely scientific interest?

Reisig: Well, I think the scientific interest was number one in as much as we had not sufficient scientific background information on the high atmosphere to recognize and assess ballistic effects. Other topics of Regener's research program, like the solar spectrum, were even more speculative with regard to atmospheric ballistics. However, eventual solar effects on our radio links to the missile, at high altitudes (Ionization effects: The A4-flight traversed the lower D-layers!) were a reasonable justification for this research topic. Of course, we had to account for the lack of understanding on the military side with regard to the search for scientific information of non-obvious military relevance.

DeVorkin: Did you prefer working on that sort of thing to working on direct military ordnance?

Reisig: Of course.

DeVorkin: Were there people who were not asked by von Braun to work on the Regener problems or on other associated scientific problems who wanted to? Your colleagues?

Reisig: No. We were so short of competent manpower, particularly in the measuring field, that there was no overlapping with assignments of other people. Measuring specialists are always a rarity. You don't find them on the street.

DeVorkin: If you were a rare commodity, how could von Braun afford to assign you then to a scientific mission and not ordnance mission?

Reisig: Well, he was blamed by Dornberger, not on this particular thing but on other issues, that his interests were too broad for a wartime situation.

DeVorkin: Did Dornberger criticize him for that?

Reisig: Yes.

DeVorkin: Did Dornberger know what von Braun was doing when he assigned you? Did it draw criticism from Dornberger?

Reisig: No, it didn't. As I said, how the contact with Regener took place, I just can't remember.

DeVorkin: Stuhlinger recalls that it was part of a large Wisdom Day that he called.

Reisig: Oh sure, but Regener was not involved in the Wisdom Day.

DeVorkin: I see. So you don't know how Regener actually did get in contact with von Braun, or vice versa?

Reisig: No.

DeVorkin: Were you aware of any scientific groups associated with Peenemünde as Regener's Friedrichshafen group was, that were doing scientific experiments, scientific research, that was literally sold to the military as being of value to the military but also having pure scientific interests? Were there any other identifiable teams?

Reisig: The flight of a metal body through the very high atmosphere (almost into "space") was such a novelty that "any" adverse physical effect could occur. Hence, we had to initiate "basic" research. For instance, one typical thing was we were

not sure what the jet exhaust, these hot gasses, would do to our radio communications. We were not sure whether that would be such an attenuation that we wouldn't get anything through. It was the ages old problem: what is the effect of charging the rockets' fuselage while the exhaust is burning? And so we had a contract with the Technical University of Darmstadt, and they had to investigate here the charge effects on the hull of the rocket. That was a merely scientific problem. We had even a theoretical physicist working on this problem. There was a professor of theoretical physics, Wessel, and I think he was a professor in Heidelberg after the war, as far as I can remember. He was drafted by the Air Force as an officer, and he was most unhappy. Of course. Somehow it could be arranged that he was transferred to the army installation at Peenemünde, and he got assigned to my group. He worked on this electrical charge problem on the rocket from the theoretical side.

Devorkin: That was clearly an applied problem. You were taking physics and applying it to this specific problem.

Reisig: In many cases it is not quite feasible to separate the "basic" from the "applied" aspects of a particular physical problem.

DeVorkin: That's different than Regener, who was certainly gathering information on temperature, pressure, composition, wind velocity.

Reisig: It was still an academic problem.

DeVorkin: An academic problem supported in order to better understand how missiles behave?

Reisig: Right, particularly with radio communications: how the rocket exhaust would influence the communication links.

DeVorkin: Do you know of any other examples like this, where academic scientists were brought in to perform theoretical calculations?

Reisig: Yes, for instance, the frequency stabilities of quartz oscillators. That was a problem which, to manage, has never been solved. Also quite a number of mathematical problems were treated, e.g. non linear effects in differential equations, or accuracy problems in integrations, particularly in control theory and ballistics.

Devorkin: Was Regener's experimentation or project more blatantly scientific and less obviously applied than most of the other academic contracts that were brought in?

Reisig: The general atmosphere was the same. You see, we needed certain information about the environment for the flight of a rocket, and we found out that the basic knowledge was missing. So we had to initiate certain areas of basic research, just for the understanding of what's going on.

DeVorkin: Do you remember when you first met Regener and when your role in the project was defined? When was that?

Reisig: I couldn't tell you exactly the date. I think it was in '42.

DeVorkin: What is the document you have there?

Reisig: That's older stuff. That's about atmospheric measurements on the A3.

DeVorkin: Development of a baro-thermograph.

Reisig: Baro-thermograph, measuring the atmospheric pressure and the temperature.

DeVorkin: This was in Berlin, 1936. Were you involved that early?

Reisig: No, but I took it over.

DeVorkin: I see. They used a bimetallic strip?

Reisig: Yes.

DeVorkin: This is signed, but I really can't tell by whom. These are all codes for the people who signed them down here.

Reisig: That is Wernher von Braun. That is Dornberger. I don't know who that is.

DeVorkin: They were interested in equipping the A3 as early as 1936 with thermobarographs. But these were the standard kinds of instruments that were sent up on balloons for height measurements.

Reisig: I wouldn't say standard, because it was special development.

DeVorkin: Oh yes, but these same measurements were made from balloonsondes to determine their altitude, etc.

Reisig: I think you know that one. Look at the date, July '42. It may have been in May '42 that I went with von Braun, Steinhoff and Zanssen, I think, to Friedrichshafen to meet Regener.

DeVorkin: Oh, before this meeting which has been described in Clay and various other books as the beginning of the Regener program?

Reisig: We paid him a visit before that.

DeVorkin: I see. What's your recollection of that visit?

Reisig: Well, it was more or less getting acquainted with the work of Regener and his ideas, and the possibility of applying his methods to rocket flight. Something preliminary, you see, it was the first contact.

DeVorkin: Sure. That was with Steinhoff?

