MILTON S. PLESSET
(1908-1991)

INTERVIEWED BY
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December 8, 1981

ARCHIVES
CALIFORNIA INSTITUTE OF TECHNOLOGY
Pasadena, California

Subject area

Engineering, applied mechanics, nuclear engineering

Abstract

Interview in 1981 with Milton S. Plesset (1908-1991), Professor of Engineering Science, Emeritus. Begins with Plesset's decision to study physics at the U. of Pittsburgh; PhD in physics at Yale [1932] on Dirac electron theory. Postdoctoral fellowship brings him to Caltech that year to work under P. Epstein. Recalls giving theoretical physics seminar which Einstein attended on day of Long Beach earthquake [March 10, 1933]; records story of Einstein and B. Gutenberg in conversation and unaware of the quaking. Importance of J. R. Oppenheimer to American theoretical physics in early 1930s; his early collaboration with Oppenheimer on Dirac electron theory. R. A. Millikan's interest in this work in connection with cosmic rays. Year spent in Copenhagen at Niels Bohr Institute as National Research Council fellow [1933-1934]. Returns to U.S. to teach at U. of Rochester; meets L. A. DuBridge there. Returns to California 1941 to do wartime work at Douglas Aircraft Co.; beginning of interest in fluid mechanics. Sent by Douglas to Europe following German surrender to investigate German rocketry [1945]. Return to Pasadena to work on torpedo hydrodynamics at Naval Ordnance Test Station (NOTS). Hired at Caltech [1948] as associate professor of

applied mechanics; begins research in hydrodynamics and cavitation. Serves on Air Force Science Advisory Board (started by T. von Kármán). Recalls McCarthy era at Caltech; cases of H-S. Tsien, Oppenheimer. Interest in nuclear energy leads to 1959 advisory appointment to California Atomic Energy Development and Radiation Protection Program; also membership on Advisory Committee on Reactor Safety for U.S. Nuclear Regulatory Commission; discussion of nuclear safety in connection with Three Mile Island reactor incident. Becomes professor of engineering science [1963]. In closing notes special admiration for Epstein, along with Oppenheimer and R. Tolman; cultural value of Epstein's "stammtisch."

Administrative information

Access

The interview is unrestricted.

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Preferred citation

Plesset, Milton S. Interview by Carol Bugé. Pasadena, California, December 8, 1981. Oral History Project, California Institute of Technology Archives. Retrieved [supply date of retrieval] from the World Wide Web: http://resolver.caltech.edu/CaltechOH:OH_Plesset_M

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Milton Plesset (left) on assignment with the U. S. Air Force in Germany following VE day, 1945. Caltech Archives photo.

Milton Plesset (left) as a postdoc in Copenhagen, 1934, with (from left) Niels Bohr, Fritz Kalckar, and Edward Teller. Caltech Archives photo.

CALIFORNIA INSTITUTE OF TECHNOLOGY

ORAL HISTORY PROJECT

INTERVIEW WITH MILTON S. PLESSET

BY CAROL BUGÉ

PASADENA, CALIFORNIA

Caltech Archives, 1984

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Interview with Milton S. Plesset **by Carol Bugé**

Pasadena, California **December 8, 1981**

Begin Tape 1, Side 1

BUGÉ: I know that you were born in 1908 in Pittsburgh. I would like you to start with reminiscences about growing up, going to school.

PLESSET: Oh, that might be a little dull. I thought you'd be interested in the Caltech part.

BUGÉ: Well, I am most interested in that part. But I didn't know when your interest in science first developed.

PLESSET: Well, that's a good question. When I started college, I really didn't know which way I would go or what I was interested in. And I really didn't decide on studying physics or science until my sophomore year—the latter part. For a while I thought, well, maybe I would go into medicine, but that meant I had to take physics, which I did as a sophomore. Well, I found it kind of interesting, so I decided to go on with it—in part, because I got a job as a reader in my junior year.

BUGÉ: What were your main interests before you really focused on science in college?

PLESSET: They were rather diffuse. I thought I might like chemistry. But I kind of stumbled into physics.

BUGÉ: So after your readership, that was definitely your focus?

PLESSET: Yes.

BUGÉ: You got both of your first two degrees in physics at the University of Pittsburgh.

PLESSET: Right.

BUGÉ: Was there anybody who particularly influenced you there?

PLESSET: I happened to have as my instructor in physics, a man who had recently come there and who was head of the department. He was new to teaching, and he was quite a bit different from most of the teachers I had had. I found his manner of doing things interesting and that helped make up my mind. He was a very poor teacher by most people's standards; but I found him very good.

BUGÉ: He managed to catch your interest with his style.

PLESSET: Yes.

BUGÉ: When you went on to Yale, was all your work in physics?

