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ORAL HISTORY TRANSCRIPT

DOROTHY M. SIMON
INTERVIEWED BY REBECCA WRIGHT
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WRIGHT: Today is August 23rd, 2012, and this oral history interview is being conducted with Dr. Dorothy Simon in Pittsboro, North Carolina for the NASA Headquarters Oral History Project. Interviewer is Rebecca Wright, assisted by Jennifer Ross-Nazzal. We thank you again for letting us come see you and visit with you and learn about all that you have done. We'd like to start if you would by telling us how you first became interested in pursuing the field of science.

SIMON: I was interested of course because my father was in that field, and I even learned the word chemistry before I could talk. I continued to be interested in chemistry and physics and mathematics in college. When I was a sophomore I decided that I would like to do chemical research and that I would need a PhD. I never changed my mind, and that's how I became interested and how I planned my life after.

WRIGHT: You went to Southwest Missouri State College [now Missouri State University, Springfield], where your father was a professor.

SIMON: Right.

WRIGHT: Were there many other girls interested in the field of science when you were in those classes?

SIMON: None.

WRIGHT: Can you tell us what that was like? Did the male students accept you as a serious student?

SIMON: Oh, I don't know. At first nobody would sit beside me, so I don't really know what that meant, but little by little that changed and nobody said anything about it.

WRIGHT: Well, apparently it didn't bother you. I understand you graduated as the first person who had scored a perfect score from that college. That's quite an accomplishment.

SIMON: It lasted for 24 years.

WRIGHT: Goodness, and with a lot of science classes too.

SIMON: Yes, that's right.

WRIGHT: When you left there, I believe you went to University of Chicago.

SIMON: Yes, I did for a year. I took the courses that the first year student needed to be a PhD. After that I was approached by the University of Illinois to become an assistant to a professor, which meant that I would have 30 students and meet with them every day between his lectures and give a wider view to his lecture, and give a short test to them for 15 minutes. That was supposed to prepare them in a better way for the subject. That was very uneventful. No problem.

WRIGHT: During that time were you able to pursue other science aspects of what you were interested in as you were the assistant to this professor?

SIMON: Yes. Most of my assistance was this work with the 30 students. He had about three people in the same position working with approximately 30 people. The students liked this. Very shortly we had [US] Force people taking the courses. Particularly they were chosen to take a medical degree [MD], and for the time that they were at the University of Illinois we gave them all the science courses that they needed to have before they could start work on a MD. For that, they had to promise to stay in the Air Force a certain number of years. I think that was three.

That was a good thing for people who really wanted to be an MD. They were hardworking students. They didn't have much time to work because they were being drilled and lectured to, but there were some very good students. The thing that was unequal was that there were people who had graduated with an AB degree [Bachelor of Arts] or whatever they had, and there were people who had finished high school and that was all. But they worked hard. If they missed a month of not making passing grades, they were sent away to the war, so they were very

frightened people. One of them said to me one day, "If I took you out for dinner would you give me a better grade?"

WRIGHT: I guess that didn't work, huh?

SIMON: It didn't work. No. He knew it and looked as if, "Well, I tried."

WRIGHT: I guess you were an exception even at that time. Were you the only female assistant that the professor had in this field?

SIMON: Right.

WRIGHT: You earned your PhD from University of Illinois. Can you talk about your work for your thesis? I understand it had a lot to do with radioactive fallout.

SIMON: Yes. It was to work with radon, which is not a manmade element, but is found in nature. It is a gas, and it deteriorates through certain other molecules. Some of those were solids at ordinary temperature, so the question was, "What happens to these?" Do they agglomerate? Which they might. Some of them stay as a gas, which probably they did. My study was with an electron microscope. The material which was going to be looked at in the microscope had to be deposited on a slide so that you had a sample. After much much trying to get what I hoped were the particles in focus, I could see the shadows of them as I moved the microscope around. It was at least three weeks of not knowing what I was seeing, until one night I saw this in the

microscope, and was the happiest person in the whole place. The next step involved looking at different times to see if there were any changes.

The particles did agglomerate, then they crystallized, so this was an indication that you would have particles big enough to be blown around by air. Later that was called fallout. I went back to the University of Chicago and talked with some of the people who were studying a similar thing; similar but not with an electron microscope. So far they had decided that they had no indication of what was really happening. They were very glad to look at the research work that I had done. Some of them thought it was significant, and some didn't of course, but in a way I think it encouraged all of us that this was a very vital barrier to get over, so that's the way I got back to the University of Chicago.

WRIGHT: Why did you choose this subject to do your work in?

SIMON: I wanted to do radiochemistry. The man to whom I reported, who was head of all the X-ray work and the microscope work, thought it was a good idea. I brought up the subject of the radon. At first he said that in the physics department they could make different kinds of molecules that were radioactive to be used by other students. Well, the half-life of some of those was less than a day, and they called me two days after they made them and said, "You can come over and get your sample now."

So that wasn't going to work. That's why I went with the radon. That made me self-sufficient. This was the first microscope of its kind that had been sold. It had times when we thought it was broken down. They sent out people from GE [General Electric] to fix it, or not fix

it. Even the electrical wiring didn't follow the color codes, so it must have been handmade by one person who didn't follow the code.

When the people came out to fix the microscope, they entertained all of us who had any connection with it. I suppose they wanted a good report. We had a great deal of fun.

WRIGHT: It was such an interesting time in American history as well, as the war [World War II] was coming to a close. Did those events connected with the wartime impact your work? Or did you see it as even more important research?

SIMON: It didn't impact my work very much because this was a fellowship from an endowment, and the government wouldn't be able to cut it. I made all of $85 a month and I didn't starve to death.

WRIGHT: I believe it was around this time period that you met Nobel Prize winner Dr. James Franck. Can you share with us how he influenced your life?

SIMON: I certainly can. My husband-to-be [Sidney L. Simon] was working with him on a postdoctoral fellowship, so I met him in that way. He was in the laboratory himself, James Franck, doing experiments in physics. He was friendly, but not too friendly. Later he said to Sid, my husband-to-be, that, "She wears her hair in a braid around her head, and those German women always did that, and I have a terrible feeling when I see somebody else [with their hair like that]". He had escaped where he had been. I can see that he had lots of things to worry him. Probably had nightmares for a long time. He was a very kind man and he didn't have much to

do with the students. He wasn't teaching, so he gave a lot of time to Sid and that was good. It was a very good experience. But I never felt that he was friendly.

WRIGHT: When you finished your work there and moved to New York.