Reisig: I think Steinhoff was there, von Braun of course, and I think Zanssen was there.

DeVorkin: That's quite a long trip, down to Friedrichshafen.

Reisig: We flew down. See, we had our own bomber. Steinhoff was an expert pilot. Do you know the story, he was holding the distance record in a glider plane? He flew from the Wasserkuppe (Rhoen mountains, about half way between Göttingen and Würzburg) to Brünn, Czechoslovakia.

DeVorkin: No, I didn't know that.

Reisig: Before the war. He was so well known for his flying capability that at the Olympiad in Berlin in '36, there was a big demonstration of zeppelins; we still had a couple of them. They were directed to make propaganda flights over the Olympic Field. Steinhoff made a loop around one of the zeppelins in flight with a glider plane! It was typical of him. A crazy guy!

DeVorkin: A daredevil -- oh my gosh!

So let's go back to the May of '42 meeting. You were on the bomber, so clearly the flight wasn't very long. It was just a few hours. Was that one of the first times you went in an airplane?

Reisig: No.

DeVorkin: Can you recall what the flavor was like upon meeting Regener, how Regener and von Braun got along? Had they met before? Did they know each other?

Reisig: I couldn't tell you for sure.

DeVorkin: What was your impression of Regener? What kind of person was he?

Reisig: Oh, he was a very pleasant person. I hoped he would be my Doktor-father. Do you know what a Doktor-father is?

DeVorkin: Thesis advisor for PhD?

Reisig: Yes. We called it Doktor-father. But he died just at that very moment.

DeVorkin: That was in 1955 approximately, or early fifties.

Reisig: Personally I had a very pleasant relation with him.

DeVorkin: How did his staff treat him? Was his word absolute law?

Reisig: Oh no, Regener wasn't that kind of a person. They were colleagues of his then, and they were very outstanding ones.

DeVorkin: Ehmert?

Reisig: Ehmert. I was a friend of Ehmert; we liked each other very much. Ehmert, Schopper, and Paetzold.

DeVorkin: Paetzold came a little later. He really wasn't in this meeting. He was hired or brought in a little later.

Reisig: Now, wait a minute. He was a student of Regener's. He got his doctorate with him, I think.

DeVorkin: I'd better check that, he didn't mention that himself.

Reisig: As far as I can recall, yes.

DeVorkin: The others were at this meeting but we're not sure about Paetzold.

Now Regener of course had had his own troubles in 1938 as well. His wife and his son had to leave. Did you tell me that his wife was Jewish?

Reisig: I think so, yes.

Devorkin: They had to leave primarily for that reason, or?

Reisig: I suppose. Regener was a professor at the university, and they had to abide to these racial requirements. And if I'm not mistaken, but you could ask Viktor Regener, the older Regener was forced by the party to divorce his wife if he wanted to stay as professor.

Devorkin: I see, and he didn't divorce his wife.

Reisig: Not Regener, no.

DeVorkin: I want to get a sense of him as a human being, as a personality, and you're helping me tremendously here.

Reisig: He was an extremely pleasant person.

DeVorkin: You'd rate him as being fair, concerned with bringing up his colleagues, letting them do their own projects?

Reisig: Absolutely.

Devorkin: You don't recall the meeting in May well enough to say what Regener's own interests were in doing all this? Did he have to be convinced? Was he very conservative or was he really anxious?

Reisig: I remember that we talked quite a lot about balloons. He had a high reputation about reaching extreme altitudes with his balloons. I remember very well the location. It was a summer resort of the father of C.F. von Weizsäcker.

DeVorkin: Down in Friedrichshafen?

Reisig: Yes. That was quite a modern house.

DeVorkin: It was very pleasant?

Reisig: Oh yes.

Devorkin: How much time did you spend down there?

Reisig: A couple of days or so.

DeVorkin: What was your sense of the result of the meeting when you left? Was he going to participate?

Reisig: Sure, he was very eager. It was a unique opportunity for him to reach the really high altitudes.

Devorkin: Do you know if he continued balloon ascents?

Reisig: I think so, yes. Do you know that he went to extreme heights and to extreme depths?

DeVorkin: Yes, I know he went down to the bottom of Lake Constance, and other places, and that he went into mines. He took his counters all over the place. Stuhlinger recalls that Regener did not fly any cosmic ray equipment, yet von Braun in his deposition, in his interrogation with Fritz Zwicky, says that ion counters were sent up as part of the Regener program. No ion counters were identified here or in the documents.

Reisig: Not at this stage. As long as I was involved, we didn't talk about cosmic ray measurements in the "Tonne".

DeVorkin: Why was that? Was that too pure, there was nothing applied?

Reisig: You had to have a starting point. First fly the more or less conventional things and then go to the sophisticated things. Nobody knew very well how the Tonne would behave.

DeVorkin: The cosmic ray counters were far less sophisticated than the ultraviolet spectrograph he designed for it though.

Reisig: Well, I think the measuring of the "conventional" parameters of the high atmosphere first helped to establish the credibility of the project. Of course, there was always a problem with our measurements, at least the external measurements: how the measurements were influenced by the flight atmosphere. You see, there's a certain kind of a flow around a body at these high velocities, going up to "Slip Flow". We were always a little bit shaky about the behavior of measurements in this flight atmosphere. Even conventional instruments like a pitot tube or a static tube or even some thermometer. We had to gain some experience with these things.

Devorkin: It's curious because cosmic ray counters were the first things flown by American people. They were very very simple, just very simple Geiger tubes. I'm just wondering whether the military justification made it more difficult for a

Geiger tube than it was for a UV spectrograph.

Reisig: Regener had his own interests, and as I recall, what he was at that time mainly interested in was the ultraviolet barrier.

DeVorkin: That's certainly true.

Reisig: I have the impression that at that time he was more interested in ultraviolet research than in cosmic ray research in the rocket.

