

Capital Reporting Company
Interview of Dr. James L. Green March 14, 2014

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INTERVIEW OF

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DR. JAMES L. GREEN

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Friday, March 14, 2014

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1 P R O C E E D I N G S

2 MR. CLINE: Well, Jim, it's an honor and a
3 pleasure to be here with you today --

4 DR. GREEN: And you're wasting tape. Let's
5 get on with it.

6 (Laughter.)

7 MR. CLINE: This will be for Brian --

8 DR. GREEN: I like short introductions.

9 MR. CLINE: Well, would you -- why don't you
10 introduce yourself to us?

11 DR. GREEN: Sure.

12 MR. CLINE: And then give us an idea of what
13 your primary research interest is.

14 DR. GREEN: Okay. I'm Jim Green. I'm the
15 Director of the Planetary Science Division at NASA
16 Headquarters. So I am the top advocate in the federal
17 government for planetary research.

18 One of my dearest loves in scientific
19 research is magnetic fields. In fact, I would call
20 myself a Magnetos Ford Physicist.

21 So I love anything and everything that
22 generates magnetic fields, and as head of the

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1 Planetary Science Division, I'm also falling in love
2 with objects that no longer have magnetic fields, such
3 as Mars.

4 And so what's really captivated my interest
5 about these bodies over time is really the phenomena
6 that occurs within those magnetic fields, how they
7 respond to the solar wind, how they actually reform
8 and reorganize themselves, how they accelerate
9 particles, how they generate electromagnetic radiation
10 that is observed by so many of our spacecraft, and
11 that gives us an ability to remotely sense what
12 happens in various distant regions of the
13 magnetosphere of anybody.

14 So, that's what's really been exciting to
15 me, is that it just is so much -- so many phenomena
16 that occur that it is a constant surprise.

17 You know, if you were standing on the moon
18 and you looked at the earth with your own eyes, the
19 earth would be blue and beautiful and oceans and
20 clouds, and you would think there would be nothing
21 around it.

22 But if you were able to see the earth's

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1 magnetosphere, it would be truly astounding. And in
2 fact, magnetospheres can be absolutely enormous.

3 From earth, if you looked up and you saw
4 Jupiter and you could actually light up its
5 magnetosphere, it would be larger than the moon in
6 size when you look into space.

7 And so, in that volume, all around that
8 planet, all sorts of fascinating things occur, and of
9 course that's actually the heart of space weather.
10 That really is where it begins for us here on earth,
11 and of course for any of the planets that are bathed
12 in the solar wind.

13 Now, I started this field in the 70's when I
14 was at the University of Iowa, and I really watched it
15 evolve. I watched -- I was part of it in terms of
16 being able to do research and contribute my knowledge
17 and scientific expertise with the rest of the
18 community to advance the field, but that was the field
19 of space physics, space science.

20 The field of space weather actually began to
21 dawn on us as we were able to relate what happens in
22 the magnetosphere and how it might affect our planet,

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1 and that actually began in the 90's where there was a
2 major thrust by earth science to be able to see or
3 make measurements of how humans might be contributing
4 to climate change, or how the climate is changing,
5 whether it's generated -- whether that change is
6 rooted in human contributions or not.

7 And so we began to think about, well, is the
8 solar wind magnetosphere interaction contributing to
9 that in some way, even if it's a small way?

10 You know, anecdotal information was always
11 kicked around about, well, you know, the mini ice age
12 occurred in Europe because of the Maunder Minimum, and
13 of course that means there was little or no sun spot
14 activity which suppresses fast solar wind, along with
15 a lot of the phenomena that current solar winds, like
16 coronal (ph) mass ejections.

17 And those are the things that really power
18 tremendous changes in the earth's magnetic field and
19 tremendous responses for which we call that field
20 "space weather."

21 And so, anecdotally, you know, one would
22 say, okay, well the mini ice age is associated with

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1 the lack of sun spots, so that connection must have
2 some -- must be rooted in some science.

