INTERVIEW

OF

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P R O C E E D I N G S

INTERVIEWER: Okay. If you could state your name and what you do.

DR. FISK: Okay. I'm Len Fisk, and I'm on the faculty of the University of Michigan.

INTERVIEWER: Okay. Thank you.

DR. FISK: Okay.

INTERVIEWER: We have a couple of questions for you, and the first one is, what is your primary research interest?

DR. FISK: My primary research interest is solar physics, solar atmosphere, the expansion of the solar atmosphere to make the solar wind, energetic particles, and that.

I think of myself as having a domain of interest, which runs from the surface of the sun to the edge of the interstellar medium, local interstellar medium, so -- and anything within that is fair game for my research. I'm a theorist, by the way, not an experimentalist. I do theories.

INTERVIEWER: Now, what is it that you find most interesting about this work?

DR. FISK: Well, first of all, you have to remember I have been in it now for 45 years. I mean, this is -- you know, I got my Ph.D. back in the late '60s. And I was interested in the subject at that time because it was a subject in which -- when you go into astrophysics, which is kind of what I was doing, you tend to like subjects where there is a lot of data, because then, if you make up theories, you have something to test it against.

And so I shied away from things that were in the -- in astrophysics, interstellar medium, you know, galaxies, all of those things -- simply because I thought they were -- that it would be kind of fun to do theories, but there would be no way to know whether they were right or wrong. And I made a conscious decision to stay within the solar system.

And by staying with the solar system I have had the pleasure of having not only to be able to develop some theories but to have them be tested against observations.

INTERVIEWER: Let's see. With what and when were you involved in space weather research that you

can share with us?

DR. FISK: Well, let's define "space weather research" as from my point of view. I mean, I -- my contention is if we are really going to succeed at having predictive capability in space weather, we need to understand the underlying physics. And that we're in danger, if we don't do that, of having models that really aren't that good.

And so where I concentrate my research on is the underlying physics. I don't get directly involved in predictive capability, but I'm hoping that the theories that I develop ultimately find their way into numerical models, and the numerical models make -- will be the basis for the predictive studies in the predictions that we make.

So I think the -- you know, from my point of view, I have been involved in space weather research from the get-go because it's essentially, you know, trying to understand how the solar wind is accelerated, how energetic particles are accelerated, all of those things, which will ultimately find their way into the predictive models.

INTERVIEWER: Start with this, and remember to start with a question, if you wouldn't mind, like stating what I'm asking.

DR. FISK: Oh, Okay.

INTERVIEWER: So --

DR. FISK: The question I think you want to ask is, you know, let's talk about the history of space weather here for a moment. And, you know, we can worry about space weather history, space weather events, and things like that. But let me take it from the point of view that I probably know something about, which is -- which is when NASA really got serious about trying to worry about this problem of how the sun works, how it influences the Earth.

And the history there is a little sort of convoluted over the years, because NASA as an agency, within its science organization, used to relegate the field of sort of solar physics and space physics to just a part of astrophysics. And so it didn't have much status in the -- within the administration of NASA.

Now, a lot of good missions took place at

that time, the first Explorer mission, Van Allen was essentially a space weather mission, if you define it in a broad sense, understanding the radiation belt.

But if you sort of follow the evolution of the field after that within the agency, you see that it sort of became a sort of second-class citizen to other disciplines. And only when you get up into the late '70s, late 1970s, does the subject of space weather, the physics of space weather, get its own division within the science office at NASA.

And it kept that division for only a few years and lost it again. And then, I, like many other scientists in this field -- are you all right there? Okay. The -- sorry, I just -- now you have something to edit.

(Laughter)

INTERVIEWER: Had to -- my arm got tired.

DR. FISK: Oh, I see. The scientists in the field at the time, you know, lobbied very hard to get the division back, because we knew that without the division, it wasn't going to be possible to have the missions that we wanted to have in the program.

