

Capital Reporting Company
Interview of Ernie Hildner

1

INTERVIEW
OF
ERNIE HILDNER

Capital Reporting Company
Interview of Ernie Hildner

2

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

2 MR. HILDNER: Ernie Hildner.

3 MR. CLINE: Hi, Ernie. How you doing? It's
4 Troy Cline.

5 MR. HILDNER: Hi, Troy. Your caller I.D.
6 came up very oddly.

7 MR. CLINE: I thought it would since we're
8 using my -- our audio engineer's Skype number. I want
9 to make sure -- I thought you'd get a strange number.
10 So when I call Joan later on, I might have to forewarn
11 her that it's a different number calling.

12 MR. HILDNER: Okay.

13 MR. CLINE: So how you doing?

14 MR. HILDNER: I'm doing all right. Thank
15 you. And you?

16 MR. CLINE: I'm doing pretty well. I think
17 we have everything set up on this end to just be
18 recording as we talk. And we actually have it set up
19 so that my voice will be recording on a separate
20 channel than yours, believe it or not. And that way
21 if I'm talking with you, we can either keep me in or
22 he can easily edit me out without much trouble. So it

Capital Reporting Company
Interview of Ernie Hildner

3

1 should make it pretty cool. And you're --

2 MR. HILDNER: Okay.

3 MR. CLINE: -- you're coming through loud
4 and clear.

5 MR. HILDNER: Sounds like plausible
6 deniability to me. Okay.

7 MR. CLINE: It certainly works. Well, do
8 you want to just go ahead and get started and we'll
9 just open up a conversation about the first question.

10 MR. HILDNER: Okay.

11 MR. CLINE: And when I say the question,
12 it's always good, again, just to kind of repeat the
13 question as you answer. That way, if we do cut me
14 out, then it won't be a problem and everyone knows
15 what you're talking about and why.

16 MR. HILDNER: Okay.

17 MR. CLINE: So do you have any questions
18 before we actually start the real interview?

19 MR. HILDNER: I don't think so. And given
20 that everything can be edited if they come up during
21 the process, why we'll just deal with them then I
22 guess.

Capital Reporting Company
Interview of Ernie Hildner

4

1 MR. CLINE: Okay. Yeah, that's no problem.

2 And you can hear me okay. Right?

3 MR. HILDNER: Yes.

4 MR. CLINE: All right. Awesome.

5 Well, thanks again for agreeing to do this.

6 This should eventually, once we have the tool put

7 together and a web site put together, it should put --

8 have quite an impact or they're anticipating just

9 thousands of people being able to listen to this and -

10 - and go through the tool on line and either listen to

11 the full podcast or just pieces and parts of all the

12 different podcasts.

13 MR. HILDNER: Uh-huh.

14 MR. CLINE: So it'd be really nice to have a

15 big mix. Well, let's --

16 MR. HILDNER: (Inaudible.)

17 MR. CLINE: -- go ahead and get started.

18 MR. HILDNER: Do it.

19 MR. CLINE: Again, thank you so much, Ernie,

20 for your time. We really appreciate it. And we

21 wanted to ask you a few questions. And by all means,

22 feel free to expand on anything you'd like, and we'll

Capital Reporting Company
Interview of Ernie Hildner

5

1 just go with it.

2 And if there's something else that catches -
3 - catches my ear, I might ask a few separate questions
4 or we'll just -- we'll keep talking. I'll try to keep
5 quiet as much as possible because we're here to hear
6 what you have to say.

7 EXAMINATION

8 BY MR. CLINE:

9 Q But our first question is, basically what --
10 what is your primary research interest and what you're
11 doing now, for instance; and also, what is it that you
12 like so much about it.

13 A Well, what I like about my research was the
14 fact that it was -- let me start over.

15 Q Yeah. You know, that's no problem. And
16 just make sure -- we'll try to keep my -- I'll try to
17 keep my energy up, make sure yours is up and all the
18 passion you talked a little bit about yesterday, and I
19 think we'll be good.

20 A Okay.

21 Q All right.

22 A Truly my primary research interest -- and

Capital Reporting Company
Interview of Ernie Hildner

6

1 it's in the past tense because I'm now retired -- my
2 primary research interest was in the solar corona and
3 then moving out in the interplanetary medium and then
4 the consequences here at earth.

5 And my initial research for my Ph.D was in
6 how quiescent prominences form, and then I got into
7 the Skylab world. So became quite fascinated with
8 coronal mass ejections.

9 And one of the fascinating things about that
10 was that it -- nobody had ever seen the corona like
11 that before. Eclipses were so rare. And artificial
12 eclipses from the earth's surface were so bothered by
13 sky brightness that when we made artificial eclipses
14 from space with a black sky, we suddenly -- and had
15 routine monitoring of the sun -- we saw phenomena some
16 people had imagined and speculated and hypothesized
17 about but they could not prove.

18 And we were the first to -- our experiment
19 team was the first to actually see and verify and
20 discover things that nobody had thought of in a
21 corona. And that was a whole lot of fun.

22 Q Now, what year, about what time frame was

Capital Reporting Company
Interview of Ernie Hildner

7

1 that happening and how did you -- were you able to
2 pull off such an accomplishment like that and actually
3 watch an eclipse from space?

4 A Well, you build a telescope and you put a --
5 the way we did it, you build a telescope and you put a
6 disk in the front that blocks out where the sun would
7 be and you very carefully center the telescope on the
8 sun, you have to dump the sun's heat, but then you
9 look at the faint atmosphere around the sun called the
10 "corona."

11 And what we saw were these ejections from
12 the sun that simply had not been seen before. There
13 were some ground-based measurements taking scans
14 around the sun of brightness that saw depletions, but
15 they didn't know whether that material had fallen back
16 into the sun or whether it had actually been blown out
17 into interplanetary space.

18 And, of course, when the earth is in the
19 line of fire of one of these explosions coming out
20 from -- these blobs of material coming out from the
21 sun, then that's when we have the space weather
22 effects here on earth.

Capital Reporting Company
Interview of Ernie Hildner

8

1 And so it was brand new stuff and it was
2 very exciting to be part of the Skylab team because
3 another set of instruments on board were the X-ray
4 telescopes. And -- because you cannot -- because the
5 earth's atmosphere absorbs X-rays, you can't see
6 astronomical objects in X-rays from the ground. You
7 have to go to space.

8 And we saw coronal holes for the first time
9 and M-regions that -- so named because there were
10 recurring geomagnetic -- magnetic storms were
11 understood to exist on the sun but nobody knew what
12 they were until Skylab saw the coronal holes.

13 That wasn't our instrument. But since we
14 were sitting at tables next to each other and since we
15 operated as a unit, then it was also extremely
16 exciting to see this brand new phenomenon that
17 explained something that people had puzzled about for
18 40 years.

19 Q And would you mind explaining for some of
20 our listeners exactly what a coronal hole is and based
21 on, I suppose, the research and discoveries that your
22 team had.

Capital Reporting Company
Interview of Ernie Hildner

9

1 A Well, a coronal hole got named that because
2 when you look at the sun in X-rays, where there is
3 more material, the sun is brighter.

4 And the very first images that came back
5 from the sun showed that there were regions that were
6 dark. It looked like you were looking down into a
7 hole. Instead of the fluffy solar corona visible in
8 X-rays elsewhere, you were just looking right down to
9 the surface of the sun which is so cold that it
10 doesn't emit X-rays.

11 So it turns out that these are regions sort
12 of like the part in your hair where the magnetic field
13 lines that come up and permeate the atmosphere of the
14 sun start to go, say, to the left on one side and to
15 the right on the other side and down the middle they
16 are straight up or they are not coming back and lying
17 back down onto the sun the way the hairs do on your
18 head either side of the part in your hair.

19 The result is that the hot solar atmosphere
20 finds it very easy to escape in that region. It's not
21 downed by those closed magnetic fields, those loops of
22 magnetic fields, but rather can come straight out. It

Capital Reporting Company
Interview of Ernie Hildner

10

1 spends no time near -- or very little time near the
2 surface of the sun and so the density of the material
3 there is much lower.

4 And that's why it's dark and that's why we
5 call them "coronal holes" but it's almost like fire
6 hoses in that -- those regions, fire hoses of material
7 streaming outward from the sun very rapidly.

8 Q So that makes sense with, often I've heard
9 of auroral activity or activity around the earth even
10 when there's a large coronal hole in our direction.

