

Capital Reporting Company
Interview of Art Poland

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INTERVIEW
OF
ART POLAND

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

2 MR. CLINE: Okay. We're recording. Okay.

3 If you could just -- it's a pleasure to be here with
4 you today, by the way.

5 EXAMINATION

6 BY MR. CLINE:

7 Q If you could just tell us who you are and
8 what your primary research interest is.

9 A Okay. I'm Dr. Art Poland. I'm a solar
10 physicist. And I used to work at Goddard, and now I'm
11 a faculty member at George Mason University.

12 And my primary research interest is the sun.
13 And when I say it that generally, it's kind of
14 exciting in that I've been able to do everything from
15 building hardware to doing theoretical modeling. And
16 so to cover all that, it's -- it's pretty difficult.

17 But my primary research interest is really
18 how does the sun work, what is making storms on the
19 sun, how does the energy get into the outer
20 atmosphere, into the corona, just a physics problem
21 basically.

22 And the way I attack it, now at least, is to

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1 analyze spectra to get the basic physics parameters --
2 that's temperature, density, and velocity, and then
3 the magnetic field strength of various places on the
4 sun.

5 We've gotten to the point in computers,
6 which is very, very exciting, to where we are actually
7 model all this stuff.

8 When I was a graduate student back in the
9 '60s, you could only dream of this. And now we're
10 actually doing, which is very exciting. And what that
11 means is we need the observations to go into those
12 models and to see, do we really understand what's
13 going on or not.

14 And in analyzing spectra, we need really
15 good telescopes, spectrometers in space. And we're
16 getting those things, which is, again, really
17 exciting. Something that you could only dream of 30
18 or 40 years ago.

19 We're able to measure the temperature, the
20 density, and the velocity of the material on the sun's
21 surface all the way from 5,000 degrees up to 20
22 million degrees.

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1 We're able to get all that information. And
2 we're able to put it into models and see how good is
3 our physics understanding. And that is indeed my
4 interest is what's going on, do we really understand
5 what's going on.

6 And what's so exciting about it all now is
7 we don't know. We can make the measurements, we can
8 put it into the models, and in many, many cases we --
9 you don't get good agreement. You know, in some cases
10 we do. We -- when we do, we say, oh, good, because we
11 do understand that.

12 But there are other things that we're seeing
13 that we can't match and that's what makes science and
14 what I do so exciting, is that we get some answers and
15 then we say, these answers don't match, we don't know
16 what's going on, we got to figure out. We have to
17 say, how can we get the answer, what is going on on
18 the sun.

19 And that leads to new physics understanding
20 and that's what makes me so excited about what I'm
21 doing.

22 Q So when you first started research having to

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1 do with solar physics and so forth, you didn't have
2 that much data to work with, or did you? What types
3 of information did you have to start with? And then
4 from there, you had to build and ask for what you
5 needed to learn, you had to learn what you needed to
6 learn apparently.

7 A Well, what's really funny -- and again, this
8 is the way science works; I mean, all the way from
9 Galileo's time -- when I started out, we had
10 telescopes, we had spectrometers, so we could measure
11 the temperature, we could measure the density, we
12 could measure the velocity but these telescopes had
13 very low resolution. They were on the surface of the
14 earth so that the earth's atmosphere blurred them.

15 And the technology we had was film. So we
16 were actually taking pictures with a camera basically,
17 and you can't do that very fast. So your time
18 resolution was -- was pretty poor. So and going
19 through the earth's atmosphere, you couldn't look in
20 the ultraviolet and extreme ultraviolet film.

21 (Off the record.)

22 MR. CLINE: Okay. Let me start the

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1 interview now.

2 MR. POLAND: Okay.

3 MR. CLINE: We had to stop for trash. Oh,
4 hold on. We have another pause.

5 MR. POLAND: Might as well stop me, we'll do
6 that again.

7 MR. CLINE: And, Brian, this is Troy. We
8 had to stop because of trash can, so you may have to
9 piece some of this together. It'll be fine. But
10 we'll pick up where we were.