SIMON: I went to work at DuPont Pioneering Research in Buffalo, New York. I guess I better say that polymers were made into things like silk stockings and tights, all that was not yet complete. They did make stockings out of it, but there was a big barrier in that you couldn't dye the material at all. When I got there they were working on a new polymer which was later called Dacron. Dacron did work very well, and the material from it was what they call a good hand. That means that it doesn't feel cold to you, and gives a good feeling, that's all I can say about it. It came later that you could mix cotton and a lot of polymers, polyester and others, but it took several years before that kind of material could be made.

It works with silk of course and it works with cotton and wool, so people who don't know the past think that it's always been around. It is very successful.

WRIGHT: You were really on your own when you moved to New York. This was your first job. So you were—

SIMON: An employee. It's different. The head of the group, Pioneering Research group, was a very good scientist himself. They were slated to build a new building near Wilmington [New York], so all of us participated in what we wanted in terms of rooms and facilities. That was the main interest of the group at that time. But one thing he did for me was that I became ill with

something like the flu. He called me up and said, "There is a place that I go when I have something like that. They'll take good care of you there. This is how you get in touch." He gave me the names. I didn't go, but I thought that was very sensitive of him to think of something like that because he had lots of other responsibilities. I appreciated that very much, and I never actually used the sanatorium.

WRIGHT: As a single woman, were you able to find a location to live easily when you moved to New York?

SIMON: Yes. I was able to rent a very nice room and the two people who lived there were very nice people. There were only about five people who lived there, so it was quiet. They gave me the living room. It was nicely furnished. The only thing was you had to open a couch to sleep at night, but that was okay. They worked for a club, and the man did the cooking, and the woman I guess did the hard work. Frequently they'd bring me something very nice to eat or drink from there, and put it in my room, and I'd find it. That was very nice. Another time, they were having trouble with a vacuum cleaner. I said, "I think I could fix that for you." So I did. It was a very minor problem. They wanted to give me a drink of 20-year-old whiskey.

These things are good to remember.

WRIGHT: So you fixed that vacuum cleaner and realized that you had all these mechanical abilities as well.

SIMON: I had to have certain mechanical abilities. I had to be able to blow glass, and I had to be able to fix pumps and things like that, but for many people I did do these simple things. Of course they all thought it was beyond them to do it.

WRIGHT: What a payment, 20-year-old whiskey. Did you stay with Pioneering? You just stayed with them for about a year or so, is that correct?

SIMON: Yes.

WRIGHT: Then you went to the—

SIMON: Oak Ridge [Laboratory, Tennessee].

WRIGHT: Again you were in radiochemical research. Is that correct?

SIMON: That's correct.

WRIGHT: Can you talk about working in that environment? Now you're in a different state, of course more south, so it's a different environment.

SIMON: I was just married. It was kind of a culture shock, Tennessee. Everybody lived in an apartment or a house that was built for the people who worked there. It was chosen by some way, but it included how many children you had, and what your status was. But [US Navy]

Captain [Hyman G.] Rickover, perhaps you've heard of him, had a house for the bachelors. My husband had been one of those that lived in that house. Captain Rickover made it possible for us to move in immediately. Otherwise you had to wait in line, so he proved his power. That was very fine. He wasn't as mean as people have said.

WRIGHT: I'm sure you got to know him on a different level than his sailors did.

SIMON: Yes.

WRIGHT: You were there at the same time as your husband. Did you work on the same projects?

SIMON: No. I worked in a chemistry laboratory. He was there to learn what was learned during the war. He worked at NACA [National Advisory Committee for Aeronautics] at that time, and he was selected by them to come for a year.

WRIGHT: I remember reading that one of the everyday processes that you did, you had to wear protective clothing because of what you were working with. Could you talk about your work there and why you had to wear that clothing, and what that was all about?

SIMON: Yes. I was working on triple fission of uranium. The bomb was made with one break, and presumably there could be a third one in which there'd be new products, and those could

chemically be identified. So it was a matter of trying with analytical chemistry to find if there were any new products.

I worked for a very nice section head who was anxious to help with different methods that would be—to his belief—a good test of whether it really existed. I didn't finish that work in the time that I was there, but I learned that the man assigned to it after I left had found indications of triple fission. That was a very interesting program.

I don't know whether you remember that one of the things that the Oak Ridge Laboratory had was a pile—as it was called—where you could artificially cause a material to become radioactive. I used that and thought how much money had been spent, and here just a chemist in the laboratory had it at her fingertips. It was exciting. It was really very exciting.

WRIGHT: It was a brand-new concept in America, wasn't it, to do this laboratory in a peacetime effort?

SIMON: Right. There was much talk of course that it should be stopped because the work wasn't going to be useful to anyone, which wasn't true. You might not have an idea of what it would be useful for, but something would turn up after you had opened the new door.

WRIGHT: Because it was a peacetime effort, did you have long hours working there?

SIMON: You couldn't work except during the hours of 9:00 to 5:00.

WRIGHT: How did you like living in that part of Tennessee, newly married?

SIMON: Well, I liked it all right. But that brings up the thought of what we were warned against. Don't drive on any road that isn't paved. You'll probably be met by a shotgun and a man ready to use it.

WRIGHT: Might have found a few moonshiners in the backwoods. You think?

SIMON: I'm sure. It was a dry county, by the way.

WRIGHT: I had found some research about the dresses; you had to wear a specific type of gown every day. Is that correct?

SIMON: That's correct. It was a prisoner's gown. It was light blue and it came just to your knee. It was made like a balloon.

WRIGHT: It wasn't very fashionable, was it?

SIMON: It wasn't very fashionable. I also had to wear lead-toed shoes, which were not very comfortable. The reason for that was that if you were working with a radioactive material in that you shouldn't touch it in any fashion; that you had to build a sort of house of lead bricks. That had been considered to be a safety risk so severe that you had to wear lead-toed shoes. Wasn't any fun, any of those things, but you had to do it. It just became routine.

WRIGHT: Were you able to build on the work that you had done at the university so that you were learning more about the subject you were interested in as well?

SIMON: Yes. A lot of work that had been done, nobody knew about it, so it was a very good education.

WRIGHT: When you left there, is that when you went on to the Argonne National Laboratory in Chicago?

SIMON: That's right. Again I worked with uranium. This time it was to see if you could build with uranium a special kind of molecule which had attached not by the usual binding but by more or less an accident. Some of those that showed up would be like acetylene for the solvents that you might use. While I was there, again it wasn't a finished job. Another person took it on. I know that it was successful in some ways, and they actually put my name on a paper, so that was nice.

WRIGHT: Were you able to publish at all at these first jobs, or were you just building up that experience?

SIMON: No, it wasn't possible at that time. It was just an education that you were getting.

WRIGHT: A big one. After your time there, I believe it was in 1949 you went to Lewis Research Center [Cleveland, Ohio] to become part of the NACA.