11 A That's -- well, a few days later, yes. The
12 sun rotates every 28 days. Think of a fire hose
13 coming out from the sun and it sweeps by under the sub
14 earth point and then two or three days later the
15 material that the fire hose nozzle was squirting
16 finally arrives at the earth.

17 So it's making spirals around the -- in the
18 interplanetary medium but eventually that material
19 comes out and hits earth and causes geomagnetic
20 disturbances and aurorean and all the other phenomena
21 that space weather cause.

22 Q Now, one of our questions that we had also

Capital Reporting Company Interview of Ernie Hildner

11

1 was -- and you already are explaining some of this due
2 to the understanding in finding coronal holes from a
3 space point of view, with what and where were you
4 involved in other aspects of space weather research
5 including what you've just been describing.

6 A Well, I was -- yeah, Skylab was exciting
7 times. I was an experiment scientist on the
8 coronagraph. But as I say, with the five instruments,
9 the five telescopes that we had, worked together.

10 And we had cooperative observing plans so
11 that we operated the telescopes jointly toward -- to
12 try to answer specific solar questions.

13 And then I moved on to become the chief of
14 the solar science -- Solar Physics branch at Marshall
15 Space Flight Center for five years. And then I came
16 to Boulder and became the director of what was then
17 the Space Environment Center where NOAA was doing
18 operational space weather forecasting.

19 So my personal involvement was -- in
20 research was pretty much with the Skylab era and then
21 trying to understand solar magnetic fields better
22 when I went down to Marshall, they had a solar

Capital Reporting Company
Interview of Ernie Hildner

12

1 magnetograph. And then being the director of a
2 research outfit at NOAA trying to improve the space
3 weather forecasts.

4 Q Do you have the sense that the work that you
5 and the team did with Skylab actually ignited some of
6 the excitement, if not a lot of it, for the public,
7 the government, NASA to learn more about space
8 weather?

9 A There's no question about that. The Skylab
10 was transformational in quite a number of ways. In
11 1968, NOAA had started to make daily predictions of
12 flare probabilities and geomagnetic storm
13 probabilities. But those were pretty crude.

14 And the Skylab project was so well-funded
15 that NOAA got enough money to set up a worldwide
16 observatory network to keep the sun under continuous
17 observance in visible light and bring those results
18 back to one location, actually two locations, one in
19 Boulder at the home location and one down in Houston
20 during Skylab to help with the operations of Skylab.

21 We changed the observing program. This was
22 novel. This was transformational. Every day with a

Capital Reporting Company
Interview of Ernie Hildner

13

1 teletype message based on what was the sun was doing.

2 And there was a huge wrangle over that
3 because NASA had been involved in shorter missions
4 before. And every minute of the astronaut's time,
5 what they would be doing during a day was, in fact,
6 scripted before the rocket ever left the ground.

7 And this was very new and uncomfortable to
8 the flight controllers that they would allow a bunch
9 of long-haired crazy sandal-wearing hippie scientists
10 -- the astronauts what they'd be doing tomorrow on a
11 day-by-day basis. And that was just a cultural shift
12 for NASA.

13 But the result was that, one, we had a
14 worldwide network of observatories; two, we had brand
15 new never before available observations of the sun and
16 we had those data coming down in real time. And the
17 understandings that developed after Skylab shut down
18 were, as I say, transformational in many ways to the
19 understanding of space weather.

20 The other thing that Skylab -- although they
21 were aware a little bit of the radiation hazard of
22 sending astronauts to the moon and back, those are

Capital Reporting Company
Interview of Ernie Hildner

14

1 still pretty short trips. Putting guys up for three
2 months at a time, you got to worry about solar flares
3 and the energetic particles.

4 And so suddenly, there's a whole radiation
5 health component that NASA got interested in doing
6 research and trying to understand the space weather
7 aspects of that.

8 And now, of course, that's hugely important
9 if we're ever going to go to Mars because that's such
10 a long mission.

11 Q Well, that's right. And I -- my
12 understanding is that for low earth orbit types of
13 things where we might have humans in space in low
14 earth orbit, they're still vulnerable, of course, to
15 radiation and storms but not nearly as vulnerable as
16 they would be if they were further away from the earth
17 or outside of the magnetic field.

18 A That's absolutely correct. The earth's
19 magnetic field provides a principal shield. And then
20 for those of us poor mortals that have to stay on the
21 ground, the atmosphere density helps a lot. But,
22 yeah, once you get outside the earth's magnetic field,

Capital Reporting Company
Interview of Ernie Hildner

15

1 you are much more at risk from radiation hazards.

2 Q Now, I believe that you have actually --
3 some of these events that you've been talking about
4 and discoveries were actual turning points in space
5 weather history.

6 And our third question actually says, you
7 know, what are some of the key events or turning
8 points in your space weather research and you've
9 actually been answering that already.

10 A Well, good.

11 Q Do you have any other type -- anything else
12 that you would like to add that you would like for our
13 listeners to hear?

14 A Well, some key events and turning points,
15 the going back even farther to my mind space weather -
16 - interest in space weather, although it wasn't called
17 -- actually started in World War II when it was
18 noticed that high frequency radio transmissions were
19 interrupted and affected by --

20 Q Hey, Ernie.

21 A -- solar --

22 Q Could I interrupt for just a second? There

Capital Reporting Company
Interview of Ernie Hildner

16

1 was a small moment there -- you're fine now -- but
2 there was just a moment where your voice bleeped out.

3 So right when you said there -- I guess that
4 the key term wasn't space weather or space weather
5 term wasn't used, it was right before that, but you
6 bleeped out.

7 But you're back now. So you might want to
8 start at the beginning of that, if you wouldn't mind.

9 A Okay. The first key turning point in space
10 weather to my mind -- although, the phenomena weren't
11 called "space weather" at that time -- it was during
12 World War II when the high frequency HF radio
13 communications were -- seemed to be disrupted and
14 connected with the phenomena on the sun. The
15 mechanisms weren't clear but the correlation was very
16 clear.

17 And so the -- each military force had its
18 own little research unit which was forced then -- into
19 a propagation laboratory part then of the National
20 Bureau of Standards when it moved to Boulder,
21 Colorado.

22 But ever since then, the government has had

Capital Reporting Company
Interview of Ernie Hildner

17

1 a -- well, before NASA was formed a research component
2 in looking into space weather.

3 As near as I can remember, space weather
4 wasn't -- there are several references using that term
5 in the literature earlier, but it never caught on
6 until George Siscoe, then a meteorology -- professor
7 in the Meteorology Department at the University of
8 California, Los Angeles, started using the term in his
9 public talks and papers.

10 And then that got people realizing that it
11 wasn't just a research effort like an astronomical or
12 astrophysical research but actually it had application
13 like meteorological research has application to what
14 people actually feel and are influenced by.

15 So that was the first. And then as I said,
16 Skylab came along and really galvanized everything,
17 both with money and with understanding. I was trying
18 to remember when NASA started up the Living With The
19 Star program, but that name is absolute genius.
20 Anybody who hears it, says, what does that mean? And
21 living with our star, you've got to adapt to its angry
22 moments. And that's different and that got people

Capital Reporting Company
Interview of Ernie Hildner

18

1 thinking about the consequences of space weather.

2 Another huge turning point was when NASA
3 launched the WIND spacecraft, so we actually could see
4 and get data about coronal mass ejections headed
5 toward earth. As I think I said earlier, it's rare
6 that earth is in the line of fire of a coronal mass
7 ejection. Usually they go off into some other part of
8 the interplanetary medium, but -- so you don't know,
9 in fact, when you see a coronal mass ejection whether
10 or not it's going to hit earth.

11 So having a sensor upstream one hour then
12 enables you to say -- to switch from a alert to a real
13 warning that it's about to hit, take action if it will
14 help. And so WIND, still up there, still operating,
15 has been a wonderful turning point.

16 I think another turning point from my mind -
17 - and you are, of course, getting the perspective of a
18 guy who's been in operations, who's very interested in
19 how space weather improves so it helps customers as
20 well as how it improves intellectually in terms of the
21 research and understanding -- but another huge --
22 along those lines, another huge jump forward was I

Capital Reporting Company
Interview of Ernie Hildner

19

1 think the Wang-Sheeley-Arge model that actually was
2 the first to try to use the observed characteristics
3 of a CME near the sun and predict how strong the
4 effect would be at earth.