PLESSET: Yes.

BUGÉ: Was there some particular focus?

PLESSET: Well, I got more interested in theoretical physics rather than experimental physics. The question really was then, what would I do for my thesis, when I went to Yale. One of the professors gave me an experimental project, which I didn't care much for. Then I worked out a theoretical paper on my own. After a lot of backing and filling, they decided, well, they would accept that. But I had to do some more experimental work, too. So I wrote a two-headed thesis—one which was on experimental work, which wasn't too good, I think; and the other one was a theoretical problem, which I had come upon myself and worked out. So that's briefly up through the Ph.D.

BUGÉ: Would you describe what the theoretical work that interested you was?

PLESSET: Well, the theoretical work had to do with the Dirac electron—that was a new thing at that time. Dirac had developed the relativistic theory of the electron, which described something which hadn't yet been built into the theory—the fine structure of atomic spectra, for example. And I worked out some features of this particular electron theory that Dirac had developed.

BUGÉ: Were you in communication with Dirac?

PLESSET: No. Just had read his papers.

BUGÉ: Did that lead to your becoming a National Research Fellow?

PLESSET: Well, I guess so. I was recommended by Yale, and was lucky enough get it. And that's when I chose to come to Caltech.

BUGÉ: Why did you choose Caltech?

PLESSET: Well, I thought it was an interesting place. And it appeared to me worthwhile to consider working with Professor Epstein, who was the professor of theoretical physics here at that time. So I came here in the summer of 1932.

BUGÉ: Was it what you had expected?

PLESSET: Well, that's hard to say. It was quite an interesting place at that time—as it is now, of course. I found it very stimulating. Very many interesting personalities, like Richard Tolman, as well as Professor Epstein, and Professor Houston.

BUGÉ: Did you take any courses from them?

PLESSET: No, I was postdoctoral fellow, and was doing reading. Actually, there was a kind of gap in the development of theoretical physics at that time. Following Dirac's theory of the electron, things were a bit static. And this theory of his had some very, what seemed, strange consequences, at that time. Some theoretical physicists even thought that there was something wrong with the theory because of the problem with the negative energy states. Well, that took a long time to get straightened out. I remember that things were pretty quiet and unexciting, even though Einstein visited Caltech in early 1933. That was interesting. But he never said much. I still remember giving a theoretical physics seminar one afternoon. It started late in the afternoon, and Einstein came—didn't say anything. I talked about the Heisenberg and Pauli theory of quantum electrodynamics—not a very elegant theory but, anyway, after it was over, we were walking toward the Athenaeum—I stayed at the Athenaeum that year—I was walking with Tolman, and ahead of us were Einstein and Professor Gutenberg, who was head of the geophysical work here. Well, they were talking earnestly, and Tolman and I were chatting. I noticed the trees were bending very strongly. I remarked about it to Tolman; he said, "Let's get off the walk." It was the Long Beach earthquake. Once we got off and stopped walking, we could feel it. But Einstein and Gutenberg—Gutenberg, of course, quite interested in earthquakes—they never noticed it; they just kept walking. We got to the front of the Athenaeum; Mrs. Einstein was down there in a panic. And they missed it. Anyway, that was quite amusing.

BUGÉ: Did you ever have a chance to discuss with Einstein his impressions of your talk, or of your work in general?

PLESSET: He wasn't really interested in that kind of quantum mechanics. And he was just being polite. He was a very polite man.

BUGÉ: Did he generate a lot of excitement on campus?

PLESSET: Oh, yes. Well, it's hard to describe. I mean, people didn't bother him. He didn't really participate to a great extent in a lot of things that were going on, except just being here.

BUGÉ: Were you particularly influenced by Millikan?

PLESSET: I'll come to that, because the state of theoretical physics in this country at that time was not very advanced, except for Oppenheimer. At that time, he was spending a quarter of each year down here—he was primarily at Berkeley. When he came down, things really started to move. He had several students that came down with him. He and I got interested in a problem with the Dirac electron. We worked out a prediction of the theory, which was kind of exciting. It meant that there was more to Dirac's theory than one might expect. So we worked very hard for a very short time, and wrote this little paper. And it put, I think, a new light on the Dirac theory. It also meant something for cosmic radiation, because it was a mechanism for the absorption of photons, which Millikan liked to assume were the primary component in cosmic radiation. So Millikan was very much interested and wanted to know all about it; he would quiz me. He was very stubborn in his ideas about cosmic rays, and he was wrong; that made it difficult. I remember one late afternoon, my girlfriend—who I later married—came to pick me up at the Athenaeum. And Millikan came by and he stopped, put his foot on the running board—people had running boards on cars in those days—and he kept me talking with him, standing in the sun, for about an hour, talking about this mechanism for absorption of photons, which he was quite concerned about. He was quite an unusual man, of course. He didn't care much for theoretical physics, or theoretical physicists for that matter. The only one he really appreciated was Professor Epstein. As far as the rest of them were concerned, they were just wasting their time.