11 MR. POLAND: Yeah.

12 MR. CLINE: And keep on going.

13 MR. POLAND: Yeah.

14 BY MR. CLINE:

15 Q Okay, all right.

16 A Okay. So back in the '50s, we had these
17 telescopes on the ground. But you couldn't look at
18 the ultraviolet and the extreme ultraviolet because
19 the earth's atmosphere doesn't let that go through.

20 But we were doing the same kind of things.
21 We had computer models. They were really crude in
22 that, you know, the biggest computer in those days

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1 wasn't what you have on your cell phone now. So the
2 models were crude, the observations were crude. We
3 were seeing things about the physics that's going on,
4 but there was a lot that we didn't know.

5 An exciting thing happened after World War
6 II. They had these V-2 rockets. And some guys from
7 NRO were approached and said, is there anything you
8 can use these for? And they said, geez, yeah, we'd
9 like to put a spectrometer up above the atmosphere and
10 see what the sun looks like. They did that. And it
11 was Dick Tousey who did it.

12 And they got these spectra back and the sun
13 just looked amazing in these ultraviolet spectra. And
14 all of a sudden, we had a whole new set of data
15 information, more temperature information, more
16 density information, more velocity information.

17 That meant that we could do better modeling.
18 And computers started getting better. And so better
19 observations, better computers, better models. You
20 found more things that didn't match. And this says,
21 boy, I'd sure like to get better spacial resolution
22 and better time resolution. And you just keep -- you

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1 build better spectrographs.

2 And then on Skylab we still had film on
3 spectrographs. So, okay, we could do better because
4 we had better resolution. We had more data because
5 those guys were up for like nine months. And we were
6 doing better modeling in those days.

7 And Skylab was really exciting because that
8 was the first time we got a really clear look at
9 what's called "coronal mass ejections," the big
10 bubbles of gas and magnetic field that come flying off
11 the sun. And if they're aimed at the earth, they come
12 crashing in the earth and interact with the earth's
13 magnetic field -- space weather.

14 That was the first really solid inkling we
15 had that the sun was shooting these things off from
16 prominences and big magnetic loops. We did know that
17 flares were a problem. They even knew that during
18 World War II, but they didn't really know about these
19 coronal mass ejections.

20 But on Skylab, again, we were limited to
21 film, low time resolution, low spacial resolution.
22 But we started to say, okay, we got these things

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1 going, they're really interesting.

2 And it was exciting for me. I was on the
3 Skylab team that was working on them. You know, so
4 some of the first papers on coronal mass ejections I
5 was a co-author on.

6 And but we started saying, geez, I wish we
7 had better spacial resolution, I wish we had better
8 time resolution. And again, the modeling started
9 coming in.

10 I got involved with somebody, we were doing
11 a little bit of modeling, computer modeling of these
12 things -- how long do they last, how is the material
13 flowing in them, doing crude models like that.

14 Then SolarMax came along in 1980. Again, a
15 new coronagraph, better spacial resolution. And in
16 that one, we had electronics instead of film. It was
17 basically TV camera kind of stuff. Better resolution
18 in time, better resolution in space.

19 Q So this was the '80s. And then Skylab went
20 for how long?

21 A Skylab was in 1973.

22 Q Okay.

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1 A So '73, this is, again, what's so exciting
2 in science. Okay. Skylab, new data, new models, new
3 things to look for.

4 SolarMax 1980, new data, better modeling,
5 new things to look for.

6 And for me at least, the next biggie was
7 SOHO. And I was the project scientist on SOHO here at
8 Goddard, the U.S.

9 project scientist. It was a joint
10 European/U.S. mission.

11 And we had fast detectors, better
12 resolution. We had spectrometers. We had a really
13 good set of instruments to be able to measure, again,
14 the basic physics parameters -- temperature, density,
15 and velocity.

16 We still have not been able to measure
17 magnetic field out in the outer atmosphere of the sun.
18 That's a very difficult measurement to make.