5 Now, it's been superseded by the Enlil model
6 that Dusan Odstrcil and his colleagues have developed,
7 which is an even better three-dimensional model with
8 MHD. But that -- both of those, the one following on
9 the other by 15 years, was -- were just wonderful.

10 And the stereo spacecraft have done a
11 wonderful job of getting different views of what's
12 going on at the sun. And when they got around to 90
13 degrees from the sun earth line, then they could
14 actually see the coronal mass ejections that were
15 about to hit earth.

16 And otherwise, we had had to inhere from
17 observations near the earth sun line which ones were
18 going to hit earth. But they got very good
19 observations of what was going to happen.

20 Q Now, with --

21 A Well --

22 Q -- the stereo moving, it's continually

Capital Reporting Company
Interview of Ernie Hildner

20

1 moving around either side of the sun. Eventually,
2 we'll lose that field of view. Correct? And do we
3 have plans for how we're going to be able to see
4 what's coming around after that?

5 A It's my understanding that after the stereo
6 spacecraft go around the far side of the sun and start
7 to come back around towards the front side, that they
8 will be useful again.

9 Q That's great.

10 A But I --

11 Q Okay.

12 A -- an expert on what -- where that stands at
13 the moment either technologically or financially.

14 Q Well, it's interesting listening to the
15 different aspects and history -- historic parts of
16 space weather because you see the importance of
17 discoveries and how things were discovered, things
18 that weren't expected, and what an impact that made
19 immediately on people, on society.

20 It just really brings home the fact that we
21 need to continue this type of research in a major way,
22 especially with all the satellites and technology and

Capital Reporting Company
Interview of Ernie Hildner

21

1 -- and people talking about venturing further and
2 further into space.

3 A You're absolutely right that the more we
4 learn about space weather and -- the better becomes
5 our ability to predict it and its consequences.

6 And as the world becomes more
7 technologically dependent upon things like GPS and the
8 electric power grid that are affected by space
9 weather, then it's certainly not a solved problem by
10 any stretch of the imagination. If, at anything, it
11 should have growing emphasis as we go forward.

12 Q That actually sounds perfect. I'm -- it's
13 funny, I'm looking at the clock, we've already been
14 doing this for 25 minutes and it's all really good. I
15 think there's going to be just minor editing so far.

16 There's quite a bit of interesting
17 information from Skylab all -- in past, that was
18 pretty interesting. I love the information you talked
19 about with the wind spacecraft. I don't think I've
20 heard anybody talking about that one yet in some of
21 these interviews.

22 A If you are -- this is off the record.

Capital Reporting Company
Interview of Ernie Hildner

22

1 Q Uh-huh.

2 A If you are a fair researcher, the WIND space
3 craft is irrelevant.

4 Q I'm so glad that you brought it up because
5 it brings even more about the space weather fleet, if
6 you will, that's out trying to understand what's going
7 on and be better -- being better at predictability and
8 predicting space weather events. Wow, how exciting is
9 that.

10 Are there any other areas before -- I think
11 we have quite a bit of really good information here,
12 and I'm wondering if there are other pieces of
13 information you'd like to share, we can certainly talk
14 about that and then edit that in as we need to.

15 A Well, there is the whole -- I was preparing
16 mentally and then I went back and looked at your
17 questions. And I see that they are research,
18 research, research.

19 Q Yeah.

20 A But there's a whole other side and that is
21 the administrative side. I already mentioned -- okay,
22 let me -- let me back up so that you don't have to

Capital Reporting Company
Interview of Ernie Hildner

23

1 edit this.

2 In addition to the research side of space
3 weather, there's a whole organization and --
4 organizational and administrative component to
5 advancing space weather research and operations. And
6 that has gradually grown in many ways. And there are
7 some big turning points there, some milestones. It is
8 -- you first have a voice crying in the wilderness,
9 this is important, listen to me.

10 And then over time that messiah attracts
11 followers and they start to spread the message and
12 eventually there is enough realization that people are
13 willing to organize themselves into cooperative
14 ventures and to seek funding for increased activity in
15 this area.

16 And again, Skylab was transformational in
17 that it showed the need and the value. And suddenly
18 within a decade after Skylab, huge understanding of
19 what was going on so that space weather products for
20 affected users were much more useful. And that, of
21 course, fed back so that there were more people doing
22 that, interested in space weather.

Capital Reporting Company
Interview of Ernie Hildner

24

1 And then in 1994 there was a meeting held
2 with the -- with Bob Corell, then director of
3 geosciences at NSF, and George Siscoe pitched a -- the
4 idea that there should be a national space weather
5 program -- a National Space Weather Service, in fact,
6 is what it was called in an article by Siscoe -- Latko
7 -- George Latko, Lou Lanzerotti, Ernie Hildner, and
8 Rich Behnke in EOS in 1994.

9 And that actually led to the National Space
10 Weather Program, seven agencies in the United States
11 government organized under the Office of the Federal
12 Coordinator for Meteorology. Because there was no
13 other place to put it, so space weather, let's put it
14 under meteorology.

15 And that office's purpose within NOAA is to
16 coordinate what all the agencies do in particular
17 areas like hurricane research or drought research.
18 And so we got space weather under that umbrella in
19 1994.

20 And then in 1999 NOAA started holding what
21 today is called "Space Weather Week," which brought
22 together the researchers, the operators that used the

Capital Reporting Company
Interview of Ernie Hildner

25

1 forecasts and the information, and the service
2 providers, the forecasters. And about 250 people
3 showed up. And it has grown almost every year since
4 then.

5 And over 350 people showed up at the most
6 recent one in 2013, but it has been a continuing
7 vibrant forum for the users to say what they need, the
8 researchers to say, well, we could provide something
9 like this if there's any demand for it, and the
10 forecasters listening to both sides and saying, okay,
11 we can make a product that has validity and that is
12 useful and we will modify or add what we do to take
13 advantage of the new knowledge and serving people with
14 new needs.

15 So then another huge milestone was the
16 establishment -- and I'm trying to remember when that
17 was -- in the early 2000s of the CCMC, the community
18 modeling center -- Cooperative Community Modeling
19 Center, which is at Goddard Space Flight Center.

20 And there, people can submit their models
21 for testing. And if they survive the testing, then
22 users can run those models in real time to see what

Capital Reporting Company
Interview of Ernie Hildner

26

1 their predictions of space weather are and how -- if
2 they relate well to reality, then they can use those
3 in what they do.

4 It is intended -- it was originally intended
5 to be a validation effort so that these could go into
6 -- these models, this new understanding, could go into
7 daily operations.

8 Finally, I would say that a major turning
9 point in the acceptance, if you will, of space weather
10 is the fact that the space environment center joined -
11 - fully joined and became a part of -- a full part of
12 the National Weather Service, the nation's
13 meteorological service, in 2005 which made the
14 American Meteorological Society, not just the American
15 geophysical union, be interested in space weather.

16 And at the national meeting of -- annual
17 meeting of the American Meteorological Society there
18 always is -- there has now started to be since then a
19 major component of space weather.

20 And so the meteorologists, both the
21 broadcast meteorologists on TV, the meteorology
22 departments at universities, the -- and other folks

Capital Reporting Company
Interview of Ernie Hildner

27

1 who would not have been exposed to space weather
2 particularly, now at their own societies national
3 convention see the emphasis that is given to space
4 weather.

5 So there's been a whole governmental and
6 public acceptance of space weather that has gone on at
7 the same time as the research side, driven largely by
8 NASA and NSF, have developed a better understanding of
9 space weather.

10 Q So it's interesting to hear all of that
11 because, in many ways, it sounds like we are still at
12 the forefront of actually creating space weather
13 history.

14 A Well, I'm retired, but I do keep the little
15 finger of my left hand involved, yes.

16 Q You know something, we didn't do at the
17 beginning that we need for the audio engineer and also
18 we might be able to edit it in, is basically just for
19 you to state your name and what you do.

20 Usually, I open it up with that and we
21 forgot to do that. So would you mind doing that for
22 just a second?

Capital Reporting Company
Interview of Ernie Hildner

28

1 A I noticed that you didn't and wondered, but
2 okay.

3 Q That's what I forgot.

4 A I'm Ernest Hildner. I'm retired. I was for
5 19 years the director of the space weather component
6 of the National Oceanic and Atmospheric
7 Administration. It had several name changes, Space
8 Environment Laboratory to more recently Space Weather
9 Prediction Center.