BUGÉ: Wasn't he also interested in theoretical physics?

PLESSET: No, he was an experimentalist. He was trying to develop a theoretical description of cosmic rays with some preconceived notions, but that was all right. I mean, after all, Carl Anderson, at Millikan's urging, studied cosmic radiation and discovered the positive electron. He stimulated a lot of interesting work.

BUGÉ: Were there any other professors who were particularly important to you?

PLESSET: Well, toward the latter part of that year here, as a National Research Fellow, Professor Houston was invited to go to Cornell. He was teaching this course in physics. He would have to give that up if he went away. So he asked me if I would do it. I did it, and that's the first time I'd really done teaching, and I liked it. It was a course in mechanics.

BUGÉ: Were most of your contacts with undergraduate students or were there other research fellows and postdoctoral students?

PLESSET: Oh, there were a lot of other advanced graduate students and postdoctoral fellows around. It was a very stimulating place.

BUGÉ: You weren't married during that year.

PLESSET: No, not at that time.

BUGÉ: So the following year, then, you had the opportunity of going to the Niels Bohr Institute.

PLESSET: Yes. And I was indebted to Dr. Millikan for fixing that up, because they were willing to give me the second and final year of the fellowship, but they were cutting out going to Europe with these fellowships. But Millikan fixed it up.

BUGÉ: So, he must have been quite impressed with your work, even though he didn't agree with it.

PLESSET: Well, I don't know. Maybe.

BUGÉ: Would you talk about that year at the Institute in Copenhagen?

PLESSET: Well, it was a very unusual time, because there were a lot of refugees from Germany already, and so the place was just swarming with them. Bohr was taking very seriously the obligation to try and help these theoretical physicists—they mostly were Jews, and therefore, not

very happy about conditions in Germany. They had either lost their jobs or were going to lose them. So this was a stopping off place for them. That's where I got to meet a lot of the theoretical physicists who were being forced out of Germany.

BUGÉ: Have you maintained any of those contacts?

PLESSET: Oh, yes. I don't see them now. I've gotten out of that kind of theoretical physics, as a result of the war.

BUGÉ: When you got to the Niels Bohr Institute, were you well-prepared for what was expected of you?

PLESSET: Well, people were working as individuals there. I guess the man with whom I was most closely associated was an Englishman, or a Welshman—Williams. He and I had a lot of discussions with each other. He was a very bright fellow. He and I spent a lot of time discussing physics. The other people who were there were these expatriates, or refugees. They had known each other before, and so they stayed pretty much with each other. Generally, it was a free and easy atmosphere.

BUGÉ: I understand Paul Ehrenfest and Max Delbrück were both there, during the time you were there.

PLESSET: Well, Bohr had a symposium which he started, and which was organized and scheduled very shortly after I arrived. Ehrenfest was there. But he didn't stay very long after the meeting was over. He committed suicide very shortly after he went home. But that was an interesting symposium—Dirac was there, and Heisenberg.

BUGÉ: Was the work that you had done regarding Dirac's work discussed?

PLESSET: Well, this was among the questions that were discussed. This theory of Dirac's, Bohr really didn't like too much because it was very formal—at least he thought it was formal. So

there was a lot of discussion over the validity of Dirac's theory. People were groping still. That was one of the topics of this meeting.

BUGÉ: When it was time for you to leave the Bohr Institute, Bohr asked you if you'd like to stay on as an assistant. What made you decide not to?

PLESSET: Well, that was the end of my year as a National Research Fellow there. And he had asked me to stay on; he said he would be able to give me a stipend. But then his budget got very badly out of joint because of all the refugees that were coming through. He thought this was going to stop, but it didn't. He thought that they would get placed more readily than they did. And so he said, well, was there any other way that I might be able to stay by getting a stipend as an American. And so I did. And I stayed on there for almost a whole year. Then I got a job at the University of Rochester. That was, I guess, Oppenheimer's doing because there was quite a slowdown in academic positions at that time, and I was lucky to get a job to come back to.

BUGÉ: Had you had any hopes at that time of coming back to Caltech, or to the California area?

PLESSET: Well, I always liked California. But it didn't seem too probable.

BUGÉ: So you taught physics at the University of Rochester for the next five years.

PLESSET: Yes. My first boss was Dr. DuBridge—a really good boss. He was a very efficient and effective leader, and really organized the physics department there very well. It was so successful, he became dean of the faculty there; they really appreciated what he was trying to do. It was a university which had not been among the leaders, but it got a big bunch of money from Mr. Eastman at Eastman Kodak. And so they were going through some kind of a change from a small-town, small university to one with significant financial proportions.