SIMON: That's right. Now that's where my husband had come from. The Argonne trip was that he wanted to do some research there. They let him have another year. He brought back a lot of information and big lectures around the lab. So it was useful quickly.

WRIGHT: It was fortunate that because of your background, being married, they found a space in the laboratory so that you were able to do your work as well.

SIMON: Yes. It was very good. Of course my husband was known in these places, and it wasn't as if I had filled in an application for a job.

WRIGHT: Talk about the work that you did for the NACA. The Center had just changed its philosophy and its research goals to investigate all types of propulsion.

SIMON: That's right.

WRIGHT: I believe you were assigned to the Fuels and Combustion Division, and did some studies on flames.

SIMON: That's right.

WRIGHT: Were you assigned that job or was that your study—you wanted to do, flames?

SIMON: That's the job I came up for after I looked at what they were planning to do. That was not one thing they were planning to do. But I had known about the fact that there were different characteristics that you could measure. One of them was the speed of the flame.

In the engine business you do have combustion, and you do have flames, so they were interested in a more fundamental look, something that could be quantified. The tests that were made to measure the speed of the flame in a tube, open-ended, so that you lighted it, and it moved quite fast. It measured the rate at which it was moving.

The other test that had been devised was called quenching. For a burning mixture in a tube there is some diameter below which the flame will go out. For the engine people that had been very important. They were glad to have more hydrocarbons that they knew what would happen, and would make the transfer in pipes or whatever at the right diameter and not run into having the flame go out.

So I did a series of hydrocarbons. By this time NACA had been allowing people to publish their work. I was very glad that I could publish my work. The only thing that had to happen was that a reviewer and editors should look over and change the paper that you were sending out. That was really helpful, but it took more time that way.

One time I got into a real argument with them. I was writing on what are called free radicals. The editor went through and changed every one of the free radicals to ions. They are not the same thing, so I had to mark them all out and then go tell him; he knew more English than he knew chemistry. But it was just marvelous to be able to publish freely. We were quite free to do so.

I had quite a number of papers published (see list of **Technical Papers,** *page 49*), and I went to symposia in England, and France and in Germany. In all these places I gave a paper, so I

made some international friends and acclaim. I was told by one of the German people that he couldn't understand people from England but he sure understood me, in the same language. I thought that was fairly funny.

WRIGHT: Were you gone for a long time period when you would go to those symposia?

SIMON: They were more like a week.

WRIGHT: This was in the late '40s, early '50s. How did you travel to Europe?

SIMON: I went on the [*RMS*] *Queen Elizabeth* the first time. I traveled on a large oceangoing vessel. I was first class when I made the first trip. I guess it was like you read about. I did enjoy it. I read some books, and sat on the deck, and didn't go swimming because it was too cold. We were taking the northern route.

WRIGHT: Then you were selected for that $10,000 grant from the Rockefeller Foundation.

SIMON: That's right.

WRIGHT: You were in Europe for almost a year.

SIMON: That's right.

WRIGHT: Tell us about that experience of being in the midst of those scientists there, and then working together to exchange your information.

SIMON: Well, I was actually working in a laboratory there. It was free radicals.

WRIGHT: Not ions.

SIMON: No. One of the students who was working for his PhD had set up, made all the equipment that was needed. I was to work with him, and he was from Germany. He'd been an [Waffen] SS [Nazi military force] person. At first it was a little bit frightening because we had a lot of batteries together which gave a big jolt of electricity, and I just thought what if he would turn them on when I—that's a terrible way to feel. But in those days we were frightened of Germans. He was as hungry as I was. The food was rationed, a lot of it. You didn't have but one egg a week. Sugar was rationed and butter was rationed. I lived in an international house. They rationed it right down to you. You had so much sugar and so much butter to eat. They had the egg for the week on Sunday evening. So that was some celebration, but they insisted upon making Toad in a Hole. Do you know what that is?

WRIGHT: You'll have to share that with me. No I don't.

SIMON: It's a hardboiled egg which has been covered on the outside with sausage meat and recooked so that the sausage meat was done, and inside was the toad, which was a hardboiled egg.

There were other strange foods too. They liked to serve hare that had been hanging for some time to be, I guess, better by their taste than if it were eaten after it was first killed. So we were rationed. Things were hard to get. We had three meals a day. That was good.

WRIGHT: Did you spend most of your time in Cambridge? Or were you in different labs as well?

SIMON: I went to other laboratories to see what they were doing, and to be entertained by them, which turned out to be very nice. Mostly they were people whose work I had read in papers they had published. Sometimes they would be ones who had come to the Combustion Institute for their annual meeting, so I knew the people to some extent. They were very friendly and wanted to show me things. Cathedrals. Going to one of the meetings with the government, it was good to see also. I walked a lot.

Everybody walks or rides a bicycle, or did then. I had injured a knee in high school doing field hockey. I just didn't think I could go very far on a bicycle.

WRIGHT: Can you share some of your recollections of what the countryside looked like in those countries that you visited? It was soon after the war had ended that you were there.

SIMON: Yes it was. Rural districts, they seemed to go on as they'd gone on for years and years, but in London and places you still saw the remnants of houses and buildings of many types that they hadn't repaired or rebuilt. It wasn't as bad as I expected it to be because they had done a lot

of work, but you could see really it's demolished. It must have been very horrible living through the war.

WRIGHT: What do you remember about going to Paris? That must have been an exciting time to be able to go to France.

SIMON: Right. They had set up some rocket motors in the laboratory for me to see how they tested. After all that was over, they said, "If you'd like we're going to drive you back to Paris and go to a cafe and sit outside and talk about other things than we've been talking about here." So I rode in a car with five people. The driver just kept going around, very randomly choosing streets it seemed to me. Finally he said, "I'm trying to outrun the guard." We did. Then we had a more friendly type of visit.

How they were living was spoken about. Paris is a beautiful, beautiful place, so that was a good trip. Then I went to Italy after that and had I guess three days there. Two of them were really more sightseeing trips than anything else. I have a fondness for Italy after that.

WRIGHT: Tell us how you were selected for this Rockefeller Foundation grant. Is this something you applied to, or did they seek you out to give you this award?

SIMON: Someone had to recommend you and write to a committee at Princeton that was going to decide who got the fellowships. You had to have a government job to get the fellowship. The head of the laboratory at NACA decided to recommend me and sent in whatever was required of him. Then one night when it had been snowing and dull in the evening, somebody knocked on

the door. It turned out to be a reporter from one of the newspapers. That's the first I had heard that I actually had one of those fellowships. The laboratory was very happy that I had received one of them. That's the way I got the $10,000.

WRIGHT: That's quite a prestigious award. What were you able to bring back from your travels and working with the scientists and the chemists in Europe to help you with the studies that you were doing at the Lewis Research Center? Was the information that you learned something that you were able to apply once you got back, to further you along on your studies?