10 In that capacity, I was overseeing the
11 research that NASA -- that NOAA did on space weather
12 and the daily forecasts and the real time alerts when
13 something happened that were produced by the center.

14 In addition, I assisted with defining the
15 instruments that would fly on NOAA's geostationary and
16 polar orbiting spacecraft, principally flown for
17 meteorological and climatological purposes.

18 And I worked very closely with an NSF and
19 with the NASA's Office of Solar and Heliospheric
20 Physics to optimize what we could do and how we could
21 best utilize research observations and understandings
22 for operations.

Capital Reporting Company
Interview of Ernie Hildner

29

1 And the WIND spacecraft is a wonderful
2 example of that where they worked with Dick Fisher so
3 that we could -- NOAA could get antennas around the
4 world to track wind in real time and a very low bit
5 rate channel was added to WIND so that it could send
6 down real time information to these spacecraft;
7 whereas, the high rate science information came down
8 to NASA antenna -- antennas at a few space places
9 around the world and eventually on subsequent
10 spacecraft.

11 We worked with NASA so that a subset of the
12 science data, when it came down to the NASA tracking
13 stations, would immediately flow into the NOAA system
14 and be available to the forecasters.

15 So the connection between NASA, NSF, and
16 NOAA was very tight and I think mutually beneficial so
17 that the research had benefits, taxpayers -- tangible
18 financial benefit to the taxpayers and the university
19 research funded by NSF had pay-offs.

20 Q Well, that sounds perfect. That -- I'm so
21 glad we did that. I was like -- the audio guy here is
22 like, oh, you need to ask him a little about himself

Capital Reporting Company
Interview of Ernie Hildner

30

1 to begin with, I'm like, yeah.

2 So thank you so much. We'll probably edit
3 that and put it up towards the beginning.

4 A The other thing I forgot to do is to say
5 "hi" to Barbara Thompson. If she's going to edit
6 this, please put -- Barbara in there.

7 Q Oh, we will. We'll make sure she gets that.
8 She'll -- she'll be able to hear part of this and
9 Carolyn Ng will go through -- and actually the entire
10 interview will be transcribed first -- and then
11 Carolyn and Barbara go through and start reading and
12 listening and editing. And then we send it to the
13 audio person who turns it into the final podcast.

14 And I've actually already created the intro
15 and exit bumpers for each of these podcasts. And the
16 first one should be going live relatively soon on the
17 Sun-Earth Day web site.

18 And then once the Space Weather Living
19 History tool is created on line, then bits and pieces
20 parts will be added as is -- as is appropriate to the
21 sections of that tool. So you'll -- you should be
22 hearing yourself quite often.

Capital Reporting Company
Interview of Ernie Hildner

31

1 A Okay. -- people are you interviewing?

2 Q We have upwards of, oh, gosh, I've already
3 interviewed probably ten to 12 different people. And
4 then we, I think, have about 20 at least on the list.

5 And then bits and pieces and parts of those
6 are used for various aspects of the tool. But all of
7 the interviews this year will appear, in some part, on
8 the Sun-Earth Day web site.

9 So I can send you -- unless you already have
10 the Sun-Earth Day link, we can send you that as these
11 interviews are ready and you can just download, listen
12 to them. And they'll be podcast so you can listen to
13 them on -- from iTunes as well.

14 A Well, one never sounds as smart when one
15 listens to one self as when one was talking.

16 Q Oh, you might be amazed. Well, we'll do
17 some pretty interesting audio sound engineering to
18 some of this. And, yeah, they come off sounding just
19 incredibly great. We've been surprised at how well
20 the Skype interviews actually do. They end up
21 sounding pretty strong.

22 A Are you planning to interview George Siscoe?

Capital Reporting Company
Interview of Ernie Hildner

32

1 Q I can find out. I know that -- I don't have
2 -- it would shock me if we aren't, but I could
3 certainly find out from Carolyn.

4 A Okay. Well, he and Lou Lanzerotti would --
5 are legendary and both as contributors and as being
6 there at the beginning.

7 Q Yeah, I just wrote their names down and
8 Carolyn will hear this, so I'm sure they have to be on
9 the list. They -- I would be shocked if they weren't.
10 But if not, they will be now.

11 A I hope so. I hope.

12 Q Oh, yeah, absolutely.

13 A Okay. It's been good ranting, venting.

14 Q It's far from that. It's just been a great
15 interview. Thank you so much.

16 A Well, you're very kind to say so. And it's
17 a pleasure to run my mind back over my professional
18 history.

19 Q Yeah, isn't it. You're -- it's always
20 shocking how much you've actually done when you're
21 asked to sit down and go over it.

22 A Well, it is fun, yes.

Capital Reporting Company
Interview of Ernie Hildner

33

1 Q Okay. Well, thanks again. And we will
2 certainly be in touch with you soon as they're ready
3 to do some of the editing of the transcripts so that
4 you can take a look at that.

5 A -- forward to that.

6 Q All right. Thanks so much, Ernie. Really
7 appreciate your time.

8 A Okay. Thanks, Troy.

9 Q Uh-huh. Bye.

10 (Whereupon, the interview of ERNIE
11 HILDNER, was concluded.)

12

13

14

15

16

17

18

19

20

21

22

Capital Reporting Company
Interview of Ernie Hildner

1 CERTIFICATE OF TRANSCRIBER

2

3 I, JANET M. RICE, a Transcriber, do hereby
4 certify that I transcribed the audio tapes(s) of the
5 proceedings had upon the hearing of this case,
6 previously captioned herein, that I thereafter had
7 reduced by typewriting the foregoing transcript; and
8 that the foregoing transcript, consisting of Pages 1
9 to 34 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
13 of August, 2013.

14

15

16

17

18 _____
JANET M. RICE
19 Transcriber

20

21

22

23

Capital Reporting Company
Interview of Ernie Hildner
Page 1

<hr/> <p style="text-align: center;">1</p> <hr/> <p>1 34:8 12 31:3 15 19:9 19 28:5 1968 12:11 1994 24:1,8,19 1999 24:20</p> <hr/> <p style="text-align: center;">2</p> <hr/> <p>20 31:4 2000s 25:17 2005 26:13 2013 25:6 34:13 25 21:14 250 25:2 26th 34:12 28 10:12</p> <hr/> <p style="text-align: center;">3</p> <hr/> <p>34 34:9 350 25:5</p> <hr/> <p style="text-align: center;">4</p> <hr/> <p>40 8:18</p> <hr/> <p style="text-align: center;">9</p> <hr/> <p>90 19:12</p> <hr/> <p style="text-align: center;">A</p> <hr/> <p>ability 21:5 able 4:9 7:1 20:3 27:18 30:8 absolute 17:19 absolutely 14:18 21:3 32:12</p>	<p>absorbs 8:5 acceptance 26:9 27:6 accomplishment 7:2 accurate 34:9 action 18:13 activity 10:9 23:14 actual 15:4 actually 2:18 3:18 6:19 7:2,16 12:5,18 15:2,6,9,17 17:12,14 18:3 19:1,14 21:12 24:9 27:12 30:9,14 31:20 32:20 adapt 17:21 add 15:12 25:12 added 29:5 30:20 addition 23:2 28:14 Administration 28:7 administrative 22:21 23:4 advancing 23:5 advantage 25:13 affected 15:19 21:8 23:20 agencies 24:10,16 agreeing 4:5 ahead 3:8 4:17 alert 18:12 alerts 28:12 allow 13:8</p>	<p>already 11:1 15:9 21:13 22:21 30:14 31:2,9 amazed 31:16 American 26:14,17 Angeles 17:8 angry 17:21 annual 26:16 answer 3:13 11:12 answering 15:9 antenna 29:8 antennas 29:3,8 anticipating 4:8 anybody 17:20 21:20 anything 4:22 15:11 21:10 appear 31:7 application 17:12,13 appreciate 4:20 33:7 appropriate 30:20 area 23:15 areas 22:10 24:17 aren't 32:2 arrives 10:16 article 24:6 artificial 6:11,13 aspects 11:4 14:7 20:15 31:6 assisted 28:14 astronauts 13:10,22</p>	<p>astronaut's 13:4 astronomical 8:6 17:11 astrophysical 17:12 atmosphere 7:9 8:5 9:13,19 14:21 Atmospheric 28:6 attracts 23:10 audio 2:8 27:17 29:21 30:13 31:17 34:4 August 34:13 auroral 10:9 aurorean 10:20 available 13:15 29:14 aware 13:21 away 14:16 Awesome 4:4</p> <hr/> <p style="text-align: center;">B</p> <hr/> <p>Barbara 30:5,6,11 based 8:20 13:1 basically 5:9 27:18 basis 13:11 became 6:7 11:16 26:11 become 11:13 becomes 21:4,6 begin 30:1 beginning 16:8 27:17 30:3 32:6 Behnke 24:8 believe 2:20 15:2</p>
--	--	--	--