BUGÉ: How was the intellectual environment for you, after having been in such high-powered places as Caltech and the Niels Bohr Institute?

PLESSET: You mean at the University of Rochester? Well, outside the physics department, it was not very exciting. But DuBridge kept that group very stimulating.

BUGÉ: What about the students?

PLESSET: We actually had some pretty good students, I must say, in physics. DuBridge was very good in getting things organized.

BUGÉ: Had you married by this time?

PLESSET: Oh, yes, I got married in Copenhagen. When Bohr said he'd want me to stay on for another year, I wrote my girlfriend and said, "If you get over here, well, we'll get married." And she did [laughter]. An offer she couldn't refuse.

BUGÉ: Were you able to continue your research while you were at Rochester?

PLESSET: Yes. But it was a difficult time for many theorists, it seemed to me. The quantum theory was kind of in the doldrums. And it took people like Feynman to lift it out; and that came much later.

BUGÉ: And how did it come about that in 1941 you were able to return to Caltech?

PLESSET: Well, I got tired of being back there, in the cold, and came back out here. Then, of course, shortly after that, the war in Europe started. It looked like we were going to get involved, and I was very anxious to get in and do something. Actually, one of the men who had been one of my students in this course that I had taught for Houston, had an important place at Douglas. That's how I decided to go there and help make better airplanes to beat the Nazis, and got interested in fluid mechanics, and stayed in it ever since.

BUGÉ: That was really quite a radical change.

PLESSET: Yes.

BUGÉ: Do you think you were influenced at least in part by the fact that theoretical physics seemed to be not going anywhere?

PLESSET: Well, it was to some extent slowed down; although it was not much later than the beginning of the war that things started in again. But I was kind of out of it by that time.

BUGÉ: Then there was a brief time, in 1945, when you started your own company, after leaving Douglas.

PLESSET: Well, everybody was trying to do that. So I tried, but not too successfully. That didn't last long.

BUGÉ: I did see a proposal that you sent to von Kármán in Washington when you were involved in that, to do research and development of safety fuels for jet engines.

PLESSET: Well, he liked the general idea, but didn't seem to see any particular reason why it should go to us rather than somewhere else.

BUGÉ: Had you known von Kármán from Caltech?

PLESSET: Yes. He was another great figure here the time I first came, in '32-'33. He was a very different, very exciting and interesting man.

BUGÉ: Had you had opportunities to discuss things with him?

PLESSET: Yes. The Athenaeum was a great social meeting place. It was very interesting. I remember Tolman always had the same seat for lunch, and he held forth. A very interesting man, a very cultured fellow in the best sense of the word. He was quite an important part of the environment.

BUGÉ: At the time that you left your research fellowship at Caltech to go to Douglas, was the Institute changing?

PLESSET: I wasn't aware of it, but, of course, it was. Because they were, as became evident later, getting into the rocket business and all that kind of stuff. The beginning of JPL was started—Kármán and some other people. I maybe should have waited and gotten into some of that instead of going to Douglas. But I was anxious to make a contribution.

BUGÉ: Then you went on to work for the Air Force in the European theater.

PLESSET: No, that was something a little bit different. When the war in Europe ended, the war with Japan was still going on. And somebody got the idea that, well, a small team of scientists and engineers might go to Europe and find out what contacts the Germans had with the Japanese—what should one expect in the way of novel or new weapons or ways of waging war. So they asked Douglas if they would send a small group of men over to go around in Germany and talk to their scientists and engineers who had been engaged in military work. It was a very rush, rush thing—emergency, do it right now. And we all had to take our shots all at once. I still remember how sick I got—and others, too. Then we finally got to Europe. There were about a half a dozen of us that went. We split up into small groups. We got to Paris, then went out to the headquarters at Saint Germaine; and they didn't know what to do with us [laughter]. So we had to decide ourselves what we would do. A couple of us formed a team—me and one of the chemists, and a fellow who worked for Douglas, who was German in origin and could speak the language very well. So we went into Germany, and went to Munich and to the neighboring areas, and found out a lot of interesting things. Then we ended up in Bad Kissingen, which is a watering place—you know how the Europeans love to go and drink the water. Well, this is what the Air Force chose as one of its bases because there were a lot of nice hotels there. And they took over one of these hotels and filled it up with German rocket experts. They had a whole hotel filled up with these scientists and engineers, German specialists with their wives and their children and their secretaries, and their mistresses. And I'll tell you, the confusion was unbelievable [laughter]. I spent some time interviewing some of them. And they had really done

a lot of interesting things with fuels for rockets. I wrote a big long report. I remember one of them, whom I'd said they shouldn't bring to the United States—we were talking about bringing some of them to the United States, you know, such invaluable talent. And I remember after I got back here one day, walking down the street in Pasadena, here's this fellow working for the Naval Ordnance Test Station. So much for their reading our reports.