SIMON: I think not. I don't remember signing a release. I'm quite sure that I never had an opportunity to do that, but I learned so much that it was up to the minute, and it did me quite a bit of good.

WRIGHT: When you got back from your travels to Europe, it wasn't too long after, you moved on to industry. You left the government. So you left NACA. I believe if my research is correct you went to Texas to work with Magnolia Petroleum. What were you doing there?

SIMON: I was evaluating the work that had been done on oil sands. Oil sands have petroleum in them. The objective was to find a method to remove the oil, to separate it from the sand underground, and profitably. Exxon I guess had some work on it. One of the people from Exxon was on the board of Avco [Corporation]. They suggested that Avco do some work and make some money out of oil sands. I tried to build in the laboratory a replica of what might be done in mining this material. Sweden had an operating system, but because of the high cost.

Electricity was very low-priced in Sweden. The Swedish people had used a five-point drilled hole around a circle. In the center was their heating equipment. The expectation was that the oil would form and would move toward the outside and be ready to put in a barrel.

They were just exploring something that the company could do that they weren't doing in the oil field. It finally got to the point that the more mathematical people were determining how much it would cost—if you could make a profit at cost. The lower limit was $4.50 a barrel, but the barrel was then $3 I think. So that didn't really cause much interest in making that a new product.

I don't know whether they continued or not, but I think they probably didn't. They had assigned to me two men who had been working under a third one, and they were supposed to do whatever was necessary to work on that problem, whatever they had to have made or anything. Well, they decided to learn German, and they had worked at least six months with no experiment in mind, no anything, except to learn German. The company had an opportunity to get a woman that could perhaps handle the two men. That was not easy, because they'd all been friends. They felt that their friend had been badly treated by the company.

I can't judge that. But really if the only thing they're doing is learning German—anything you wanted you could have had translated for less than teaching three people German. Anyway no work had been done on oil sands. The two men in the group were given over to me. This was the time when the space age was coming very fast. My husband had a very good opportunity to go to New England and work at Avco Corporation, so we decided that we'd go there. Avco had provided for me to have work to do there too.

It was strange to be in Texas, and to be told what to do when you were working on the line, that if you were bitten by a snake, what you should do. The remedy was take out your knife and cut around the points. That would save your life. Fortunately I wasn't working outside.

WRIGHT: That's a good thing.

SIMON: That's a good thing.

WRIGHT: Dr. Simon, what you were working on then to separate the oil from the sands, is that somewhat of what oil companies are doing now? What I think they refer to as fracking? Is that something different?

SIMON: No, that's a different thing entirely. It starts with shale, not with the oil sand. The shale is supposed to give up the oil if you break it all up. But as you know, a lot of states and cities and places are fighting because they don't want the pollution and they don't want the chance of getting cancer. That's two reasonable things to think about. Also recently it has been found that there isn't as much oil shale as was originally predicted. I think the prediction was 100 years for supplying the United States. Now probably it's 10 years.

WRIGHT: That's a big difference.

SIMON: A big difference.

WRIGHT: Well, I have to think it was a big difference moving from the Dallas area up to Massachusetts.

SIMON: Well, indeed it was.

WRIGHT: Did you and your husband make a decision that this was where you were going to be for a while because of the opportunities?

SIMON: Yes.

WRIGHT: Tell us about that transition and starting a new job with this company. For instance, were you able to pick the area that you wanted to work?

SIMON: To some extent, but it had to be within the interests of course of the corporation. One of the vice presidents I met, James [R.] Kerr, was in his 30s then I think. He was going to be made president of one of the research units. It was called research and development. Then it was going to be more closely aligned with science, another unit within the overall division. That was to be headed by Arthur [R.] Kantrowitz. I knew him from his early published work. Also I had met him frequently in the symposiums. He wanted to hire me and have me come to Boston. My husband was supposed to stay in Bridgeport. Well, that didn't sound like a very good solution to our problem, so that didn't occur. He wanted me to be in his group. I didn't want to go to Boston alone.

But the work was quite interesting that I did here. It was to handle the work that was being done under the government, but it was free. You got a stipend from the government when you gave your proposals. They were not linked with any contracts that had been requested or were in existence. Each year the contracts had to be justified and all the new work that you planned to do in the next year had to be written up and reviewed. You were qualified through negotiation to take from the expenses for each government project a certain percentage. That varied from one unit to another.

I was appointed to go around to five divisions, see what they were doing with the money that they were spending, and approve what they were predicting that they would spend, then go each year and negotiate with three government divisions. Those were the Army, the Navy and the Air Force. At first, we negotiated for each unit separately, but I would press the auditors that were there to give me the authority, and that I would divide it as economically for them as I could. They gave me that authority.

The people who did the negotiation were of different divisions. They went home very very angry. The larger engine general who was at home called me up the next day and said he was going to the Navy, where he had been a captain, and he was going to have that reversed.

Well, he didn't get there. But oh, I've never known anybody as angry as he was. He thought his unit would be putting in more money than the others, and then they might not get all that back if it's divided differently. I couldn't fault him for that. That interest ended with my being an assistant to the president and doing the same kind of thing. Not for the government money so much now, but whether the proposals to the government were reasonably within our interests. So I was now a manager. It was interesting, but I missed having my own work to do.

WRIGHT: You missed your lab.

SIMON: Yes. But it was a promotion, and that always makes one happy when you're promoted.

WRIGHT: Your boss was not of a technical or scientific nature, so you were the one that these ideas filtered through before they got to him. Is that correct?

SIMON: That's correct.

WRIGHT: Did you have many proposals that came through on a routine basis? How did you make up your mind which ones you felt were good, in the interest of the company? How did you discard the rest or make them a lower priority?

SIMON: I asked the head of the engineering department what they believed was good about the work that was going on. Then from my education and what I could decide to do, as I came in, helped me to see whether this was just being written for the money's sake or whether there was experience and a real interest in what was being proposed.

I learned that some companies went against the rules by having the proposals, for example to the Navy, worked on before they knew what the Navy was going to ask. It was specifically so that it would help them to get the proposal. That was not supposed to be allowed, but people talked about it frankly. I think I prevented that from happening. If you were caught it would not be so good.

WRIGHT: Avco was quite a conglomerate at the time, wasn't it?

SIMON: Yes.

WRIGHT: So you had diverse types of projects that were coming through for your review. Is that correct?

SIMON: No. The only ones that came through were the scientific ones.

[pause]

WRIGHT: Before we took a break we were starting to talk about your role at Avco.

SIMON: Right. Before that I said I never worked for the Atomic Energy Commission. That is not true that I didn't. They had the laboratories of Oak Ridge and Argonne, but I didn't realize now today that I had had to get different secret clearances and everything.