DeVorkin: I know that ozone research had gone way back in his work. But he also did a lot of cosmic ray work.

Reisig: Sure.

DeVorkin: That's why he went on the bottoms of oceans and that sort of thing. Certainly his work with his son in 1934 through '36, developing an ultraviolet spectrograph for balloons, was one of his big projects. That was really quite something. I assume he talked about that?

Reisig: Sure.

Devorkin: Did you see some of his balloon sondes?

Reisig: Oh yes.

Devorkin: So he saved some, maybe? I'd love to get my hands on one!

Did you meet Pfozter at this time?

Reisig: No, I don't recall that it was at that time. I met Pfozter later on in Lindau. He had very close connections with Ehmert.

DeVorkin: I know that Pfozter is no longer alive.

Reisig: No, he died, after Ehmert.

DeVorkin: I'm not sure about Ehmert.

Reisig: He died before Pfozter.

DeVorkin: He did?

Reisig:" It was a very sad moment; we were really good friends.

DeVorkin: Oh, it was unexpected?

Reisig: Well, he suffered from angina pectoris.

DeVorkin: Angina, heart disease.

Reisig: Yes, and one day he couldn't make it any more.

DeVorkin: What were your responsibilities then? You remained in Peenemünde.

Reisig: Yes.

DeVorkin: Regener was working at Friedrichshafen.

Reisig: Right.

DeVorkin: What kind of contact did you have? Did you fly back and forth? Were you a technical liaison?

Reisig: Maybe the best characterization is technical liaison. You see, I was quite familiar with the electrical and electronic arrangements in the A4 rocket, and this system had to fit in. But at that time we were already under such time pressure that I couldn't afford too many trips any more just to go to Friedrichshafen and talk problems. I remember, I think I mentioned to you in one of my letters that this Dr. Rau came to Peenemünde more frequently.

DeVorkin: Dr. Rau, yes, you mentioned that. But I've not been able to track down anything more about him.

Reisig: Paetzold might know. I'm surprised that Schopper didn't respond.

DeVorkin: Schopper did not respond, no. He's at CERN now, isn't he?

Reisig: No, that's the other Schopper.

DeVorkin: Oops, I sent it to the wrong Schopper!

Reisig: Didn't I give you his address in Frankfurt? Paetzold was in very poor shape a few years ago.

DeVorkin: I heard that he was in poor health, but he sent me some very good, helpful comments. I'm going to definitely check on that.

Collins: What year are we talking about now?

DeVorkin: 1942, '43.

Collins: Somewhere along the way here you joined General Dornberger's staff?

Reisig: Yes.

DeVorkin: I want to get you up to June of '43. You say around spring of '43 you joined General Dornberger's staff. Let us get up to that point. We've identified what your involvement was, we've mentioned Dr. Rau. You mentioned in your letters to me that at the point when you left the Regener project you had no choice; you were detailed, things were obviously getting tighter, schedules were getting tighten.

Reisig: It was hectic.

DeVorkin: Very hectic. The Wasserfall project was coming up and others things like that. You say they were still doing general design analysis trying to get the configuration of the Tonne straightened out at this time? This sounds right to you? Ok, that's wonderful, because I have some documents from Dr. Paetzold, three records of meetings actually, that took place in May and June of 1943. This is already when you left, because Dr. Weiss, and Dr. Krause were involved.

Reisig: Dr. Weiss took over for me.

DeVorkin: Exactly. Here are these documents, enclosures 2 and 3, from Dr. Paetzold. One is May 4, 1943, the other one is June 3 and June 4 of '43. Both of these meetings were at Friedrichshafen. Could you tell me a little more about Dr. Weiss, Dr. Krause if you knew him, and engineer D.I. Helsen? You said that you were not aware that Helsen was involved?

Reisig: Do you know this one?

DeVorkin: Yes, this is a review of the itinerary for the testing and final integration of the Tonne starting in October of '44, ending in January of '45. It starts on page 2, curiously enough. All of these start on page 2.

Reisig: There probably was a common letter.

DeVorkin: Yes, in fact, I think you have more in here. Aren't these bits and pieces of the pictures of the spectrograph?

Reisig: No, the original pictures are in Munich.

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DeVorkin: I wrote to Rathjen about these pictures and sent him xeroxes. I got a few of them. No, I have not written to Heinrich or Romalo at the Deutches Museum, only to Walter Rathjen.

Reisig: No, he is remote from that.

DeVorkin: Okay, because the one critical picture he couldn't find, although he found the others.

Reisig: Yes, but he has to go to Heinrich anyway.

DeVorkin: You see this picture of the spectrograph opened? That's the one he couldn't get, and that's the one I wanted more than anything so we could see the components. Well, we should get the record of the person we should write to. Also, we could simply write to Otto Mayr.

Reisig: He's very busy!

DeVorkin: I know.

Reisig: I missed the opportunity to meet him. We were supposed to have a conference on computerizing their documentation and it just fizzled.

DeVorkin: That's too bad. Well, what do you think of these two documents? It's very long but it describes all the very broad technical problems, such as the design of the Tonne, some wind tunnel tests of models of the Tonne, the problem of the parachute is described throughout this whole thing. And when it gets down to the scientific apparatus, such as the ultraviolet spectrograph, it's only in the most general outline that these things are discussed. Now, this is what I'd like to get from you if possible. You had already left the project, but not too long before this, and of course when these were written, when these meetings took place, was just about D-Day in fact, June of '43. It was also just about time when the V-2 shot went awry and landed in Sweden.

Reisig: No, this was one year later. The "Sweden-Shot" occurred on 13 June 1944 (=D+7).

DeVorkin: I'd love to get some sort of a background feeling for how the atmosphere changed at Peenemünde during this time, because of course the story seems to be developing that it became more and more difficult at Peenemünde to do any projects that were not absolutely directly related to producing as many V-2s as possible, and making them work as well as possible. All these things were happening, and this was the state of the

project. It wasn't very far along.