Capital Reporting Company
Interview of Ernie Hildner
Page 2

<p>beneficial 29:16 benefit 29:18 benefits 29:17 best 28:21 better 11:21 19:7 21:4 22:7 27:8 bit 5:18 13:21 21:16 22:11 29:4 bits 30:19 31:5 black 6:14 bleeped 16:2,6 blobs 7:20 blocks 7:6 blown 7:16 board 8:3 Bob 24:2 bothered 6:12 Boulder 11:16 12:19 16:20 branch 11:14 brand 8:1,16 13:14 brighter 9:3 brightness 6:13 7:14 bring 12:17 brings 20:20 22:5 broadcast 26:21 brought 22:4 24:21 build 7:4,5 bumpers 30:15 bunch 13:8 Bureau 16:20</p>	<p>Bye 33:9</p> <hr/> <p style="text-align: center;">C</p> <hr/> <p>California 17:8 caller 2:5 capacity 28:10 captioned 34:6 carefully 7:7 Carolyn 30:9,11 32:3,8 case 34:5 catches 5:2,3 caught 17:5 cause 10:21 34:11 causes 10:19 CCMC 25:17 center 7:7 11:15,17 25:18,19 26:10 28:9,13 certainly 3:7 21:9 22:13 32:3 33:2 CERTIFICATE 34:1 certify 34:4 changed 12:21 changes 28:7 channel 2:20 29:5 characteristics 19:2 chief 11:13 clear 3:4 16:15,16 climatological 28:17 Cline 2:3,4,7,13,16 3:3,7,11,17</p>	<p>4:1,4,14,17,19 5:8 clock 21:13 closed 9:21 closely 28:18 CME 19:3 cold 9:9 colleagues 19:6 Colorado 16:21 comes 10:19 coming 3:3 7:19,20 9:16 10:13 13:16 20:4 communications 16:13 community 25:17,18 component 14:5 17:1 23:4 26:19 28:5 concluded 33:11 connected 16:14 connection 29:15 consequences 6:4 18:1 21:5 consisting 34:8 constitutes 34:9 continually 19:22 continue 20:21 continuing 25:6 continuous 12:16 contributors 32:5 controllers 13:8 convention 27:3 conversation 3:9</p>	<p>cool 3:1 cooperative 11:10 23:13 25:18 coordinate 24:16 Coordinator 24:12 Corell 24:2 corona 6:2,10,21 7:10 9:7 coronagraph 11:8 coronal 6:8 8:8,12,20 9:1 10:5,10 11:2 18:4,6,9 19:14 correct 14:18 20:2 correlation 16:15 course 7:18 14:8,14 18:17 23:21 craft 22:3 crazy 13:9 created 30:14,19 creating 27:12 crude 12:13 crying 23:8 cultural 13:11 customers 18:19 cut 3:13</p> <hr/> <p style="text-align: center;">D</p> <hr/> <p>daily 12:11 26:7 28:12 dark 9:6 10:4 data 13:16 18:4 29:12 day 12:22 13:5 30:17 31:8,10</p>
--	---	--	---

Capital Reporting Company

Interview of Ernie Hildner

Page 3

<p>34:12</p> <p>day-by-day 13:11</p> <p>days 10:11,12,14</p> <p>deal 3:21</p> <p>decade 23:18</p> <p>defining 28:14</p> <p>degrees 19:13</p> <p>demand 25:9</p> <p>deniability 3:6</p> <p>density 10:2 14:21</p> <p>Department 17:7</p> <p>departments 26:22</p> <p>dependent 21:7</p> <p>depletions 7:14</p> <p>describing 11:5</p> <p>developed 13:17 19:6 27:8</p> <p>Dick 29:2</p> <p>different 2:11 4:12 17:22 19:11 20:15 31:3</p> <p>direction 10:10</p> <p>director 11:16 12:1 24:2 28:5</p> <p>discover 6:20</p> <p>discovered 20:17</p> <p>discoveries 8:21 15:4 20:17</p> <p>disk 7:6</p> <p>disrupted 16:13</p> <p>disturbances 10:20</p> <p>done 19:10 32:20</p> <p>downed 9:21</p>	<p>download 31:11</p> <p>driven 27:7</p> <p>drought 24:17</p> <p>due 11:1</p> <p>dump 7:8</p> <p>during 3:20 12:20 13:5 16:11</p> <p>Dusan 19:6</p> <hr/> <p style="text-align: center;">E</p> <hr/> <p>ear 5:3</p> <p>earlier 17:5 18:5</p> <p>early 25:17</p> <p>earth 6:4 7:18,22 10:9,14,16,19 14:12,14,16 18:5,6,10 19:4,13,15,17,18</p> <p>earth's 6:12 8:5 14:18,22</p> <p>easily 2:22</p> <p>easy 9:20</p> <p>eclipse 7:3</p> <p>eclipses 6:11,12,13</p> <p>edit 2:22 22:14 23:1 27:18 30:2,5</p> <p>edited 3:20</p> <p>editing 21:15 30:12 33:3</p> <p>effect 19:4</p> <p>effects 7:22</p> <p>effort 17:11 26:5</p> <p>either 2:21 4:10 9:18 20:1,13</p> <p>ejection 18:7,9</p>	<p>ejections 6:8 7:11 18:4 19:14</p> <p>electric 21:8</p> <p>else 5:2 15:11</p> <p>elsewhere 9:8</p> <p>emit 9:10</p> <p>emphasis 21:11 27:3</p> <p>enables 18:12</p> <p>energetic 14:3</p> <p>energy 5:17</p> <p>engineer 27:17</p> <p>engineering 31:17</p> <p>engineer's 2:8</p> <p>Enlil 19:5</p> <p>entire 30:9</p> <p>environment 11:17 26:10 28:8</p> <p>EOS 24:8</p> <p>era 11:20</p> <p>Ernest 28:4</p> <p>Ernie 1:9 2:2,3 4:19 15:20 24:7 33:6,10</p> <p>escape 9:20</p> <p>especially 20:22</p> <p>establishment 25:16</p> <p>events 15:3,7,14 22:8</p> <p>eventually 4:6 10:18 20:1 23:12 29:9</p> <p>everyone 3:14</p> <p>everything 2:17 3:20 17:16</p>	<p>exactly 8:20</p> <p>EXAMINATION 5:7</p> <p>example 29:2</p> <p>excitement 12:6</p> <p>exciting 8:2,16 11:6 22:8</p> <p>exist 8:11</p> <p>exit 30:15</p> <p>expand 4:22</p> <p>expected 20:18</p> <p>experiment 6:18 11:7</p> <p>expert 20:12</p> <p>explained 8:17</p> <p>explaining 8:19 11:1</p> <p>explosions 7:19</p> <p>exposed 27:1</p> <p>extremely 8:15</p> <hr/> <p style="text-align: center;">F</p> <hr/> <p>fact 5:14 13:5 18:9 20:20 24:5 26:10</p> <p>faint 7:9</p> <p>fair 22:2</p> <p>fallen 7:15</p> <p>farther 15:15</p> <p>fascinated 6:7</p> <p>fascinating 6:9</p> <p>fed 23:21</p> <p>Federal 24:11</p> <p>feel 4:22 17:14</p> <p>field 9:12 14:17,19,22 20:2</p>
---	--	---	---