WRIGHT: Did you have a secret clearance for working for NACA?

SIMON: Oh yes. I had top secret.

WRIGHT: So you've almost always worked under a very secluded environment.

SIMON: That's right. That's why a lot of the work didn't come out to people who would like to know.

WRIGHT: How did you exchange information with other people like you that were of the same type of clearance? Were you able to talk with them?

SIMON: Yes you could. Not just the two of you, but in a group, and when some of these meetings were held. You'd have a submeeting with people whose work you knew about but had never had a chance to talk.

WRIGHT: Dr. Simon, when you went to Avco, I think you mentioned that you didn't work in a laboratory. After you were there for a little while you became the technical assistant to the boss. Then at some point you became a vice president.

SIMON: That's right.

WRIGHT: Tell us how your job changed and what some of the duties were that you were doing as you moved through the company and became more high level in the management structure.

SIMON: When I moved to the highest position in the corporation that I reached, I had to move to New York. Our headquarters were there at that time. My job with the president of the company then was somewhat similar to the one that I had had before, except that he got a lot more people

anxious to talk about work they wanted to sell. He would talk to them first and then they would come to me.

You couldn't help but laugh with some people that thought they had the world's best program. Usually they were very flawed, and they really didn't have what they thought they had. One I remember said that he had this fluid that you could put on your car windows and the frozen part would go away immediately and you could see just as clearly as if it had never been there. I started asking him how he mixed this whatever it was, and how he controlled it. Well, those questions had no answers; he was as far from production as you could possibly be. So that one was out.

[pause]

WRIGHT: I think when we stopped this last time we were talking about some of the ideas that people brought to Avco. We were talking too about you had gone to New York where you were vice president. You had told us about someone who came in and wanted to put the fluid on the windshields. Do you remember any more? Maybe one that worked that you really were proud of bringing through Avco?

SIMON: Well, mostly they were so small that they would not have impacted Avco at all. What they were doing was trying to begin to get some other areas of work that were not under the government. But the way the government money left us, there was a long period when nothing was coming in. Then they sold out. Not while I was there. The various divisions were purchased by companies that were doing work in their area, so it worked out for the people very well, as well as it could I think. They took over our retirement and paid it to this day.

WRIGHT: Oh, that's good news.

SIMON: Yes it is good news.

WRIGHT: Can we talk about Avco's and your contributions to the project for the reentry for the spacecraft?

SIMON: Yes I can.

WRIGHT: Please tell us how that happened.

SIMON: That's for the heat shield that you wanted to hear. Avco had been working on a project for about three years before I got there. What they had found were failures, just as other companies were finding. They simultaneously decided what a vehicle would look like if their program was successful.

The way it looked when I first got there was like a half of a sphere. That means a very broad front, made of copper. They found that that wasn't going to hold up because the flow that they expected to be laminar. It wasn't, so therefore heat was transmitted fast. It was outside the range that would have to be used if you were going to get through the atmosphere.

By that time it had been decided that the best kind of a material to use went from a solid to a gas. There are several things that do that, but even among the materials they had worked

with that did have that property, they still didn't absorb enough heat. You might call them all inorganic materials.

As you know, I had worked at DuPont, and I had quite a lot of valuable knowledge of polymers. I'd made some calculations and found that with the heat that they would absorb it would solve the problem. In one of the meetings where everybody was going over the problem and trying to decide where we went next, I discussed what I had quickly calculated, and suggested that as the next way to go.

Well, it was accepted, and it was accomplished, and it had a positive test. Then the engineers had to figure out how they held it in place. I think you remember some times when they lost part of the tiles that were on the vehicle.

I'm not sure how they changed that. But in any event, it followed the whole years and years and with probably many changes in those years. But it was a very very vital point. You would not have had a space program if they couldn't come home. Even if they had been to Mars, they couldn't get back. So it was very successful. I got certain congratulations from people, but I wasn't included in the report. At first I was worried about it, but then I thought I've done something important. Why should I bother? That's what I'm here for, is to do something that really is important.

I think one of your questions was, "What did I think was the most important thing that I had done?" That is it.

WRIGHT: Wasn't that in the early '60s when you made that suggestion? It has surpassed many a test in time since.

SIMON: That's right. It did make an enormous effect on the future.

WRIGHT: Did you also transfer that technology for ballistic missiles as well? Did you also work on those projects for some of the nose cones and nose caps and different types of pieces?

SIMON: Right.

WRIGHT: We were also talking about always working under a secret classification. Were you ever concerned about your safety, working so closely to those types of projects during the height of the Cold War?

SIMON: No, I wasn't. I wasn't really worried about that. But when I got on the board of the paper company out in California, they were warning us, if we were driving from work to wherever we lived not to take the same route every day, but to change often the way that we went.

Once I had a telephone call from I guess something called the Arab something or other. He said he had sent letters to the President and to the Secretary of Defense and all these people and that we weren't fulfilling what we should do. Why he called me I don't know, but it was startling.

Then he wrote a letter and he said, "I'm in the library in New York, and this is where I'm writing this letter." So he was not real with it, but anyway it frightens you. As I drove home, I always looked to see if somebody was behind me or following me.

WRIGHT: You were with Avco for about 30 years?

SIMON: That's right.

WRIGHT: That's a long time to stay in one place.

SIMON: Yes it is.

WRIGHT: But the job kept changing and projects kept changing?

SIMON: I kept changing.

WRIGHT: Kept learning more.

SIMON: I was very glad that when my husband died, I had 10 years more to work there; that my life wasn't totally interrupted, and that I could continue to save money for the days that I got old.

WRIGHT: Worked out well.

SIMON: Yes, it's worked out well.

WRIGHT: You two worked at the same place for a long time. But not always.

SIMON: That's right. Both of us thought it would be better if we worked at different places, but the way it started is that the only thing I could do was to follow him. Maybe not follow, but together decide that I would go. The only time I was away was when I went to England. He was supposed to come and meet me during one of the two-week vacations they had in Cambridge. Just before, he was accused—this was the time when people were being accused—and he was accused of going to a dance that was sponsored by communists. That's a great thing. He was with the NACA then. They didn't take it to heart. They fought it. Finally the conclusion was that he was 95 percent cleared. But that didn't bother anybody.

Isn't that a terrible way to—

WRIGHT: Yes. Yes.

SIMON: Of course that whole thing was a scandalous thing.

WRIGHT: A terrible time in American history [McCarthy Era].

You were able to come home one time during your year in England, isn't that correct? I think you came home for Christmas.

SIMON: I did come home.

WRIGHT: You made that boat trip twice then.