3 And so, as we began to work in that
4 particular area. From my perspective the real turning
5 point in the understanding of space weather and its
6 effect, not only here on earth and the earth's
7 climate, but more importantly the space assets that we
8 have in space, really occurred when I started studying
9 the Carrington (ph) event.

10 And I've written several papers about the
11 Carrington event, and it was actually two coronal mass
12 ejections that occurred in 1859, one right after the
13 other, for which the second one was actually observed
14 by Carrington at an observatory in England. He was
15 actually looking at sunspots and sketching them.

16 The sunspot group he was looking at actually
17 fuzzed up enormously. He could hardly see what was
18 happening, and what was really occurring was a solar
19 flare right at the photosphere of the sun, which
20 doesn't happen very much.

21 And that brightening that was causing him to
22 have difficulty in seeing and sketching the sunspot

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1 was called a "white light flare" because he was
2 observing it in the visible spectrum.

3 And 17 hours later an enormous aurora took
4 place. And so this really was the start of the field
5 of the sun-earth connection, the start of space
6 weather as we know it, and that particular event
7 really turned my attention to it.

8 I studied that event because I really wanted
9 to understand -- how bad could it get? How intense
10 could geomagnetic storms be, given the activity of the
11 sun.

12 So, have we seen everything the sun could
13 put out or not? That was the question. And what we
14 found in the last 40 years of research with our own
15 spacecraft -- indeed we have not seen everything the
16 sun can put out.

17 The Carrington event clearly demonstrated
18 that the sun can be far more active and far more
19 extreme in space weather than we ever imagined.

20 There's a phenomenon in magnetosphere
21 physics called "magnetic reconnection" that we're
22 realizing it's of fundamental importance to understand

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1 it.

2 It happens in our Earth's magnetosphere when
3 it interacts with the solar wind. It happens in the
4 solar environment -- the solar atmosphere. It happens
5 at other stars, and it probably happens even when one
6 galaxy interacts with another.

7 And this particular phenomena --
8 reconnection -- is a rearrangement of the magnetic
9 fields based on the fact that they are being pushed
10 together. Two objects that carry these fields are
11 coming close together and the fields must be able to
12 interact.

13 And that interaction causes all sorts of
14 phenomena like particles to be accelerated, sometimes
15 at enormous velocities. So, the heart of space
16 weather really starts at understanding what
17 reconnection is all about, how it occurs, and what
18 happens when it does occur.

19 MR. CLINE: Okay. If we --

20 DR. GREEN: You know, when I look back at --
21 okay, so, sorry --

22 MR. CLINE: No, it's good.

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1 DR. GREEN: When I look back in my career
2 and I see a number of individuals that really have
3 affected me in major ways in getting me to be a better
4 scientist, the individual I think of most is James Van
5 Allen.

6 Dr. Van Allen could teach not only the
7 undergraduate classes, but also the graduate classes.
8 I've had him for both and he was magnificent in each
9 of those.

10 Of course the earliest pioneer -- the
11 discoverer of the Van Allen radiation belts -- is
12 somebody that had a lifelong career of science and was
13 writing papers almost until the day he died. That's
14 an individual that you have to admire just by the
15 sheer volume of work and knowledge that he's done.

16 One of the things that I really enjoyed
17 about Dr. Van Allen is his ability to entice you to do
18 research in such an easy way by appealing to your
19 sense of curiosity.

20 I had a course from him called "Readings in
21 Astronomy" and once he learned that I had actually
22 done a lot of photography of the sun and looking at

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1 sunspots, he immediately got me interested in actually
2 doing some research of that and through that research
3 I really got hooked into the next set of research that
4 I wanted to do.