Anyway, it was a different kind of experience.

BUGÉ: Did you feel this was a security risk?

PLESSET: No, I just thought this fellow was a Nazi. It was a bit of a shock; but I wasn't too surprised.

Well, then I went to London, where they had collected an enormous quantity of literature from the Germans—most of it was just rubbish, and they didn't know what to do with it. It was a very wasteful operation.

Then we came back. While we were in London, the atomic bomb was dropped on Hiroshima, and the excitement was unbelievable. We were on our way back at that time.

BUGÉ: What was the reaction of people in London?

PLESSET: Well, they were really awestruck. It was obvious that this was going to be a dramatic ending of the war. It wasn't until a little later that people began to say, well, maybe they shouldn't have dropped it; they should have made a demonstration. But they were fed up with the war.

BUGÉ: So you came back to Pasadena, then, and got a job with the Naval Ordnance Test Station?

PLESSET: Yes. Still in fluid mechanics.

BUGÉ: What was involved in that job?

PLESSET: Well, they had an office up on Green Street. And one thing that they were concerned about was the problem of water entry of torpedoes. They were still trying to drop torpedoes from airplanes, trying to shoot at ships. And often they would drop these torpedoes, and they would break up. They had to go very slowly. So an airplane would fly very slowly and steadily at low altitude. And here, the ship is shooting at them all the time. And most of them never made it. Then they had problems with torpedoes fired from submarines. Sometimes instead of going to the ship, it would come around and threaten to come back [laughter]. Things like that. So that the hydrodynamics of underwater bodies had some problems. And they were still working on the problems of water entry, dropping torpedoes from airplanes and so on.

BUGÉ: During that time, were you in touch with people at Caltech?

PLESSET: Yes, to some extent.

BUGÉ: And then you were hired by Caltech, as Associate Professor of Applied Mechanics.

PLESSET: Right.

BUGÉ: And DuBridge was then…

PLESSET: He was president, yes. This was just about a year or two after he became president at Caltech.

BUGÉ: Did your contact with him lead to your being hired?

PLESSET: I don't know. Maybe [laughter]. I'd like to give him the credit.

BUGÉ: Did you feel that the Institute was different when you came back and DuBridge was president?

PLESSET: Well, of course it was. It seemed very small when Millikan was running it. And it

wasn't so small when I came back—at least it didn't seem to be so small; but still smaller than it is now. But DuBridge was very keen on maintaining a very high level of activity. He was always that way; he was that way at Rochester. So I think he did a lot to keep Caltech at a very elevated level of activity, particularly in research. It could have slid downhill, but it didn't. I think he did an awful lot in keeping Caltech just way up there, and through a difficult time when a lot of places were changing.

BUGÉ: Do you think the war left any lasting effects on the Institute?

PLESSET: Well, I hadn't thought about that. I think the war changed engineering quite a bit, and it changed it here at Caltech, too, because people became much more aware of what engineering and applied physics and applied science, what their capabilities were. So I think that that did make a change here at Caltech.

BUGÉ: You must have been dealing with different professors since your previous experience had been in the physics department.

PLESSET: Yes, it was a different group of people. They were also very stimulating.

BUGÉ: Is there anybody from that time who stands out in your mind?

PLESSET: Well, I didn't know very many of them in engineering. But one soon found out they were very smart people.

BUGÉ: It has been said that your favorite class to teach was classical theoretical physics. Would you agree?

PLESSET: [Laughter] Yes, that's right.

BUGÉ: So, in some ways, your interests haven't changed all that much.

PLESSET: No, not really.

BUGÉ: Can you describe, then, from 1948 up to ’51, when you became a full professor, what your experience was at Caltech? How you felt about your classes and the students.

PLESSET: Well, students that I ran into were just outstanding. They were so bright and so capable that it was scary at times [laughter]. It’s remarkable how they kept getting such good students—these were graduate students for the most part, though I did have some undergraduates in some of the classes that I’ve taught—they were just awfully good. That was very stimulating, the teaching, because the students were so good.

BUGÉ: Were you pursuing any research in particular during these years?

PLESSET: Well, I got interested in this field of cavitation and the related effects. I wanted to understand it; and I think I did do some things that contributed to understanding it.

BUGÉ: Cavitation has to do with bubble-flow?

PLESSET: Well, it has to do with the formation of vapor cavities in a liquid flow. If the pressure falls, there’s a possibility that the liquid will boil at low temperature, thus cavitation. Boiling takes place because you lower the pressure, not because you raise the temperature—it’s a similar phenomenon, though.