What are your feelings about this, in terms of the reason for this long period of development? Could you give me a sense of it? I know you went to Wasserfall. Could you tell me what happened to others in the project, the Regener project at least? Do you know when other personnel at Peenemünde had to leave for more direct involvement in weapons development?

Reisig: There were two things which were actually disadvantages to the V-2 development. The one thing was the militarization. At that time it had already been decided to motorize the whole deployment of the V-2 in the field. That was a tremendous undertaking. Industry was not prepared at all to assume such an assignment. So our people had to be sent to the industrial firms to just get it going.

Devorkin: This was the development of the Meillerwagen?

Reisig: Such things, yes. It was a tremendous project.

DeVorkin: Were these afterthoughts to the project actually?

Reisig: What do you mean by afterthoughts?

DeVorkin: They weren't initially designed into the project. They were big parts of the project that were developed later on?

Reisig: Yes. You see, I remember very well when, as it became acute that the poor V-2 should be deployed on the front, that von Braun asked Dornberger, "See, we are not military people, somebody should tell us how the employment of the A4 should be done in the field. We don't know how to deploy such a technically complex vehicle in the front situation, and how the military workings should be.

And Dornberger said, "Oh, don't you worry, there will be six general staff officers coming from Berlin and they will solve your problem."

They never came! And so our people had to apply their own imagination to how you could do that. That's how the motorized version of the deployment came about. We had another genius, one of the old rocketeers, who actually designed the mobile deployment, by the name of Klaus Riedel. Tremendous, what he put together, without any military help!

DeVorkin: What I'm looking for is new projects that, like Wasserfall and others, would have taken more people off the

Regener project. I know that Paetzold had to leave from time to time to work on the Wasserfall. Do you know of any others?

Reisig: Paetzold?

DeVorkin: Yes. I may have it wrong but someone else in the group had to leave and work on Wasserfall every so often. You don't have that recollection? Do you know of any others of the Regener team people either in Peenemünde or Friedrichshafen who were taken off the project to work on war-related things? No, you don't? Okay, fine.

Reisig: Not of the Regener team proper, but Dr. Weiss was also in charge of the homing (target seeking) device for the Wasserfall which took the largest part of his time. See, this motorization was not the only thing. It was decided that the V-2 should go into production, and we had a very difficult transition period when the development device was to be converted into an industrial device, so to speak, that you could manufacture in large quantities. There was nobody available for really doing that, other than the development people. I think it was one of the great shortcomings of Peenemünde that we had to employ our own highly qualified development people for these industrial aspects of the whole thing.

Tape 2, Side 2

DeVorkin: So you were in desperate need of development people?

Reisig: Well, we were in need of industrial engineers who could take the development device to industry and make a mass product out of it in a version and configuration which could be produced in large quantities.

DeVorkin: Did you find that it was difficult to retrain people who were in development to be operation liaison people to show how to make it an operational vehicle?

Reisig: Generally it wasn't much of a problem.

DeVorkin: So the people you already had, who had had to develop the A4, were able to adapt to industry easily?

Reisig: We had a number of people who had had industrial experience before they came to Peenemünde. They were to a certain extent familiar with the environment of industry.

DeVorkin: Let me go back then -- we have to move ahead with this -- you say those two documents show the Regener Tonne

program to be very much in the state that it was in when you left?

Reisig: Well, it was even less specified than this here. See, that's what we had to work on. A whole set of problems popped up. For instance the ejection procedure and what I said about the flight environment, or the flight atmosphere, falsifying the measurements.

DeVorkin: Yes, the effect of wind falsifying the temperature measurements, barographic measurements.

Reisig: The stability problem was also a substantial one.

DeVorkin: So what I saw when I went through that document, when Sophie translated parts of it and I read it, and from other things I've been developing, the design of the instruments to make the measurements they wanted was pretty well understood.

Reisig: Yes.

DeVorkin: How to make the instrument work on a rocket, not a balloon, and how to make the Tonne work, was the big problem. It was the housekeeping.

Reisig: Yes, that is very clearly expressed here in these details.

DeVorkin: Ok, that's very understandable. It was a much bigger problem than just making the instrument.

Reisig: Yes, there were project inflators, so to speak. All these problems popped up.

DeVorkin: Integration, controls, stability, ejection, recovery; all of these things. Bits and pieces of it were available. The ejection and recovery had been tested somewhere but it had to be modified for the Tonne, and these were big problems.

Ok, I'll take those back. That's the second one in June, I think, which is more of the same thing. Yes, the parachute.

Reisig: They had even to go into the wind tunnel.

DeVorkin: Yes. Models were made, too, at that time. They did not have a full scale Tonne or anything like that.

Reisig: After all, you had to consider that the V-2 was a

supersonic missile!

DeVorkin: Let's talk about how your life changed as you moved to Dornberger's staff. How did that come about? Did von Braun delegate you? Who took you off the Regener project?

Reisig: More or less Steinhoff. There was a need for a man who had experienced the chain of developments from the A3 through the A4, so to speak, an insider to be on the staff of General Dornberger. There weren't too many people around who had this long chain of experience as I did. The bulk of our people came during the war to Peenemünde, and the work crew which was there before the war was not too large. So the first thing that happened to me is that I was drafted because I didn't have any military training yet, and was sent to Russia.

DeVorkin: When was this?

Reisig: Shortly before Easter, '43. After I finished my basic training in Russia in the Crimea, I was called back by Dornberger. I had a transition period when I worked with the man who had designed all this motorized deployment of the A4-rocket, and then, when I was through with that, I went to Schwedt, to General Dornberger's staff quarters.

DeVorkin. That's when you worked on Wasserfall?

Reisig: No. I didn't specifically work on Wasserfall except for the things which were used as a foreproduct, so to speak, and put into the Wasserfall. Later on, at the beginning of 1945, I was more heavily involved in the Wasserfall project, when General Dornberger was assigned the "Commissioner for Breaking the Bombing Terror."