And there was actually a "gang of six" -- as we were known -- who sort of marched up and down to NASA headquarters and said, you know, "Give us back our division." And the only way we actually got the division back was I became the Associate Administrator of NASA in 1987, and one of my first acts was to reinstate the division, which was then called Solar Terrestrial Division, I think was the name.

And that division has persisted under various since then. It became Sun-Earth Connections, now it's Heliophysics, but it has given, within the agency, the opportunity to have a division on the same status as planetary and astrophysics and earth science to be able to do the research that NASA needs to do for the space weather problem.

I think without that division we would be -- we wouldn't have the missions that we have flying today, and we wouldn't have an opportunity for missions going forward of any size and status, because if you are just a part of somebody else's division, you are always second priority in the choice of missions that are going to be pursued.

Your question was, what happened before we had a real-time monitor? I mean, I think the -- and scientifically of course it made no difference, because, you know, we measure the observations and we use them for the theory.

You would have to ask the predictive side of this as to what they did, but I assume they did nothing in effect, because this is one of the key sense of measurements that you needed to have a predictive capability of whether you're going to get hit by something going -- coming at you. At least you have an hour and a half warning, or whatever it is.

And one of the things that sort of bothered us at the time -- remember, there was an IC program, IC3, International Center of Explorers 3, that was sitting out at L1. And I think you may be telling me something that I don't know, whether it had a real-time monitor on it or not, but I assume what you're saying it didn't.

That is -- but somebody got a bright idea to go off and chase a comet with IC3, and they did that. It wasn't much of a -- it wasn't a comet mission, so it

didn't make a lot of measurements, but it allowed the U.S. to claim it was interested in comets when the Europeans and the Russians and the Japanese were all going to Halley's Comet and we weren't.

But that took one of the key monitors off the front of the Earth, not a real-time monitor but, still, a -- and I thought that was a stupid decision to make at the time. It was not my -- it was before I was Associate Administrator.

Now, I think the other thing that you -- you know, you may want to put in your thinking on this is the IMPs, all of those IMPs. And I'm -- now I'm not as coherent, so you may have to do some editing here.

INTERVIEWER: That's no problem.

DR. FISK: But remember the IMP program was established during the Apollo program, because it was sold on the grounds that it would allow a predictive capability of radiation during the Apollo program, you know, solar flares and all of that stuff. And NASA had a lot of money at that point, and Frank McDonald, who sold it to the agency as a necessary part of protecting the astronauts. Whether it was or not, in fact, is

kind of immaterial. That was -- but NASA bought it on those grounds.

And of course we had I think eight IMPs, if I remember correctly, and including some that lasted a very long time. But most of what we know about the magnetosphere, the Earth, and, you know, solar energetic particles, you know, in the early part of the space program, all came from those IMP missions.

And they were there to essentially make space weather measurements, if you think of it in the Apollo sense, you know, which is -- which was worrying about radiation damage, you know, radiation -- you have solar flare going off in the middle of an Apollo mission.

I had an interesting dinnertime conversation once with Neil Armstrong. And we were just chatting, and he said that the thing that he feared the most on the Apollo 11 mission was a solar flare. And he said it -- that it was -- you could see the logic was, everything else he controlled, he was the test pilot, he was the pilot, and he could -- he had confidence in his vehicle, and he had confidence in himself. But the solar flare was something that he absolutely, you know,

could not control.

And of course we were very fortunate during Apollo, because I think -- I want to say between the last two Apollos was the big 1972 solar flare. And it would have caused considerable harm had it gone off during either of those missions.

So certainly, you know, the agency and the Apollo program and others were very aware of space weather issues. And, you know, they didn't call it space weather, of course, at that time, but radiation issues, and the IMP program was put in place to do that, and of course IC had a role in that afterwards.

But being able to provide sort of real-time monitoring was not something that was done then, but, nonetheless, the study of the -- of all of these phenomena were very much part of NASA's thinking at that time, for their own protection.

(Whereupon, the interview of DR. LEN FISK was concluded.)

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