BUGÉ: Did you have any specific applications in mind for the research you were doing?

PLESSET: Well, with the development of more efficient pumps, higher speed, you run into cavitation more, and have to be more concerned with it. So that was the application.

BUGÉ: Was the field of engineering science developing at this time? Or was it already established as a field?

PLESSET: Well, it's a way of handling changes in engineering curriculum. If you didn't have something that fit into the usual conventional categories of engineering, you could put it in engineering science. And that's where a lot of the computing stuff started, and then separated off. I think that there's an advantage to having this kind of an option, because it's a place where you can keep unconventional things until they either blossom or wither. Also, it's a way to recognize the contribution that can be made from classical physics and mathematics to applied problems. So that's really what it's all about.

BUGÉ: It allows interdisciplinary cooperation then, too.

PLESSET: Yes.

BUGÉ: Then in 1952, General Vandenberg asked you to serve on a scientific advisory board with a panel of physical scientists. Could you discuss this?

PLESSET: Well, I wouldn't put it as personally as that. They had—they still do, I guess—a Science Advisory Board for the Air Force. I served on that for a term. It was interesting. They had a lot of physicists and mathematicians and the like get together. Kármán started this, and was head of it for a long time—the chief civilian head of it. They would consider problems of concern to the Air Force—technical problems, scientific problems—and it was successful. They wanted to be sure that they weren't losing out on possible applications of science and engineering for their purposes. And there's a lot of concern about weapons and weapons effects, which were quite new, like the effects from big bombs. This was an area that was new.

Begin Tape 1, Side 2

BUGÉ: Was this the first time that you had been involved in that concern, of the effects of weapons?

PLESSET: Not really. I had been a consultant at Rand in their physics department for some time. And they were concerned with these things. Well, one gets tired of it pretty easily.

BUGÉ: Tired of the concern?

PLESSET: Tired of the effects. Tired is not the word—but discouraged.

BUGÉ: In 1955, your name was suggested to President DuBridge to be on a committee which was discussing applied nuclear energy. Did you participate on that committee?

PLESSET: I don't think that ever got anywhere.

BUGÉ: During the fifties, when the McCarthy hearings were going on, did you feel that they affected the campus environment here?

PLESSET: I think Caltech was very fortunate. They weren't seriously affected. I think that it was a bad time; and academic freedom was really threatened in a lot of places. The administrations at a lot of schools yielded too easily to this kind of pressure. But I thought here at Caltech that they did a very good job of protecting academic freedom. And as a result, I think that the Institute got through it in pretty good shape, unlike some other places.

BUGÉ: Did you know people personally who were hurt by this?

PLESSET: Well, not here at Caltech. Except there was one fellow, who was a chemist. He was a research fellow in chemistry. And he was accused of being a communist. And Pauling went to bat for him. Pauling felt very strongly about rights of that kind.

Now, Tsien, the Chinese—I knew him, of course—a very able fellow. And that was a very strange and unfortunate thing.

BUGÉ: Can you describe what happened?

PLESSET: As I recall, he went back to China. I guess he was going to get married. And then when he re-entered, they questioned him about whether he was a Communist or not. He said he wasn't. Then they started after him, because he was very active in the U. S. military rocket

program. So then they decided they wanted to deport him as a Communist. And then another group in the government decided they shouldn't let him go [laughter]. So he was detained. It was a mess! And he became very bitter about it, and with some justice, I thought.

BUGÉ: And the Caltech community was really not able to help.

PLESSET: Oh, they stood by him as far as I could tell. DuBridge was very active in trying to help him and protect him. And it took some guts to do this. But they tried very hard to help him.

BUGÉ: When Oppenheimer's case came up and his integrity was questioned, having had close contact with him earlier, were you personally involved?

PLESSET: No, I knew nothing about any of this. And I don't believe that he was guilty of any of the things they charged him with. That was a bad thing, too.

BUGÉ: In 1959, you served on the California Atomic Energy Development and Radiation Commission.

PLESSET: Yes. They asked me to make a study of what the effects of an accident at a nuclear power plant might be, and what were the problems. And I did write a report for them. Nothing much came of it, though.

BUGÉ: Was this a new application of your interest?

PLESSET: No, I was interested in nuclear energy, and had been for a long time. I guess that's how they got to me. Well, I wrote a report for them.

BUGÉ: What other things have you done regarding nuclear energy?

PLESSET: Well, for about six years, I have been a member of this advisory committee on reactor safeguards. That's almost a full-time job. And I guess I should quit pretty soon. I'm leaving

tomorrow for Washington.

BUGÉ: That's what most of your traveling is for?