DeVorkin: I see. How did you feel about being conscripted into the army at this point? Did you know you were going to go back to Peenemünde?

Reisig: Oh, sure, it was kind of an agreement. It wasn't too difficult because we had our own military outfit. I don't know if you ever heard about that?

DeVorkin: No.

Reisig: There was a serious shortage of manpower. It was really a desperate situation. And these stupid military administrators pulled all the people with technical training into the infantry, and got them shot by the Russians. It was idiotic! I heard that the British and the Americans never did such a thing. And the only solution came from Field Marshall

von Brauchitsch.

DeVorkin: What was his role?

Reisig: He was the supreme commander of the army when the war broke out. He was the successor of the von Fritsch, you may have heard of the Fritsch affair. He was the regimental "father" of Dornberger. Dornberger was in his regiment when he was a lower grade officer. I don't know how it's in the American army but in the German army there was always almost a family relation between let's say the chief of the regiment and his officers. They were his boys. They called him their "father."

DeVorkin: Just like Doktor-father.

Reisig: Yes, exactly.

DeVorkin: Very paternal.

Reisig: Therefore Dornberger had a very good position. Von Brauchitsch was high on the top and his idea was to get these drafted technical people back from the front. He established a military unit at Peenemünde.

DeVorkin: A contingent?

Reisig: A contingent termed "VKN"(Versuchs-Kommando Nord). The soldiers were pulled out of the front troops, yet still remained a part of the front troops so that no other military organization could grab them again and send them back to the front. That's the way we got the manpower that we needed!

DeVorkin: I see. Paetzold was in the army or in the reserves or something.

Reisig: Yes.

DeVorkin: And he was recruited out; they were able to bring him out to work with Regener. But in this case you created an army contingent at Peenemünde so that people could be brought in to work at Pennemünde?

Reisig: Yes. On this arrangement I came back to Peenemünde myself. Dornberger just gave the order, "Send Reisig back here to my unit". They put me on march, and so I came back after I think three months. I had my basic training and finally was a respectable person in military Germany.

DeVorkin: You were there during the August 17th RAF raid?

Reisig: No, just by accident I wasn't there. See, when I came back from Russia, I became pretty badly sick. I caught a very bad infection in Russia. They never really found out what it was, a kind of a Russian fever. So I was put in a military hospital for three months, and the doctors thought I wouldn't even make it. During this time the Peenemünde raid occurred. I had already taken my family out of Peenemünde. They went back to my wife's parents, in Dresden. So they didn't experience that raid.

DeVorkin: Your own family remained in Leipzig?

Reisig: Yes.

DeVorkin: Frank Winter wants to know your assessment and feelings about Helmut Gröttrup's contributions toward the V-2. How significant were his contributions, both during the war and after the war in the Soviet program?

Reisig: As a matter of fact, I hired him. He was my deputy; he was a very talented fellow. He actually got his degree in physics, but I think his capability in mathematics was superior to his capability in physics.

DeVorkin: What were his specific responsibilities? Did you hire him after you were detailed back to Dornberger?

Reisig: No, that was before that time. I assigned him specifically to be the project leader for the telemetry development, another "Peenemünde first".

DeVorkin: Did he ever work on the Regener project at all?

Reisig: Well, in a certain way. After I left he was assigned as a special assistant to Steinhoff, and I think in this capacity he also was involved in the Regener project.

DeVorkin: Yes, because his name does come up once or twice. Let me ask, when you were assigned to the Regener project, was that your full time project?

Reisig: Oh no. I didn't have enough time for just that as a full time project.

DeVorkin: You were never full time?

Reisig: No.

DeVorkin: Was anyone full time at Peenemünde on the Regener project?

Reisig: I doubt it. Weiss had other very big assignments with Wasserfall.

DeVorkin: So it was just one of many things you were doing. To your knowledge was the Regener team itself, in Friedrichshafen, devoted solely to this or did they have other things to do as well?

Reisig: I think they continued the other projects of Regener as well, e.g. the cosmic ray research.

DeVorkin: They were doing a number of other things, then.

Reisig: Paetzold would know in detail what was going on in Friedrichshafen.

DeVorkin: Good. Let me ask you more about Gröttrup. As his immediate supervisor in Peenemünde, could you tell us in your own view why he chose to go to the Soviet side?

Reisig: It was a very sad story. Did you hear that von Braun, Klaus Riedel (who designed this motorized version of the V-2 development), and Gröttrup were arrested by the Gestapo?
DeVorkin: For talking about space and things like that?

Reisig: Right.

DeVorkin: I know, I've read that story in James McGovern's book, CROSSBOW AND OVERCAST, and various other places. Well, you tell me the story and how that affected Gröttrup. Did that cause him to go to the Russians eventually?

Reisig: Not directly. It's very complex. Dornberger then had to vouch for these three men at the highest level, and finally Minister Speer managed to convince Hitler that it was foolish to arrest these three people who were in key positions in Peenemünde. I wrote it in here.

DeVorkin: You have it here in the article, "Development of the Apollo-Rocket Saturn V".

Reisig: Yes. It was really grotesque. These three Peenemündians were accused of sabotage because they didn't devote every single minute of their lives to the V-2, and talking in their leisure time about space flight. Then dear Himmler put them in jail in Stettin, taking them away from their key positions so they couldn't do their militarily high priority jobs any more! I mean, such an idiotic idea. I think Hitler realized that and released them conditionally.

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DeVorkin: Was there any danger of this sort of thing happening to people like Regener, who were doing a little bit of science as well?

Reisig: Well, in principle, yes. But even the Gestapo didn't know everything of military relevance.

DeVorkin: Yes, but let's say von Braun did succeed in getting the Regener Tonne to fly on a V-2. Could they have been arrested for doing that?