5 So Dr. Van Allen was just such a critical
6 part of my research life that I think fondly of him
7 all the time.

8 MR. CLINE: Okay. We're ready.

9 DR. GREEN: When James Van Allen came to
10 Huntsville from an invite that I had given him --
11 okay, let me back up because I --

12 MR. CLINE: Uh-huh.

13 DR. GREEN: You know, after I left the
14 University of Iowa, the first place I went to work was
15 at Marshall Space Flight Center, and I wasn't there
16 very long before I invited Dr. Van Allen to come down
17 and give a talk.

18 And he came down and gave a wonderful talk
19 and of course I invited him over to the house, and a
20 number of my friends and neighbors, and we had a very
21 nice little party, and I remember very distinctly Dr.
22 Van Allen standing in my living room having munchies.

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1 And I was walking around with a tray of hors
2 d'oeurvres and was talking to one of the Marshall
3 Space Flight Center engineers that had been there for
4 many years, and what caught my attention was the two
5 of them were talking about Explorer One.

6 And the engineer asked Dr. Van Allen, did he
7 know why Huntsville engineers painted two letters on
8 Explorer one? And Van Allen knew what the letters
9 were. They were the letters "U" and "E," but he did
10 not know the significance of those.

11 And the engineer said, "Well, there are nine
12 letters in Huntsville. "U" is the second letter, so
13 that's a two, and "E" is the ninth letter, and that's
14 a nine. So this was really the 29th rocket, so "UE"
15 was a code, and Van goes, "I didn't know that."

16 Now, I'm standing there with a tray of hors
17 d'oeurves, and I said, "Well, why did they do that?"
18 He said it was very simple, if this rocket was
19 successful they did not want the press asking them,
20 "If they wrote 29 on it, what happened to the other
21 28?" And the answer is simple, they all blew up.

22 (Laughter.)

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1 MR. CLINE: All right. I just turned it on
2 and we're recording and you can retell that story.
3 It's incredible.

4 DR. GREEN: Well, soon after I got my degree
5 at the University of Iowa I went to work at Marshall
6 Space Flight Center and of course I invited Dr. Van
7 Allen to come down and give a talk, and he gave a
8 wonderful talk. The place was packed.

9 And of course at the end I invited him over
10 to the house, and I invited my science research
11 friends and many of the neighbors, and one of the
12 neighbors was an engineer, a retired engineer, who
13 worked at the Arsenal -- Redstone Arsenal -- and was
14 involved in building the Explorer One rocket.

15 So as I was walking around handing out hors
16 d'oeuvres, I came up to Dr. Van Allen and he was
17 talking to this particular engineer, and in the
18 conversation the engineer asked Dr. Van Allen if he
19 knew the significance of the two letter that were
20 painted on the side of the rocket.

21 Well, Dr. Van Allen thought a minute and he
22 said, "Yeah, I remember that it's the letters 'U' and

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1 'E,' but I don't remember the significance.

2 And the engineer said, "Well, there are ten
3 letters in "Huntsville. The 'U' represents the number
4 two in those ten letters. 'E' represents zero in
5 those ten letters -- you know, number 10 -- and so
6 that means there were 20 spacecraft that are of this
7 vintage, and 'UE' was indeed the 20th one."

8 And Dr. Van Allen did not know that. And of
9 course I was very intrigued, and I asked the engineer,
10 "Well, what happened to the -- okay -- what happened
11 to the other 19?" And of course the other -- his
12 reply is "The other 19 all blew up."

13 The reason why they put a code on the rocket
14 is of course they did not want the press to pry into
15 the fact that many had exploded prior to Explorer One.

16 MR. CLINE: So now we know the code.

17 DR. GREEN: Now we know the code. Yeah.

18 MR. CLINE: Thank you.

19 (End.)

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CERTIFICATE OF TRANSCRIBER

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I, ANNMARIE WASKO, do hereby certify that this transcript was prepared from audio to the best of my ability. I am neither counsel for, nor party to this action nor am I interested in the outcome of this action.

ANNMARIE WASKO