PLESSET: That's what all of it is.

BUGÉ: What does that involve?

PLESSET: Well, when they passed the Atomic Energy Act, Congress included this committee in the law, and described that it should be a committee of fifteen persons that should advise the Atomic Energy Commission. The Act has been revised. Of course, the AEC has been split up. And the peaceful part is the Nuclear Regulatory Commission. So they kept this committee there. They are supposed to be outside, independent members and are supposed to review every application for a site, for a nuclear plant, and for an operating license. And they couldn't go ahead with the operation of any plant until this committee wrote a letter, saying they thought it was all right or it wasn't all right. So it didn't have any power at all, except that they couldn't proceed until the committee wrote a letter, which meant there was some power in itself. Well, the committee advises the commissioners who are kind of political appointments and who don't know too much about technical aspects. So they get advice from this ACRS, the advisory committee on reactor safety, as well as this legal requirement that they have to say it's okay to go ahead with this plant. And they can't go ahead until they get this letter. And then, the Nuclear Regulatory Commission has changed quite a bit. It didn't have much technical expertise until fairly recently. They've hired a lot of engineers and scientists, until now there are a couple of thousand of them working for the Nuclear Regulatory Commission. This technical staff also looks to the ACRS for advice and criticisms, and so on. So that they're serving two functions—they are advising the commissioners, and they are serving as a link to the technical staff.

BUGÉ: And this is nationwide, which is why you do so much traveling.

PLESSET: Yes. Well, we are required to meet in Washington once a month—that's the full committee. Then there are subcommittees that meet in between, to delve more deeply into

specific items. I'm chairman of the subcommittee on emergency core cooling systems, and I'm chairman of the subcommittee on fluid dynamics. A lot of the problems in nuclear power plants involve fluid flow, the heat transfer. So that's where I help.

Then they have a safety research program—the NRC does. And so, first, the commissioners asked the ACRS to review it and write a report for it. Then the Congress heard about this, and they wanted a report. So we wrote two reports—one in July for the commissioners, and one in January for Congress—telling what's good about it, what's bad about it. I don't know, maybe it does some good.

BUGÉ: Are you personally concerned about the safety of nuclear reactors?

PLESSET: Well, that's a big question. Certainly, that is our concern. We're supposed to protect the public health and safety; that's the mission of the committee. We don't approve a plant unless we feel it can be operated without undue risk. Now, what does this mean? Well, it means a plant that's presumably properly designed—and I think that they are—the question that then comes up is, will it be properly built? And the final question is, will it be properly operated? These are difficult things. I think that the plants are pretty well—and I'll say this even of Diablo Canyon—reasonably well built. Now, the utilities, this is a different area for them. It's high technology. And some of them don't appreciate this. Some of them do, and are excellent. But this is a technology which everybody has to realize is different; you've got to take your work very seriously. This goes down all the way to the lowest maintenance man. And if the management doesn't appreciate this, you can get into trouble. Now, fortunately, the plants are designed so that they can do a lot of stupid things and nothing much is going to happen [laughter]. Like Three Mile Island, they were incredibly stupid, and they destroyed a billion dollar investment, but nobody got hurt. But that's not good enough. And I think that management has to appreciate that they don't want to lose a lot of money or get into a lot of hot water, and that they've got to treat it differently than they treat some old coal-burning or oil-burning plant.

I think that things will get better, but it's going to have an adverse effect on the technology. They're not going to sell anymore plants. And it is a useful and big source of energy; most people don't appreciate that. Combustion can be bad for us. And here's this stuff,

uranium, that's not good for anything else, absolutely nothing.

BUGÉ: You don't think an accident like Three Mile Island's can have long-range damaging effects and we simply don't know yet what they might be?

PLESSET: Oh, we know a lot about effects of radiation on living things. The public is, I think, sensitized to radioactivity, excessively sensitized. Well, we are living in a sea of radioactivity all the time. And it's been that way since the beginning of time. Any increment from Three Mile Island is negligible. You know, we don't think anything about stepping on an airplane, as I will tomorrow, increasing my dose of radioactivity to about what some of the people in and around Three Mile Island got. We don't think anything of it. Why not? Just happen not to know about it. So I don't think we should get overly excited about that. Greater activity is easily detected, easily managed. Of course, people do stupid things.

BUGÉ: You built a device, which measured the electric current caused by a high-altitude hydrogen blast.

PLESSET: Oh, this was a long time ago. This is of some interest, this kind of thing. You have a high-altitude nuclear explosion, you generate a lot of current. And this current is easily detected. And that's what we detected out in Azusa. We put this wire on the ground and detected this. And actually, this is one of the things you may have heard about in the paper, about the electromagnetic pulse. That this is one of the possible effects of nuclear weapons if they're exploded in the atmosphere, say in the center of the country. You can knock out all of the power plants, the electric generating stations, because it would effect the transistors. So that's something you don't want to have happen. Now vacuum tubes aren't sensitive to this kind of an electromagnetic pulse. But transistors are.