Capital Reporting Company

Interview of Ernie Hildner

Page 4

<p>fields 9:21,22 11:21</p> <p>final 30:13</p> <p>finally 10:16 26:8</p> <p>financial 29:18</p> <p>financially 20:13</p> <p>finding 11:2</p> <p>finds 9:20</p> <p>fine 16:1</p> <p>finger 27:15</p> <p>fire 7:19 10:5,6,12,15 18:6</p> <p>first 3:9 5:9 6:18,19 8:8 9:4 16:9 17:15 19:2 23:8 30:10,16</p> <p>Fisher 29:2</p> <p>five 11:8,9,15</p> <p>flare 12:12</p> <p>flares 14:2</p> <p>fleet 22:5</p> <p>flight 11:15 13:8 25:19</p> <p>flow 29:13</p> <p>flown 28:16</p> <p>fluffy 9:7</p> <p>fly 28:15</p> <p>folks 26:22</p> <p>followers 23:11</p> <p>force 16:17</p> <p>forced 16:18</p> <p>forecasters 25:2,10 29:14</p> <p>forecasting 11:18</p>	<p>forecasts 12:3 25:1 28:12</p> <p>forefront 27:12</p> <p>foregoing 34:7,8</p> <p>forewarn 2:10</p> <p>forgot 27:21 28:3 30:4</p> <p>form 6:6</p> <p>formed 17:1</p> <p>forum 25:7</p> <p>forward 18:22 21:11 33:5</p> <p>frame 6:22</p> <p>free 4:22</p> <p>frequency 15:18 16:12</p> <p>front 7:6 20:7</p> <p>full 4:11 26:11</p> <p>fully 26:11</p> <p>fun 6:21 32:22</p> <p>funded 29:19</p> <p>funding 23:14</p> <p>funny 21:13</p> <hr/> <p style="text-align: center;">G</p> <hr/> <p>galvanized 17:16</p> <p>genius 17:19</p> <p>geomagnetic 8:10 10:19 12:12</p> <p>geophysical 26:15</p> <p>George 17:6 24:3,7 31:22</p> <p>geosciences 24:3</p> <p>geostationary 28:15</p>	<p>gets 30:7</p> <p>getting 18:17 19:11</p> <p>given 3:19 27:3</p> <p>glad 22:4 29:21</p> <p>Goddard 25:19</p> <p>gone 27:6</p> <p>gosh 31:2</p> <p>government 12:7 16:22 24:11</p> <p>governmental 27:5</p> <p>GPS 21:7</p> <p>gradually 23:6</p> <p>great 20:9 31:19 32:14</p> <p>grid 21:8</p> <p>ground 8:6 13:6 14:21</p> <p>ground-based 7:13</p> <p>growing 21:11</p> <p>grown 23:6 25:3</p> <p>guess 3:22 16:3</p> <p>guy 18:18 29:21</p> <p>guys 14:1</p> <hr/> <p style="text-align: center;">H</p> <hr/> <p>hair 9:12,18</p> <p>hairs 9:17</p> <p>hand 27:15 34:12</p> <p>happen 19:19</p> <p>happened 28:13</p> <p>having 18:11</p> <p>hazard 13:21</p>	<p>hazards 15:1</p> <p>head 9:18</p> <p>headed 18:4</p> <p>health 14:5</p> <p>hear 4:2 5:5 15:13 27:10 30:8 32:8</p> <p>heard 10:8 21:20</p> <p>hearing 30:22 34:5,10</p> <p>hears 17:20</p> <p>heat 7:8</p> <p>held 24:1</p> <p>Heliospheric 28:19</p> <p>help 12:20 18:14</p> <p>helps 14:21 18:19</p> <p>hereby 34:3</p> <p>herein 34:6</p> <p>Hey 15:20</p> <p>HF 16:12</p> <p>hi 2:3,5 30:5</p> <p>high 15:18 16:12 29:7</p> <p>Hildner 1:9 2:2,5,12,14 3:2,5,10,16,19 4:3,13,16,18 24:7 28:4 33:11</p> <p>hippie 13:9</p> <p>historic 20:15</p> <p>history 15:5 20:15 27:13 30:19 32:18</p> <p>hit 18:10,13 19:15,18</p> <p>hits 10:19</p>
---	---	---	---

Capital Reporting Company

Interview of Ernie Hildner

Page 5

<p>holding 24:20</p> <p>hole 8:20 9:1,7 10:10</p> <p>holes 8:8,12 10:5 11:2</p> <p>home 12:19 20:20</p> <p>hope 32:11</p> <p>hose 10:12,15</p> <p>hoses 10:6</p> <p>hot 9:19</p> <p>hour 18:11</p> <p>Houston 12:19</p> <p>huge 13:2 18:2,21,22 23:18 25:15</p> <p>hugely 14:8</p> <p>humans 14:13</p> <p>hurricane 24:17</p> <p>hypothesized 6:16</p> <hr/> <p style="text-align: center;">I</p> <hr/> <p>I.D 2:5</p> <p>idea 24:4</p> <p>ignited 12:5</p> <p>II 15:17 16:12</p> <p>I'll 5:4,16</p> <p>I'm 2:14,16,21 6:1 21:12,13 22:4,12 25:16 27:14 28:4 29:20 30:1 32:8</p> <p>images 9:4</p> <p>imagination 21:10</p> <p>imagined 6:16</p> <p>immediately 20:19 29:13</p> <p>impact 4:8 20:18</p>	<p>importance 20:16</p> <p>important 14:8 23:9</p> <p>improve 12:2</p> <p>improves 18:19,20</p> <p>Inaudible 4:16</p> <p>including 11:5</p> <p>inclusive 34:9</p> <p>increased 23:14</p> <p>incredibly 31:19</p> <p>influenced 17:14</p> <p>information 21:17,18 22:11,13 25:1 29:6,7</p> <p>inhere 19:16</p> <p>initial 6:5</p> <p>instance 5:11</p> <p>Instead 9:7</p> <p>instrument 8:13</p> <p>instruments 8:3 11:8 28:15</p> <p>intellectually 18:20</p> <p>intended 26:4</p> <p>interest 5:10,22 6:2 15:16</p> <p>interested 14:5 18:18 23:22 26:15</p> <p>interesting 20:14 21:16,18 27:10 31:17</p> <p>interplanetary 6:3 7:17 10:18 18:8</p> <p>interrupt 15:22</p>	<p>interrupted 15:19</p> <p>interview 1:7 3:18 30:10 31:22 32:15 33:10</p> <p>interviewed 31:3</p> <p>interviewing 31:1</p> <p>interviews 21:21 31:7,11,20</p> <p>intro 30:14</p> <p>involved 11:4 13:3 27:15</p> <p>involvement 11:19</p> <p>irrelevant 22:3</p> <p>isn't 32:19</p> <p>it'd 4:14</p> <p>it's 2:3,11 3:12 6:1 9:20 10:4,5,17 18:5,10,13 19:5,22 20:5,14 21:9,12,14 27:10 32:13,14,16,19</p> <p>iTunes 31:13</p> <p>I've 10:8 21:19 30:14 31:2</p> <hr/> <p style="text-align: center;">J</p> <hr/> <p>JANET 34:3,18</p> <p>Joan 2:10</p> <p>job 19:11</p> <p>joined 26:10,11</p> <p>jointly 11:11</p> <p>jump 18:22</p> <hr/> <p style="text-align: center;">K</p> <hr/> <p>key 15:7,14 16:4,9</p> <p>knew 8:11</p> <p>knowledge 25:13</p>	<hr/> <p style="text-align: center;">L</p> <hr/> <p>laboratory 16:19 28:8</p> <p>Lanzerotti 24:7 32:4</p> <p>large 10:10</p> <p>largely 27:7</p> <p>later 2:10 10:11,14</p> <p>Latko 24:6,7</p> <p>launched 18:3</p> <p>learn 12:7 21:4</p> <p>least 31:4</p> <p>led 24:9</p> <p>legendary 32:5</p> <p>let's 4:15 24:13</p> <p>light 12:17</p> <p>line 4:10 7:19 18:6 19:13,17 30:19</p> <p>lines 9:13 18:22</p> <p>link 31:10</p> <p>list 31:4 32:9</p> <p>listen 4:9,10 23:9 31:11,12</p> <p>listeners 8:20 15:13</p> <p>listening 20:14 25:10 30:12</p> <p>listens 31:15</p> <p>literature 17:5</p> <p>little 5:18 10:1 13:21 16:18 27:14 29:22</p> <p>live 30:16</p> <p>living 17:18,21 30:18</p>
--	--	---	---