19 But with the new data from SOHO, and I guess
20 what I have to say was the most exciting thing about
21 SOHO is we had really good time resolution and good
22 spacial resolution so that you had pretty movies.

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1 We were able to get these movies onto
2 television. And they were being shown on the 6
3 o'clock news. And all of a sudden, solar physics was
4 exciting to the public because we had these exciting
5 movies. And it was great for us as scientists to be
6 involved in something that the public cared about.

7 And again, also it was exciting because we
8 were able to do better research on it. And we started
9 to get to the point after SOHO -- I shouldn't say
10 after SOHO because it's still running now in 2013, but
11 -- and SOHO was launched, by the way, in '96. So it's
12 been going for a long time.

13 All of a sudden, we had what I would have to
14 start calling "space weather." We didn't call it at
15 the time -- we didn't call it "space weather" at the
16 time.

17 But, you know, all of a sudden, we had a
18 practical use. You know, we had these science
19 instruments and they were able to give a heads-up
20 warning to the power companies, to satellite operators
21 that, hey, there's a storm on the sun and it's coming
22 in two days and it's liable to cause disruptions in

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1 the earth's magnetosphere and to systems on the earth.

2 And NOAA was picking this stuff this up.

3 They were actually taking live feeds from SOHO and
4 putting it into their space forecast. I don't want to
5 use "space weather" yet because space weather wasn't
6 really a term at the time.

7 What then happened -- and it was kind of
8 interesting, I forget the exact year, but I decided,
9 okay, I don't want to be project scientist on SOHO
10 anymore, I don't want to be a manager anymore, I want
11 to just do research.

12 And so I quit my management positions and
13 just gathered all the stuff together and started doing
14 research again.

15 And George Withrow came to me one day from
16 headquarters and he said, Art, we got this new idea,
17 we'd like to start a program in space weather, what do
18 you think. And usually when somebody, from
19 headquarters especially, would approach me with a new
20 idea, I'd say, I don't want anything to do with that.

21 And what George had to say, said to me, this
22 is exciting and we can really do it, we've got the

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1 tools, and if we can get the money to put together a
2 space weather research program, this is going to be
3 exciting, it can be like earth weather, you know, we
4 can put a bunch of space weather buoys out there in
5 space and get really good predictions and do something
6 useful for society.

7 And so I dropped my research and said, okay,
8 here I go again, back into management. And I worked
9 with George and Dick Fisher and Bill Wagner and
10 several other people to put together what would a
11 space weather research program look like, what
12 satellites do we need, what research do we know, you
13 know, what kind of things we know, what do we need to
14 know to be able to do something that's fun research
15 for scientists and practical for society.

16 Q And this was part of the "Living With A
17 Star" program?

18 A Exactly. It developed and Bill Wagner was
19 the one who came up with the "Living With A Star"
20 idea. That's what we were going to call it, "Living
21 With A Star." And everybody said great idea, we're
22 going with -- that's the title, that's what we're

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1 going to call space weather, we're going to call it

2 "Living With A Star."

3 Q In one of our recent interviews, we were
4 laughing about the idea of how we could also have said
5 "living in a star" because we live within the
6 atmosphere of the sun.

7 A Right.

8 Q Which is --

9 A Right.

10 Q -- pretty interesting.

11 A Yep. Yep.

12 But anyway, so I went and started working
13 down at NASA headquarters part of the time to help
14 develop this program.

15 And I was in the chief scientist's office,
16 which was actually pretty exciting because my idea or
17 position there was to help put the sales package
18 together to make this something that upper management
19 and Congress would want to say, yeah, we should do
20 that and also to try to get the earth science people
21 involved to try to make it a really, what the military
22 calls, "a sun to mud" approach where something happens

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1 on the sun, we study it, we understand it, and it has
2 an impact on the soldier on the ground.

3 And actually space weather does do that
4 because it affects communication and it affects GPS
5 and affects how the -- those guided missiles that they
6 send down somebody's front door, how well are they
7 going to work, that is affected by space weather.