SIMON: So I did. I came home because I was getting a letter about once every day from my husband. He was really depressed. He didn't know if he was going to be out of a job, and nobody else would have hired him. So anyway it turned out not too bad.

WRIGHT: That's good. It's reassuring to know he worked with people who believed in him to fight for his expertise.

SIMON: Yes.

WRIGHT: You spent a long time in Massachusetts. Is that where your home was for a while, you and your husband's?

SIMON: Yes. He was there I guess until the '70s. He had developed a heart problem so that he only served as a consultant to a few places. Then one day he had a heart attack and that was it.

WRIGHT: What a loss. You spent so many years together working in the same location, but not doing the same thing. Did you feel like you had a professional competition or more of a professional partnership?

SIMON: A partnership. Somebody once started that business of saying, "they are competitive." Well, what they really should have said was that we were working for "companies that were competitive." But of course when you read it, it didn't come out that way. So that's followed me.

WRIGHT: When you first started out, were there many places for you as a female scientist to have been able to be employed? Was there a barrier against you because you were female, or did people just want to hire good scientists, chemists?

SIMON: I guess I didn't know if there was a barrier. Even when I graduated with my PhD, I went to three different companies, and every one of them offered me something either I liked or didn't like. So I didn't feel that. But there was affirmative action. That was really important for women. When they made the reports, they had one person in a high place.

WRIGHT: When I was looking through some information, I read that you gave a report at a conference held in 1964; you reported on the First International Conference on Women in Science and Engineering. Do you remember going to that [international] conference and how that conference came about? Were you involved in making that happen?

SIMON: There were two conferences. The one at M.I.T. [Cambridge, Massachusetts] was by invitation only. There were only 12-15 people in that conference. Two were students at Rice University. The other one was an International conference for women in science and engineering. I was involved in that conference. The U.S. government had given the society of women engineers a very small amount of money. We decided that we would use that money to help women who wanted to come and had passed all the things, such as what they had done in science and engineering. Yes, there was a section of the society of women engineers in New York who hosted the conference. I was a member of that section. My part was to help the

women who could not cover their expenses but had enough money to pay at least three quarters of it. Some of the women were given money by various institutions to come to the conference.

In Ireland there was a woman who worked in transportation. She was the only one in Ireland who had a chance to come. Her friends and relatives had put together the money for her. This became a pretty important thing in the newspapers that she was going. So the industry that made clothing gave her everything. $8,000. She was a beautiful person. It was wonderful to think that so many people wanted to help her for what she was doing.

There were some other times when I'd just get a call while they were traveling. They didn't have this or didn't have that, so I would have a check sent to wherever they were. The people who did that for us in Avco said, "You mean we're sending her $50?" But that's what she needed.

It was a very nice thing for people to do. The women that came from India were supported by their government. There were about five that came, so that was good. I can't remember anymore how large the meeting was. But we had it in a big auditorium. It was translated into different languages so that was good also.

WRIGHT: Was it New York?

SIMON: It was in New York.

WRIGHT: How exciting.

SIMON: It was exciting. It really was to me particularly since I had not spoken to these people, but I had had letters from them and in some cases phone calls. I expected to meet them when they came to the conference.

One night each of us in the New York Society of Women Engineers section invited a few to a small dinner someplace. That was very nice. They were to wear the costumes of their country if they wanted to. I had one group, and it worked very well. We were living in the Cornell Club building. My husband became a member of the Cornell Club, so I had use of the dining room. There's a dining room for women and a dining room for men. All my guests were women of course. They didn't know that the dining room was a place where men didn't come. But that was a nice dining room. It was a brand-new building. We were the first people to move in.

Our furniture didn't all get in till midnight that night. The man who ran it was from Germany I think. His wife was also. That night at midnight she brought us a beautiful cake, so we celebrated together.

WRIGHT: That's great. It was a long way from when you moved to New York for DuPont [Pioneer Research] in the room with the couch that folded out.

SIMON: That's right. It was a long way from that. We had a balcony over three rooms, so we really had a real view of the other buildings and out toward the river. It was a very nice place.

WRIGHT: Sounds like it. If it's okay, I'm going to ask Jennifer if she's got a question for you as well.

SIMON: Okay.

ROSS-NAZZAL: I thought of several, Dr. Simon. I was curious. We shared with you some of the materials that we had pulled. What did you think of the media coverage and their interest in your career?

WRIGHT: The *Saturday Evening Post* did the article on you [in September 1959]. What did you think about these writers who wanted to come talk to you about your career?

SIMON: Well, it made my husband very angry. He talked to his good friend from NACA. He said, "If they don't call you a communist or a criminal, you're all right."

ROSS-NAZZAL: He was so concerned about that possibility?

SIMON: No. I don't think he was. Maybe he didn't like the competition.

WRIGHT: Maybe not. But did you see yourself as unique in that time period?

SIMON: Yes. I didn't meet anybody like me. It was really prefeminist time.

ROSS-NAZZAL: Did you find that there was hostility in the workforce when you started? In the late ’40s and ’50s they were encouraging women to stay home and raise babies, and not really work or go into fields such as science. Was there hostility towards women that you found?

SIMON: No, not really, because during the war all the women were being asked to do something. Rosie the Riveter, and that kind of thing. There was an anxiety to have women to use in the workforce. I don’t think there were too many times when people knew me that they felt any bad feelings about what I had done. My mother-in-law was sorry I hadn’t had any children. Maybe my parents were too. But it wasn’t in the book.

WRIGHT: You were writing a new book.

ROSS-NAZZAL: Did you work with other female engineers or scientists, or were you pretty much the only woman in the company?

SIMON: I was the only woman except for the secretaries. I had a woman secretary. Somebody suggested I ought to have a man secretary.

ROSS-NAZZAL: What would your husband have thought of that?

SIMON: I wouldn’t have mentioned it, but I wouldn’t have liked that either.

ROSS-NAZZAL: Did you belong to any women’s organizations or groups?

SIMON: I belonged to the Society of Women Engineers. The other societies, like the American Chemical Society and the Society for Aeronautics and Astronautics, that was more what I was doing. I served on the board of that for a while.

WRIGHT: You made a number of presentations and speeches in your life. Are there any that stick out in your memory as those that are more special than others?

SIMON: I guess the one that sticks out in my mind is the one that I gave at Missouri State for the graduates in the summertime. It was very interesting. I gave a very short speech, and there were many who said, "You said what you wanted to say, and it was so much better than sitting there and hearing somebody [else]." We had a very terrible storm during the time, I was giving it. I had expected to wear a robe of course, but it was so hot that everybody was taking off their robes. So they were not going to appear that way.

Well, I hadn't really thought about my dress, but I had on a sleeveless navy blue linen dress. That's what I wore.