Capital Reporting Company

Interview of Ernie Hildner

Page 6

<p>location 12:18,19 locations 12:18 long 14:10 long-haired 13:9 loops 9:21 Los 17:8 lose 20:2 lot 6:21 12:6 14:21 Lou 24:7 32:4 loud 3:3 love 21:18 low 14:12,13 29:4 lower 10:3 lying 9:16</p> <hr/> <p style="text-align: center;">M</p> <p>magnetic 8:10 9:12,21,22 11:21 14:17,19,22 magnetograph 12:1 major 20:21 26:8,19 Mars 14:9 Marshall 11:14,22 mass 6:8 18:4,6,9 19:14 material 7:15,20 9:3 10:2,6,15,18 mean 17:20 means 4:21 measurements 7:13 mechanisms 16:15 medium 6:3 10:18 18:8</p>	<p>meeting 24:1 26:16,17 mentally 22:16 mentioned 22:21 message 13:1 23:11 messiah 23:10 meteorological 17:13 26:13,14,17 28:17 meteorologists 26:20,21 meteorology 17:6,7 24:12,14 26:21 MHD 19:8 middle 9:15 milestone 25:15 milestones 23:7 military 16:17 mind 8:19 15:15 16:8,10 18:16 27:21 32:17 minor 21:15 minute 13:4 minutes 21:14 mission 14:10 missions 13:3 mix 4:15 model 19:1,5,7 modeling 25:18 models 25:20,22 26:6 modify 25:12 moment 16:1,2</p>	<p>20:13 moments 17:22 money 12:15 17:17 monitoring 6:15 months 14:2 moon 13:22 mortals 14:20 moved 11:13 16:20 moving 6:3 19:22 20:1 M-regions 8:9 mutually 29:16</p> <hr/> <p style="text-align: center;">N</p> <p>NASA 12:7 13:3,12 14:5 17:1,18 18:2 27:8 28:11 29:8,11,12,15 NASA's 28:19 national 16:19 24:4,5,9 26:12,16 27:2 28:6 nation's 26:12 nearly 14:15 network 12:16 13:14 Ng 30:9 nice 4:14 NOAA 11:17 12:2,11,15 24:15,20 28:11 29:3,13,16 NOAA's 28:15</p>	<p>nobody 6:10,20 8:11 noticed 15:18 28:1 novel 12:22 nozzle 10:15 NSF 24:3 27:8 28:18 29:15,19</p> <hr/> <p style="text-align: center;">O</p> <p>objects 8:6 observance 12:17 observations 13:15 19:17,19 28:21 observatories 13:14 observatory 12:16 Oceanic 28:6 oddly 2:6 Odstrcil 19:6 Office 24:11 28:19 office's 24:15 oh 29:22 30:7 31:2,16 32:12 okay 2:12 3:2,6,10,16 4:1,2 5:20 16:9 20:11 22:21 25:10 28:2 31:1 32:4,13 33:1,8 ones 19:17 onto 9:17 open 3:9 27:20 operated 8:15 11:11 operating 18:14 operational 11:18</p>
---	--	--	---

Capital Reporting Company

Interview of Ernie Hildner

Page 7

<p>operations 12:20 18:18 23:5 26:7 28:22</p> <p>operators 24:22</p> <p>optimize 28:20</p> <p>orbit 14:12,14</p> <p>orbiting 28:16</p> <p>organization 23:3</p> <p>organizational 23:4</p> <p>organize 23:13</p> <p>organized 24:11</p> <p>originally 26:4</p> <p>otherwise 19:16</p> <p>outfit 12:2</p> <p>outside 14:17,22</p> <p>outward 10:7</p> <p>overseeing 28:10</p> <hr/> <p style="text-align: center;">P</p> <hr/> <p>Pages 34:8</p> <p>papers 17:9</p> <p>particles 14:3</p> <p>particular 24:16</p> <p>particularly 27:2</p> <p>passion 5:18</p> <p>past 6:1 21:17</p> <p>pay-offs 29:19</p> <p>people 4:9 6:16 8:17 17:10,14,22 20:19 21:1 23:12,21 25:2,5,13,20 31:1,3</p> <p>perfect 21:12 29:20</p>	<p>permeate 9:13</p> <p>person 30:13</p> <p>personal 11:19</p> <p>perspective 18:17</p> <p>Ph.D 6:5</p> <p>phenomena 6:15 10:20 16:10,14</p> <p>phenomenon 8:16</p> <p>Physics 11:14 28:20</p> <p>pieces 4:11 22:12 30:19 31:5</p> <p>pitched 24:3</p> <p>places 29:8</p> <p>planning 31:22</p> <p>plans 11:10 20:3</p> <p>plausible 3:5</p> <p>please 30:6</p> <p>pleasure 32:17</p> <p>podcast 4:11 30:13 31:12</p> <p>podcasts 4:12 30:15</p> <p>point 10:14 11:3 16:9 18:2,15,16 26:9</p> <p>points 15:4,8,14 23:7</p> <p>polar 28:16</p> <p>poor 14:20</p> <p>possible 5:5</p> <p>power 21:8</p> <p>predict 19:3 21:5</p> <p>predictability 22:7</p> <p>predicting 22:8</p>	<p>Prediction 28:9</p> <p>predictions 12:11 26:1</p> <p>preparing 22:15</p> <p>pretty 2:16 3:1 11:20 12:13 14:1 21:18 31:17,21</p> <p>previously 34:6</p> <p>primary 5:10,22 6:2</p> <p>principal 14:19</p> <p>principally 28:16</p> <p>probabilities 12:12,13</p> <p>probably 30:2 31:3</p> <p>problem 3:14 4:1 5:15 21:9</p> <p>proceedings 34:5,10</p> <p>process 3:21</p> <p>produced 28:13</p> <p>product 25:11</p> <p>products 23:19</p> <p>professional 32:17</p> <p>professor 17:6</p> <p>program 12:21 17:19 24:5,10</p> <p>project 12:14</p> <p>prominences 6:6</p> <p>propagation 16:19</p> <p>prove 6:17</p> <p>provide 25:8</p> <p>providers 25:2</p> <p>provides 14:19</p>	<p>public 12:6 17:9 27:6</p> <p>pull 7:2</p> <p>purpose 24:15</p> <p>purposes 28:17</p> <p>Putting 14:1</p> <p>puzzled 8:17</p> <hr/> <p style="text-align: center;">Q</p> <hr/> <p>question 3:9,11,13 5:9 12:9 15:6</p> <p>questions 3:17 4:21 5:3 10:22 11:12 22:17</p> <p>quiescent 6:6</p> <p>quiet 5:5</p> <p>quite 4:8 6:7 12:10 21:16 22:11 30:22</p> <hr/> <p style="text-align: center;">R</p> <hr/> <p>radiation 13:21 14:4,15 15:1</p> <p>radio 15:18 16:12</p> <p>ranting 32:13</p> <p>rapidly 10:7</p> <p>rare 6:11 18:5</p> <p>rate 29:5,7</p> <p>rather 9:22</p> <p>reading 30:11</p> <p>ready 31:11 33:2</p> <p>real 3:18 13:16 18:12 25:22 28:12 29:4,6</p> <p>reality 26:2</p> <p>realization 23:12</p>
--	---	--	--