8 So we became involved with the military, we
9 became involved with NOAA. It became a multi-agency
10 effort. FAA got involved because it's -- in the long-
11 run it was going to affect how airplanes land.

12 I remember one day landing in -- at Paris
13 Charles de Gaulle Airport and the fog was so thick you
14 couldn't see the end of the wings, but yet, they were
15 landing -- landing this plane at the airport. And if
16 the GPS wasn't working right, it wasn't going to work
17 too good.

18 And space weather's going to affect that.
19 So here I was thinking, here I'm working on this stuff
20 that's going to impact what we're going to do.

21 So that's how I became involved in the space
22 weather. And one of the questions that's of interest

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1 to everybody is, what are the key events and turning
2 points in space weather research.

3 And I'd have to say there are two big key
4 turning points. The first one was SOHO, when we were
5 able to get really cool movies and put them on the 6
6 o'clock news. All of a sudden, the public was aware
7 of this stuff.

8 And I have to give the NASA public affairs
9 office here at Goddard a lot of credit for that. They
10 helped us put together movies that would sell to the
11 news media. I mean, without that, we're not going to
12 go anywhere.

13 I remember as a scientist trying to get to
14 the news people and say, hey, we got these really
15 slick movies, and they wouldn't even call back, you
16 know.

17 And after the public affairs office here
18 started working with them and started sending them
19 movies, as project scientist, I was getting telephone
20 calls from the news media, what do you got that's
21 interesting, you know. So that was a big turning
22 point because all of a sudden we were of interest to

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1 the public.

2 The next big turning point was George
3 Withrow and the group at headquarters saying, we need
4 a special new program within NASA that is space
5 weather, and that that is something that we can get
6 major funding for. And we got like a billion dollars
7 over ten years. And with something like that, you can
8 put together a good set of satellites, you can put
9 together a good research program, and make real
10 progress.

11 And what's exciting for me now is we did
12 this all ten years ago, ten, 12 years ago. And I'm
13 looking at it now and I'm saying, it worked, we have a
14 great set of satellites up, and we're doing good
15 research, really good research, and NOAA is actually
16 taking our information and using it in a practical way
17 for commercial space weather predictions.

18 Q It's interesting to listen to at what points
19 the public became engaged in heliophysics and space
20 weather and all of these thoughts. Because as a
21 teacher, even 15 years ago, we taught a little bit
22 about the sun, we had some information about it, but

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1 the students weren't as interested in all the
2 mechanics and what's happening with what we call
3 "space weather" now until just in the recent years.

4 So all of that, I hadn't realized really
5 took off really since in this millennium.

6 A Yeah. Yeah, and there's a real key to that
7 in my mind. And, you know, being a teacher now, if
8 you just put a bunch of words in front of people, it's
9 in one side and out the other.

10 If you've got a picture, okay, you can grab
11 their attention. If you've got a movie that has flash
12 boom on it, you've got it, they're really excited by
13 that.

14 Q We also found out if you tell students their
15 cell phone communication could be --

16 A Oh, yeah.

17 Q -- hampered.

18 A Well, I had an interesting -- I used to go
19 to high schools and talk a lot, and I always tried to
20 make sure that every kid in the class had some
21 interaction with me. And there was one kid that he
22 was looking out the window the whole time.

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1 And I mentioned about the GPS affect. And
2 all of a sudden, the kid lights up, he raises his
3 hand, and he says, you just said GPS, is that like
4 what my dad's got on his boat. All of a sudden, the
5 kid was interested again. And that's because it had
6 an impact on him personally.

7 Q From the sun to the mud. Right?

8 A Yep. Yep.

9 (Whereupon, the interview of ART
10 POLAND was concluded.)

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1 CERTIFICATE OF TRANSCRIBER

2

3 I, JANET M. RICE, a Transcriber, do hereby
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9 to 19 both inclusive, constitutes a true, and accurate
10 record of the proceedings had upon the hearing of said
11 cause, and of the whole thereof.

12 WITNESS my hand as Transcriber this 26th day
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JANET M. RICE
Transcriber

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