Reisig: I doubt it, because von Braun was so smart to tell them, if necessary, a big story on how important it was for successful V-2 flights. They were much too stupid to ever question that.

DeVorkin: Very good. What about Gröttrup going to Russia?

Reisig: Now, von Braun and Klaus Riedel were released immediately and returned to Peenemünde proper. Gröttrup was the one who was the most suspicious, because allegedly he had connections to the Communist underground organization, which was sheer nonsense. It was just a product of their own fantasy. He was put under house arrest. And to manage that, he was sent to the Dornberger staff in Schwedt where we had our staff headquarters, where he was to work in our staff buildings, which actually were guarded barracks, and he lived there. Of course he had to have a meal every day, so we took him with us when we went to our casino, which was the officer's mess. There is a very beautiful one in Schwedt. We had to take him along for having his meal and afterwards he said he had to have some fresh air, so I took him in the Oder meadows to pick flowers and to have a walk! Then I had to bring him back to the barracks.

DeVorkin: While in the barracks was he able to work?

Reisig: He could do what he wanted there. He could do theoretical work.

DeVorkin: But he really couldn't work on the project?

Reisig: Well, he could work on theoretical problems.

DeVorkin. As you say, he was a good mathematician.

Reisig: A very brilliant man. Finally, after I don't know how many months, he was released and could go back to Peenemünde in quite a key position again, as a special assistant to Steinhoff.

Collins: It sounds as though, being on General Dornberger's staff, you were away from Peenemünde, is that right?

Reisig: Sure, we were located in Schwedt on the Oder river, south of Stettin. That's culturally a very famous little town, because the Markgraf of Brandenburg resided in Schwedt, in a nice castle there. He was a relative of the Hohenzollern, I don't know what the relations were. Bach wrote the Brandenburg Concerti for this prince in Schwedt. That's the reason they are called the Brandenburg Concerti.

Collins: Now, what was the reason why Gröttrup went to the USSR?

Reisig: The next thing was that the SS, the Gestapo, was still after Gröttrup. We on General Dornberger's staff had, of course, our channels, and we learned that Gröttrup was to be shot in the very last days of the war. So we warned him, "Be careful, they are after you."

Then when this transfer of the whole Peenemünde crew to the Alps occurred -- and of course we had special trains for the Peenemünde people -- the train from the Harz Mountains area to the Alps had to make a stop in Leipzig. Gröttrup had a brother in a military hospital in Leipzig who was badly wounded. I think he lost his eye sight and what not. Gröttrup asked the chairman of the transport for leave to see his brother in the hospital, and he was allowed to go, but he never came back. That was the chance for his escape from the SS.

DeVorkin: Was Leipzig in the Russian sector then?

Reisig: No, the Russian Sector didn't exist yet at that time.

DeVorkin: I know it didn't exist at that time, but did he have a choice of going to the American side or the Russian?

Reisig: He went to the front lines in the west and reported to US headquarters in Frankfurt, to be safe.

DeVorkin: So he was under U.S. custody for a while, but then elected to go to Russia?

Reisig: Now, then came the consultations or conferences with Colonel Toftoy and his staff, about transferring a group of our people to the US. There were people in our own group in pretty high positions who claimed Gröttrup was a traitor who had delivered to the "enemy" essential documents on the V-2 when he went to Frankfurt to go under US custody, which was a really

mean lie.

First of all, Gröttrup didn't have such documents with him, and he never talked about this. He was much too cautious about it. But it's a very sad story, because we found out later on, when we were in this country, that the man who claimed that Gröttrup was a traitor had the plan himself to deliver the V-2 documents to the U.S. occupation forces.

Collins: This is before the end of the war?

Reisig: It was during the very last days of the war.

And so this man even convinced von Braun not to take Gröttrup along to the United States.

DeVorkin: Who was this man?

Reisig: That was another Riedel. He was Chief of Design. A mean person. Later on, when we were in Fort Bliss, he was kicked out of our team.

DeVorkin: Sent back to Germany?

Reisig: He went to California, I think, with North American Aviation. He died pretty soon afterwards.

DeVorkin: Did he have some animosity for Gröttrup?

Reisig: Evidently so. Just mere envy or whatever.

DeVorkin: Did you ever see Gröttrup again after he went to Russia?

Reisig: Unfortunately not. I had planned to.

DeVorkin: Did you know other of your colleagues at Peenemünde who went to the USSR? Have you heard from any of them?

Reisig: No. I met one who came back whom I didn't know before. But otherwise I didn't meet anybody. Did you know that the wife of Gröttrup wrote a very interesting book about their stay in Russia?

DeVorkin: Oh my. Is that book generally known?

Reisig: Oh yes. I think it's even translated.

DeVorkin: I'm not that aware of the literature, but that's obviously a very important document.

Frank's last question here is, did von Braun play strictly an administrative role at Peenemünde and Kummersdorf, or was there a hands-on technical role?

Reisig: He was a technical genius. Administration for him was a must, but nothing else.

DeVorkin: So he got his hands dirty, so to speak?

Reisig: And how!

DeVorkin: He designed. Did he actually do any machining himself?

Reisig: No, not at that time. He did in Reinickendorf, in Oberth's and Nebel's time.

But he was very much interested in any technical details. His big contribution was that he was a genius in setting up or putting together a system. Nowadays there is so much talk about systems engineering and systems analysis and what not. von Braun did that at Peenemünde, but we didn't call it that. He had it all up here in his head. He could synthesize everything in his head. He was really a genius.

DeVorkin: Let's move to some of the interrogations. We don't have time, unfortunately, for everything. Were you interrogated by Zwicky or by any of the people who might have been interested in science, Krause, the Porter team?

Reisig: No. I was interrogated by a very young fellow who hardly knew what a rocket was. Pretty stupid conversation. Finally, of course, I got reluctant to tell him things. Why should I tell him? His final verdict was, "You are telling me a lot but you don't say a thing." And I thought: "You idiot! You couldn't give me a better excuse than that!"