ROSS-NAZZAL: Would you tell us how the workplace changed over the years? You started working right after the war, and then you were working for so long [afterwards]. Tell us how things changed in terms of dress, or the type of people you worked with and attitudes.

SIMON: Well, let's start with dress. In came the casual dress for certain days. That was not around, so that was a big change in the environment. As a matter of fact, in some of the science

and laboratory places they never dress other than in a casual way. You just couldn't go around in a suit and tie. So that was true, but it wasn't of course anything the secretaries or anybody like that would have worn.

ROSS-NAZZAL: Did attitudes change over time? Did you notice a lot more women coming into the workplace?

SIMON: Well, they didn't come in that fast. After all, most women weren't educated to hold those jobs, not only in science but in other fields. They had to be educated and then move up until they could get a higher salary and a better job.

I moved out by then and retired, and I didn't see that happen. I remember another question was whether I ever served as a mentor. I did with maybe one or two people a year. I found that very rewarding.

WRIGHT: I also understand that you were on the committee for the National Medal of Science during the [President James E. "Jimmy"] Carter administration. Tell us about how you were selected to work with that? That's quite an honor.

SIMON: I don't know how I was selected. I just got a letter saying that they would like me to do that. It was a very difficult task. I was the only one in chemistry. I got two file drawers of applications. I got them three months before we were going to meet, and every weekend I had to go through those files. Naturally there were only some fields of chemistry that I could judge

well, so you had to rely a bit on what people were writing about what the other one had done and why it was important.

I got about 10 people that I thought would be deserving. In the event, after we met, it was decided that we should send 20 names for the total list. Some of them were of course selected. They gave a big banquet for them in the State Department. The committee was invited of course, and we had a chance to see who had been on the list, and how friendly they were. It was a very nice thing to be able to do. Now we also suggested that instead of just having one medal for science, have one for fundamental scientists and one for engineering. That actually went into operation.

It was better, because you can't compare an electrical engineer with somebody who is a computer expert and had made changes that would affect that section, so that was done. The committee had some pretty well known educators, and they were always coming up with ideas of changing it. It was time to do it.

Actually we had suggested some young people, one of whom was selected to get the medal.

WRIGHT: It looks like it still brings great smiles to your face. That must have been a rewarding experience to serve on that.

SIMON: Yes, that was a very nice thing. I also served on committees, one of them was to decide what technologies should not be sent overseas. That was an interesting one too. Then another of them was to look at the holding property, which was chemicals that could be used for making other things. Of course it's gasoline. But several stockpiles were really out of tune with what

was needed, so we made recommendations on that. We heard a lot of people speak about what they thought should be done.

It was just a waste of money to hold those things if they weren't going to be used, so they revamped the whole materials stored in there.

WRIGHT: That's interesting. Speaking of those types of committees, I found a list. One was the Department of Commerce Committee for National Bureau of Standards. Now that was a very unique one to add to the list. What did you do with that?

SIMON: The Bureau of Standards had a very wide range of programs. They didn't have much to do with measurements and the thing you think they would. They had some advances in radiochemistry and other such things. The point was to see whether it was balanced research work that they were doing, how it fitted in with their primary job relations and they separated. The department no longer had say, atomic energy programs such as that. They went to this new laboratory.

I think it was a very good thing. It was too widespread. You've got to have some nucleus of scientists who are doing the same kind of problems in a field that becomes known then that that's a place to go and to get a lot of information. So every one I was on turned out to make suggestions of reorganizations and such as that.

WRIGHT: Sounds like a pattern there, and all very different but yet somewhat related.

SIMON: That's right. I think it was the time after the war when you needed to look at what had been going on because everybody was focused on materials for war and there wasn't, thank goodness.

WRIGHT: I know you retired from Avco, but did you continue working?

SIMON: Well, at the age of 65, being an officer of the company, I had to retire. The policy had been that you could work till you were 70 or something. I think I would have gone ahead, but it was just a new phase of my life. We had planned to come to North Carolina, and the reasons were just as good for me as they were for the two of us, and I'm very glad that I came here.

WRIGHT: You chose a beautiful piece of America to live.

ROSS-NAZZAL: The only other question I thought about is, you worked in industry and you also worked for the government. Would you talk about the differences between those two different types of jobs?

SIMON: Yes. Not working for an industry, you have much more freedom to decide what you would like to do. You would like to tie it in somewhat with the laboratory and certainly with what the laboratory was supposed to do, but not the same as in industry when you are essentially assigned a program to do. You may suggest other things later, but the first thing that you do is to spend a year or two following the assignments. At DuPont the reason that I had gone there in the first place was it was one of the only companies that let you advance on two ways. One of those

was being a scientist and you didn't have to get a management job to get higher wages, and then the management side. Many a person has given up real talent to go over and become a manager. That isn't quite right. They were the only company I knew at the time who used that double ladder. But I wasn't there long enough to have it affect me.

One of my colleagues there was from the University of Illinois. After I left, we stayed in contact through Christmas cards, things like that. One day he wrote on a card, "It's taken 10 years here to complete the work that you started." I was very very pleased that they went on with that work.

WRIGHT: So you left a lot of foundations for people to build upon. It's a nice legacy.

SIMON: A nice legacy. Right.

WRIGHT: As you look back on your years of contributions to industry and government, are there some things that we didn't talk about that you can remember you'd like for us to know?

SIMON: Let's see. In industry you are more likely to be asked to leave than in a government laboratory. You have to really do something terrible in a government laboratory to be asked to leave. Just even a misunderstanding can cause you to lose your job in industry, if you can't get along with your boss. Then his story is good.

WRIGHT: It's the only one that people listen to?

SIMON: That's right. You don't get a chance to defend yourself. It wouldn't go over anyway if you tried.

WRIGHT: What was your favorite time to be working? The decades that you worked, things were so different from one to the other. That constant change.

SIMON: They were different because I worked at the front edge. Everyone was at that stage with practically everything, so it's really hard to say why that was so. The war had a great deal to do with it because there was a total revision of what was important after the war. Where people could look and say, "Oh this is going to have breakthroughs and we're going to move fast." I guess that's what all of us wanted.

WRIGHT: I remember reading that one paper you gave, I believe it was to the AIAA [American Institute of Aeronautics and Astronautics], was about innovation. Did you have a great belief that as Americans we need to be innovators?

SIMON: What the paper was about was how I had found innovation better if you paired people who were in the same field, but they had gone to different universities and they had a different look. In the materials division, I had the two people work on a program that they together had proposed. The papers that they wrote on that brought them personal fame. Of course they both left, but I had written a paper on it I guess. When I moved to Greenwich, there was another company there whose chief scientist leader had read the paper. He learned that I had moved

there, so he wanted me to come and talk about it. He said, "It's the first paper on management that I ever understood."