BUGÉ: In 1963, you became professor of engineering science instead of applied mechanics. Why was that?

PLESSET: Well, applied mechanics grew here to represent solid mechanics and elasticity; and I

wasn't working in that. So this seemed like a good title.

BUGÉ: Was it your choice or was it an administrative shift?

PLESSET: I think it was my choice.

BUGÉ: What is your involvement now with Caltech?

PLESSET: I'm very much interested in Caltech.

BUGÉ: Do you ever see students, as an advisor?

PLESSET: Some, yes.

BUGÉ: Do you still have lunch with your colleagues here?

PLESSET: Oh, yes.

BUGÉ: Do you [professors emeriti] ever get together and look back on the changes in Caltech, possibly review whether you think it's changed for the better or for the worse? Or do you have any feelings on that?

PLESSET: Not me. Of course, nothing that they do is as good as the way it used to be [laughter]. They're really doing pretty well. And I think that it will continue to be a good place. I'm very favorably impressed with Goldberger. I think that they've been pretty lucky with their presidents here. DuBridge was a great choice, who got them through a very critical time. And I think that Goldberger is also a very good man who will get them bigger and better things.

BUGÉ: Looking back, can you see that the directions have changed with the interests of the president?

PLESSET: Well, I think that it's not the interests of the president himself so much. He can encourage different lines of development, but they all really have to come from the faculty. If they're remiss there, he can certainly stimulate them. And I think that DuBridge did that. He was very keen on having good people on the faculty, and took a deep interest in that. And I think so does Goldberger.

BUGÉ: Do you see changes in the students?

PLESSET: Well, the graduate students are the same. About the undergraduates, I don't know as much. Well, they have girls now, and they seem to be at least as good as the men [laughter].

BUGÉ: Is there anything that you would like to add that I haven't asked you?

PLESSET: Epstein was one of the most colorful and interesting professors here. I think he was the only theoretical physicist that Millikan really respected. He didn't think much of most of the theoretical physicists. He discounted them. He discounted Oppenheimer, for example. But Epstein he seemed to have respected quite considerably. So that speaks well of Epstein. I must say, I found him a most charming and helpful man. He was very clear in his scientific efforts. He was very able to express himself technically. And he was also very colorful in nontechnical things.

We had a psychologist on the faculty here for a while—he's not here anymore. One day, at lunch, he sat beside Epstein. Epstein was very knowledgeable about psychoanalysis. He was really quite an impressive intellect. Anyway, this fellow says to Professor Epstein, would he explain something about the ego in psychoanalysis. And Epstein just looked with the greatest disdain at him and said, "Why should I bother to try to explain it to you?" And the poor fellow. [laughter]. He was pretty good at that.

BUGÉ: I've heard that he had a way of putting people in their place.

PLESSET: Oh, yes. He was not very tolerant all the time.

BUGÉ: Did you ever participate in his stammtisch?

PLESSET: Yes. That was very exciting. That was something that Tolman really organized. The time when I participated was when Oppenheimer was down here. That was a stimulating, cultural exchange.

BUGÉ: Do things like that happen now?

PLESSET: I don't know. I don't think so. I think that there is a tendency for the people here to be less like the Epsteins and the Tolmans. They get to be more technicians than they used to be. But that may be because I'm not in touch with this kind of stammtisch sort of thing. Maybe it's going on and I don't know about it. But I'm a little bit doubtful. People are more technicians now than they used to be.

BUGÉ: I have heard that even though Caltech has always had a humanities division, and that students were required to take humanities courses, that now the emphasis rather than being on the classics or on literature or poetry, is much more on the social sciences and quantitative subjects.

PLESSET: I personally regard that as an unfortunate thing. I don't think that Caltech should try to be a preeminent place in social science and economics. I think that the old way of having the stimulating teachers in English and history, is much more pertinent. But I guess you just have to satisfy the social scientists as well. Me, I wouldn't do it [laughter].

BUGÉ: Is there anything you'd like to add?

PLESSET: Well, this is one difference now, that has an effect on how we get our students. That was the entrance exam. In the "good old days," the entrance exams were made up by the Caltech professors. And I can assure you they were very interesting examinations, which the professors themselves would get a kick out of trying to pass. Now—and I can see why they have to do it—they have these college boards; these exams are taken all over the world, all over the country.

And college boards are the only way to do it. And it's a big chore making these exams up. But we've lost a lot. We've lost something by using these college board exams. I don't think that they screen out what we don't want and let in what we do want.