Devorkin: Do you have any idea how the information about Regener's work was transmitted to the United States? I have some records on it. I know that some of his instruments went to Aberdeen Proving Ground, and I know that people did talk about it. But I have very very little evidence that the actual documentation, such as these papers here that we've been looking at, were seen by scientists at the Naval Research Lab or other places before they started working. Did they have any contact with you in late 1945 or 1946 about scientific experiments?

Reisig: We were talking about the Regener-Tonne in that we had

the project and that we intended certain things, but of course we didn't talk about the results or flight experiments.

DeVorkin: Do you recall any of the people at NRL that you might have talked to? Did you talk to Krause?

Reisig: It's possible, yes.

DeVorkin: T.H. Johnson of Aberdeen? Klemperer from Douglas?

Reisig: Johnson, maybe, Klemperer, no.

DeVorkin: But you might have talked to Johnson?

Reisig: Possibly.

DeVorkin: He was one of the closest contacts for the Regener instruments that were at Aberdeen. By February or March, even April of 1946, the scientists who were building equipment for the V-2 science experiments did see these at Aberdeen, but they couldn't figure them out completely because there was no documentation. Does that sound right to you?

Reisig: Yes, sure. You see, Frank and myself, we hit these papers just accidentally.

DeVorkin: You're holding up now the records from Peenemünde that describe the final testing procedures, wind tunnel and transportation procedures.

Reisig: This "Termin-plan," yes.

DeVorkin: This is from the Deutsches Museum. You say you found them just by accident?

Reisig: Not even the museum people knew that they were there. We just pulled this file, and all of a sudden, ah, that's Regener, yes. It's typical, you see, it has neither the GD nor the FE number. How did it come there?

DeVorkin: I see, these are the record group numbers. It doesn't have them on it. For the record, you have a 2 1/2 inch thick index.

Reisig: All the documents which were at Aberdeen have these signatures here. GD means German Document, 6 means guided missile, and then specific subject. These are the FE numbers from Fort Eustis, who did an excellent job on the translations and abstracts. But these Regener papers.

DeVorkin: Have no FE or GD numbers, so there's no question that they didn't see them.

Reisig: Heaven knows how they happened to end up in the Deutsches Museum.

DeVorkin: We've only seen them in the Deutsches Museum, we've never seen them here. So they never came here?

Reisig: I imagine, yes.

DeVorkin: That helps me a lot, in terms of what the Americans knew and what they didn't know. They knew all about the V-2, and especially the NRL people were seeing all of the interrogation records and were reading all about it, but they had very little or no information, other than the fact that the Regener instruments existed and that they might have flown or didn't fly. They didn't know whether they flew or not, nor that they tried to do different experiments.

Reisig: It was the same thing with this one here. I don't know how it happened.

DeVorkin: How did you find that without the GD and FE numbers?

Reisig: That's one of the official Peenemünde papers.

DeVorkin: This is '42, this very important conference with Regener, Steinhoff, von Braun and all of those. Yes, that doesn't have it either. This was found in the file as well. Klee found this and has published parts of it in his book.

Reisig: It was together with these papers.

DeVorkin: Yes. But again, this one never would have made it to the United States at that time, or certainly wasn't translated.

Reisig: I can't explain why.

DeVorkin: I'm at the end of my time and we haven't really explicitly talked about Beyerchen and Irving's opinions for the role of science and scientists in World War II and all the difficulties. But these were rationales, and you said you had some comments. You wanted to make some comments and I'd like you to make them now.

Reisig: You might have heard that we, the old Peenemünde group in Germany, and the Militär Historische Forschungs Amt in

Freiburg, are working now on a historical record of Peenemünde activities.

DeVorkin: Yes, that's tremendous.

Reisig: For that reason I wanted to participate here in finding working documents and putting things together from my memory, for a special aspect of the Peenemünde project that is an aspect of cybernetic concepts. That's an entirely different approach to the whole thing. It is not typically historical. It is about the presentation of the whole Peenemünde project as a system.

That conceptual approach started snowballing, adding more and more aspects which I didn't expect, and so far my participation in this joint project between the old Peenemünde group and the Freiburg historical group seems to develop into a quite formidable piece of work.

DeVorkin: Will this provide a perspective on German science that is different from what Irving or Beyerchen provide?

Reisig: You will realize that I studied quite a few pieces of literature on that, and I'd like, if you would accept it, to warn you about certain things.

DeVorkin: Yes, please.

Reisig: One person I would like to warn you about is Irving. He's absolutely not reliable. Do you get the notion that he allegedly has a big book writing factory? I heard that he's not writing his books all by himself.

DeVorkin: I see, the VIRUS HOUSE and the MARE'S NEST and these books are being written by other people?

Reisig: It's unbelievable, what he publishes!

Collins: Could you point out some specific examples of inaccuracies?

Reisig: One thing I'm really mad about is his MARE'S NEST. That's a mean piece of literature. I wonder whether he's lying on purpose.

Collins: What specifically do you feel he's lying about?

Reisig: Well, to put it very bluntly, I think in a couple of pages he tries to prove that we more or less were idiots.

DeVorkin: He and others like Lesley Simon talk about over-instrumentation, over-design.

Reisig: Now, excuse me, Dr. DeVorkin, I'd like to warn you about Simon.

DeVorkin: All right. I'm very receptive to this. I want to hear your feelings.

Reisig: Simon was a very ambitious man, and he didn't know half as much as he claimed to. I had an experience with Simon later on when I was director of the research lab in Redstone Arsenal (ABMA). He came there for periodic status reviews. He was one of the big shots. Once, he was already retired, and was in a commission to scrutinize and evaluate our research effect. I experienced occasions with him when he just talked nonsense. He was very ambitious. I think he was the first one who wrote a book on German science during the war.