WRIGHT: I found it very interesting as I read the [1959] article in the *Saturday Evening Post* about you and Sidney living in your home in Massachusetts, and on Sunday mornings you would have a gathering of people that were sharing ideas over meals. I just thought that was such a wonderful atmosphere.

SIMON: It was. It was limited in scope because two MDs that worked for Avco saw all these people who should make things faster and more innovative than they had. One of them was about the method of feeding people who needed to get their nourishment and couldn't get it from eating meals.

One of the problems when they were trying to push it through [the tube] was that there wasn't enough weight on the end of it to work properly. So a couple of people came up with ideas that sounded good. One of the days that we were getting together, one of the two doctors called up and said, "I've got a dead body." He meant he was going to bring a study corpse like medical students and show people exactly what he wanted to do, and he did.

WRIGHT: Must have had some very unique conversations on those Sunday mornings.

SIMON: That's right.

WRIGHT: I know that you worked on reviewing ideas, but did you have your own set of inventions or your own set of projects that you saw come to fruition?

SIMON: Well, of course the heat shield was one that lots of people had to work on before it was a success. But that did please me very much to see that that was.

WRIGHT: Well, we can end there, knowing that that contribution made such a difference to all those spacecraft that came through re-entry.

SIMON: That's right.

WRIGHT: Thank you so much. We really enjoyed learning so much.

SIMON: I've enjoyed it very much too.

WRIGHT: Thank you.

[End of interview]

Technical Papers

The following NACA papers were published as reports of Dr. Dorothy Simon's research work on flame characteristics. This list includes the names of the people who worked with Dr. Dorothy Simon and a summary of the work. She published two papers on flame speeds for a number of hydrocarbons in scientific journals.

An evaluation of the soap-bubble method for burning velocity measurements using ethylene-oxygen nitrogen and methane-oxygen-nitrogen mixtures
http://hdl.handle.net/2060/19930083831
Simon, Dorothy M; Wong, Edgar L
1954
NACA-TN-3106

Prediction of flame velocities of hydrocarbon flames
http://hdl.handle.net/2060/19930092187
Dugger, Gordon L; Simon, Dorothy M
1954
NACA-TR-1158
The laminar-flame-velocity data previously reported by the Lewis Laboratory are surveyed with respect to the correspondence between experimental flame velocities and values predicted by semi-theoretical and empirical methods. The combustible mixture variables covered are hydrocarbon structure (56 hydrocarbons), equivalence ratio of fuel-air mixture, mole fraction of oxygen in the primary oxygen nitrogen mixture (0.17 to 0.50), and initial mixture temperature (200 degrees to 615 degrees k). The semi-theoretical method of prediction considered are based on three approximate theoretical equations for flame velocity: the Semenov equation, the Tanford-Pease equation, and the Manson equation.

Prediction of flame velocities of hydrocarbon flames
http://hdl.handle.net/2060/19930087439
Dugger, Gordon L; Simon, Dorothy M
1953
NACA-RM-E52J13

Miscellaneous Articles:

Dr. Dorothy M. Simon — Vice president, Avco Corporation, and director of corporate research. Chairman of the Grants Committee of Society, she has held positions of responsibility at Oak Ridge National Laboratory, NASA, duPont, and was the principal research chemist for Magnolia Petroleum Corporation. An American, she has been a lecturer at the Imperial College, London, and at Cambridge University.

Society of Women Engineers, "Women Engineers and Scientists,"
http://uihistoriesproject.chass.illinois.edu/REPOSITORYCACHE/58/6GO68xpKhC2VL5wMem68qLDU0axCnPllrj5Oe0
22MlqQvaW7GU6RMWQlW28S1i1J9SWf499840CT4O2O01D7dzMm8054N79k2ilJ730DYD2_31825.pdf

David Lucht, "The idea of reforming fire safety practice in the United States is not entirely new, even though our loss rate is among the worst. In 1983, Dr. Dorothy Simon, who was then Vice-President at AVCO Corporation, testified before the Senate Subcommittee on Science, Technology and Space, stating that fire-related costs of building construction in the United States could be reduced by 40 percent through the use of modern fire technology. Unfortunately, unlike many other governments in the world, our government never mounted an aggressive effort to undertake a program to take advantage of these opportunities."

THE PRESIDENT'S COMMISSION ON CRITICAL INFRASTRUCTURE PROTECTION PUBLIC MEETING BOSTON, MASSACHUSETTS FRIDAY, JUNE 6, 1997;
http://www.iwar.org.uk/cip/resources/pccip/bstn_trn.pdf

NACA Technical Reports:

Flame velocities over a wide composition range for pentane-air, ethylene-air, and propyne-air flames. http://hdl.handle.net/2060/19930086813
Simon, Dorothy M; Wong, Edgar, L.
1951
NACA-RM-E51H09
Fundamental flame velocities are reported for pentane air, ethylene-air, and propylene-air mixtures for the concentration range 60 to 130 percent of stoichiometric. A form of the Tanford and Pease equation, which includes a small constant velocity term independent of diffusion, will predict the observed changes in flame velocity.

Variation of the pressure limits of flame propagation with tube diameter for propane-air mixtures http://hdl.handle.net/2060/19930087025
Belles, Frank E; Simon, Dorothy M
1951

NACA-RM-E51J09
An investigation was made of the variation of the pressure limits of flame propagation with tube diameter for quiescent propane with tube diameter for quiescent propane-air mixtures. Pressure limits were measured in glass tubes of six different inside diameters, with a precise apparatus. Critical diameters for flame propagation were calculated and the effect of pressure was determined. The critical diameters depended on the pressure to the -0.97 power for stoichiometric mixtures. The pressure dependence decreased with decreasing propane concentration. Critical diameters were related to quenching distance, flame speeds, and minimum ignition energy.

An active particle diffusion theory of flame quenching for laminar flames.
http://hdl.handle.net/2060/19930086923
Dorothy M. Simon and Frank E. Belles
1952
NACA-RM-E51L18
An equation for quenching distance based on the destruction of chain carriers by the surface is derived. The equation expresses the quenching distance in terms of the diffusion coefficients and partial pressures of the chain carriers and gas phase molecules, the efficiency of the surface as a chain breaker, the total pressure of the mixture, and a constant which depends on the geometry of the quenching surface. Quenching distances measured by flashback for propane-air flames are shown to be consistent with the mechanism. The derived equation is used with the lean inflammability limit and a rate constant calculated from burning velocity data to estimate quenching distances for propane-air (hydrocarbon lean) flames satisfactorily.

Effects of additives on pressure limits of flame propagation of propane-air mixtures
http://hdl.handle.net/2060/19930088034
Belles, Frank E; Simon, Dorothy M
1953
NACA-RM-E53I29