DeVorkin: Yes.

Reisig: My impression was, he wanted to be the first one no matter how good his writing was.

DeVorkin: It was a very simplistic book. I know, it's the one that I used.

Reisig: I think it's well known. We have it in our library.

DeVorkin: Yes. German Research in World War II (1947). Tell me, what was your impression of Toftoy? What did you think of Toftoy?

Reisig: Oh, he was a "first rate" gentleman. He was unique. We really loved him.

DeVorkin: Did you get to know his associates, James Bain and Hamill?

Reisig: Hamill was our commanding officer in Fort Bliss and then during our first period at Redstone Arsenal.

DeVorkin: Did you know James G. Bain at all?

Reisig: I can't recall. Probably I've met him, but we met so many people.

DeVorkin: He was not stationed out there. He was stationed at

the Pentagon.

Reisig: Toftoy was stationed during the first period, also at the Pentagon. He later on came to Redstone and was commander of the arsenal.

DeVorkin: That's right, and then he replaced Simon, in fact, at Aberdeen.

Reisig: Hamill did? Col. Hamill was assigned Director of BLA Ballistics Lab, Aberdeen (an organizational element of the Proving ground).

DeVorkin: No, Toftoy did. Toftoy was at Aberdeen for a little while.

Reisig: Right! Toftoy became commander of Aberdeen Proving Ground.

DeVorkin: Let's go back. Have you read Beyerchen's work?

Reisig: No.

DeVorkin: I think Alan Beyerchen is more reliable than Irving. But you really have very serious doubts about Irving?

Reisig: Yes. Also Dr. Boog warned me about him.

DeVorkin: Boog?

Reisig: Oh, you don't know who he is. He is a man at Freiburg in the Military Historical Institute. He's the man in charge of writing the history of the Second World War. They arrived at the period of employment of the V weapons. He's our counterpart in Freiburg.

DeVorkin: Of course Beyerchen quotes Irving a lot, so there's a problem.

Reisig: That's a bad thing. Second sources, we don't accept.

DeVorkin: What do you feel about the stereotype of German over-instrumentation, over-design?

Reisig: I don't know how you people got this idea!

DeVorkin: The Regener instruments were far more complex than what was designed in the United States. Just looking at the

two, Richard Tousey's designs were trivial compared to what Regener developed as a device for collecting sunlight over broad areas. There was little more complexity in the Applied Physics Lab instruments. The cosmic ray instruments did get very complex: the big lead igloos that APL and NRL developed. But then both realized that they were far more complex than they needed and they started flying just single tubes later on. The quartz barometer tube that Regener developed, the whole measuring apparatus, the photographic registration drums, all those things were very elaborate. I never could quite figure out exactly how they worked, where the light source came from. Do you know where the light source came from, in the Photoregistration Tonne?

Reisig: No. Principally, with regard to the apparent complexity of Regener's instrumentation: Regener was a very systematic scientific worker).*

DeVorkin: They just seemed to be complex, that's all. If this is a bias that I have please correct it. You're the good engineer, not me!

Reisig: We heard it over and over again in this country. I'm afraid honestly the primary source of such assertions is envy.

You see, now, the primary source of this whole opinion is in my opinion the fact that we Germans were always poor people. In other words, we were supposed to have success, and many things we couldn't do twice. It had to work the first time. That meant, in my opinion, one of the main reasons that we got into real details was to assure that we avoided basic errors to begin with. And it paid off very well. Yet industry blamed us for over-engineering again and again. But look at this, such a technically debatable thing as the Space Shuttle! Not with us, we would not have accepted it.

Now, there is another unfortunate thing -- but I don't want to offend you as an American -- and that's the philosophy of industry. They want to make money in the first place. So they make big promises to get a contract, and they know very well that they can't accomplish that, but they have the contract

*I suppose he made it very clear to himself what he wanted to accomplish with his experiments in terms of novel physical information. He then developed the pertinent specifications for the design of his instrumentation. Ambitious goals of novel information call for correspondingly "complex" instrumentation.

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in their pocket anyway. If nothing works or many things don't work in the first place, they will get an attachment to their contract and make more money just repairing their own faults. Correcting their own faults.

DeVorkin: German industry did not do this sort of stuff?

Reisig: We didn't have the money for such a philosophy.

DeVorkin: They knew the resources weren't there.

Reisig: That's true. Also we were ambitious enough to say: "I want to deliver for my money a top product."

DeVorkin: Was it a question of resources or a question of integrity?

Reisig: Both. As I say, it paid off well. I don't want to brag about it, but imagine a vehicle like the Saturn V. It stands higher than the Statue of Liberty. Now bring such a monster into the air in stable flight! The very first Saturn V firing went up like a candle. And why? Because of our alleged "over-engineering".

There was an old rule here in this country: If you build a rocket it takes 11 firings before you have a success.

DeVorkin: That was true of Atlas and others.

Reisig: A lot of them. You would really do us a favor if you would not follow this foolish story of the over-engineering, which is absolutely a misconception. We know about "the other side of the coin" too: The very popular "Trial and Error" concept is inefficient, expensive, and time-consuming, as we witnessed in numerous cases.

Collins: Was this a criticism that you encountered soon after you came to the United States?

Reisig: Sure! Again and again. I remember General Toftoy: We fired, I think, the second or third Redstone, I am not quite sure. It was a perfect flight. I was standing beside General Toftoy and we discussed some details of the flight, and he said, "Well, boys, we now have to build in some artificial trouble. Otherwise the Pentagon will take the money away from us."

DeVorkin: That's a marvelous recollection! Toftoy was very sympathetic.

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Reisig: Always. As I say, we really loved him.

DeVorkin: Did he ever talk about doing science with the V-2s with you?

Reisig: Toftoy? I can't recall.

DeVorkin: I'm at the end of the tape. I want to thank you very much.

Reisig: I want to thank you, for your time and your kind interest, too.