Capital Reporting Company
Interview of Ernie Hildner
Page 8

<p>realizing 17:10 really 4:14,20 17:16 20:20 21:14 22:11 33:6 recent 25:6 recently 28:8 record 21:22 34:10 recording 2:18,19 recurring 8:10 reduced 34:7 references 17:4 region 9:20 regions 9:5,11 10:6 relate 26:2 relatively 30:16 remember 17:3,18 25:16 repeat 3:12 research 5:10,13,22 6:2,5 8:21 11:4,20 12:2 14:6 15:8 16:18 17:1,11,12,13 18:21 20:21 22:17,18 23:2,5 24:17 27:7 28:11,21 29:17,19 researcher 22:2 researchers 24:22 25:8 result 9:19 13:13 results 12:17 retired 6:1 27:14</p>	<p>28:4 RICE 34:3,18 Rich 24:8 risk 15:1 rocket 13:6 rotates 10:12 routine 6:15 run 25:22 32:17 <hr/> <p style="text-align: center;">S</p> <hr/> sandal-wearing 13:9 satellites 20:22 saw 6:15 7:11,14 8:8,12 scans 7:13 science 11:14 29:7,12 scientist 11:7 scientists 13:9 scripted 13:6 second 15:22 27:22 sections 30:21 seek 23:14 seemed 16:13 seen 6:10 7:12 self 31:15 send 29:5 30:12 31:9,10 sending 13:22 sense 10:8 12:4 sensor 18:11 separate 2:19 5:3 service 24:5 25:1</p>	<p>26:12,13 serving 25:13 seven 24:10 several 17:4 28:7 share 22:13 she'll 30:8 she's 30:5 shield 14:19 shift 13:11 shock 32:2 shocked 32:9 shocking 32:20 short 14:1 shorter 13:3 showed 9:5 23:17 25:3,5 shut 13:17 sides 25:10 simply 7:12 Siscoe 17:6 24:3,6 31:22 sit 32:21 site 4:7 30:17 31:8 sitting 8:14 sky 6:13,14 Skylab 6:7 8:2,12 11:6,20 12:5,9,14,20 13:17,20 17:16 21:17 23:16,18 Skype 2:8 31:20 small 16:1 smart 31:14 societies 27:2 society 20:19</p>	<p>26:14,17 solar 6:2 9:7,19 11:12,14,21,22 14:2 15:21 28:19 solved 21:9 sort 9:11 sound 31:17 sounding 31:18,21 sounds 3:5 21:12 27:11 29:20 31:14 space 6:14 7:3,17,21 8:7 10:21 11:3,4,15,17,18 12:2,7 13:19 14:6,13 15:4,8,15,16 16:4,9,11 17:2,3 18:1,19 20:16 21:2,4,8 22:2,5,8 23:2,5,19,22 24:4,5,9,13,18,2 1 25:19 26:1,9,10,15,19 27:1,3,6,9,12 28:5,7,8,11 29:8 30:18 spacecraft 18:3 19:10 20:6 21:19 28:16 29:1,6,10 specific 11:12 speculated 6:16 spends 10:1 spirals 10:17 spread 23:11 squirting 10:15 Standards 16:20 stands 20:12</p>
--	---	--	--

Capital Reporting Company

Interview of Ernie Hildner

Page 9

<p>star 17:19,21</p> <p>start 3:18 5:14 9:14 16:8 20:6 23:11 30:11</p> <p>started 3:8 4:17 12:11 15:17 17:8,18 24:20 26:18</p> <p>state 27:19</p> <p>States 24:10</p> <p>stations 29:13</p> <p>stay 14:20</p> <p>stereo 19:10,22 20:5</p> <p>storm 12:12</p> <p>storms 8:10 14:15</p> <p>straight 9:16,22</p> <p>strange 2:9</p> <p>streaming 10:7</p> <p>stretch 21:10</p> <p>strong 19:3 31:21</p> <p>stuff 8:1</p> <p>sub 10:13</p> <p>submit 25:20</p> <p>subsequent 29:9</p> <p>subset 29:11</p> <p>suddenly 6:14 14:4 23:17</p> <p>sun 6:15 7:6,8,9,12,14,16, 21 8:11 9:2,3,5,9,14,17 10:2,7,12,13 12:16 13:1,15 16:14 19:3,12,13,17 20:1,6</p>	<p>Sun-Earth 30:17 31:8,10</p> <p>sun's 7:8</p> <p>superseded 19:5</p> <p>suppose 8:21</p> <p>sure 2:9 5:16,17 30:7 32:8</p> <p>surface 6:12 9:9 10:2</p> <p>surprised 31:19</p> <p>survive 25:21</p> <p>sweeps 10:13</p> <p>switch 18:12</p> <p>system 29:13</p> <hr/> <p style="text-align: center;">T</p> <hr/> <p>tables 8:14</p> <p>taking 7:13</p> <p>talk 2:18 22:13</p> <p>talked 5:18 21:18</p> <p>talking 2:21 3:15 5:4 15:3 21:1,20 31:15</p> <p>talks 17:9</p> <p>tangible 29:17</p> <p>tapes(s) 34:4</p> <p>taxpayers 29:17,18</p> <p>team 6:19 8:2,22 12:5</p> <p>technologically 20:13 21:7</p> <p>technology 20:22</p> <p>telescope 7:4,5,7</p> <p>telescopes 8:4 11:9,11</p>	<p>teletype 13:1</p> <p>ten 31:3</p> <p>tense 6:1</p> <p>term 16:4,5 17:4,8</p> <p>terms 18:20</p> <p>testing 25:21</p> <p>thank 2:14 4:19 30:2 32:15</p> <p>thanks 4:5 33:1,6,8</p> <p>that's 4:1 5:15 7:21 10:4,11 14:8,9,11,18 17:22 20:9 22:6 28:3</p> <p>themselves 23:13</p> <p>thereafter 34:6</p> <p>thereof 34:11</p> <p>there's 5:2 10:10 12:9 14:4 21:15,16 22:20 23:3 25:9 27:5</p> <p>they'd 13:10</p> <p>they'll 31:12</p> <p>they're 4:8 14:14 33:2</p> <p>third 15:6</p> <p>Thompson 30:5</p> <p>thousands 4:9</p> <p>three-dimensional 19:7</p> <p>tight 29:16</p> <p>today 24:21</p> <p>tomorrow 13:10</p> <p>tool 4:6,10 30:19,21 31:6</p>	<p>touch 33:2</p> <p>toward 11:11 18:5</p> <p>towards 20:7 30:3</p> <p>track 29:4</p> <p>tracking 29:12</p> <p>transcribed 30:10 34:4</p> <p>Transcriber 34:1,3,12,18</p> <p>transcript 34:7,8</p> <p>transcripts 33:3</p> <p>transformational 12:10,22 13:18 23:16</p> <p>transmissions 15:18</p> <p>trips 14:1</p> <p>trouble 2:22</p> <p>Troy 2:4,5 33:8</p> <p>true 34:9</p> <p>Truly 5:22</p> <p>try 5:4,16 11:12 19:2</p> <p>trying 11:21 12:2 14:6 17:17 22:6 25:16</p> <p>turning 15:4,7,14 16:9 18:2,15,16 23:7 26:8</p> <p>turns 9:11 30:13</p> <p>TV 26:21</p> <p>type 15:11 20:21</p> <p>types 14:12</p> <p>typewriting 34:7</p> <hr/> <p style="text-align: center;">U</p> <hr/>
---	--	---	---

Capital Reporting Company
Interview of Ernie Hildner
Page 10

<p>Uh-huh 4:13 22:1 33:9</p> <p>umbrella 24:18</p> <p>uncomfortable 13:7</p> <p>understand 11:21 14:6 22:6</p> <p>understanding 11:2 13:19 14:12 17:17 18:21 20:5 23:18 26:6 27:8</p> <p>understandings 13:17 28:21</p> <p>understood 8:11</p> <p>union 26:15</p> <p>unit 8:15 16:18</p> <p>United 24:10</p> <p>universities 26:22</p> <p>university 17:7 29:18</p> <p>unless 31:9</p> <p>upon 21:7 34:5,10</p> <p>upstream 18:11</p> <p>upwards 31:2</p> <p>useful 20:8 23:20 25:12</p> <p>users 23:20 25:7,22</p> <p>Usually 18:7 27:20</p> <p>utilize 28:21</p> <hr/> <p style="text-align: center;">V</p> <hr/> <p>validation 26:5</p> <p>validity 25:11</p> <p>value 23:17</p> <p>various 31:6</p>	<p>venting 32:13</p> <p>ventures 23:14</p> <p>venturing 21:1</p> <p>verify 6:19</p> <p>vibrant 25:7</p> <p>view 11:3 20:2</p> <p>views 19:11</p> <p>visible 9:7 12:17</p> <p>voice 2:19 16:2 23:8</p> <p>vulnerable 14:14,15</p> <hr/> <p style="text-align: center;">W</p> <hr/> <p>Wang-Sheeley- Arge 19:1</p> <p>War 15:17 16:12</p> <p>warning 18:13</p> <p>wasn't 8:13 15:16 16:4,5 17:4,11</p> <p>watch 7:3</p> <p>ways 12:10 13:18 23:6 27:11</p> <p>weather 7:21 10:21 11:4,18 12:3,8 13:19 14:6 15:5,8,15,16 16:4,10,11 17:2,3 18:1,19 20:16 21:4,9 22:5,8 23:3,5,19,22 24:4,5,10,13,18, 21 26:1,9,12,15,19 27:1,4,6,9,12 28:5,8,11 30:18</p>	<p>web 4:7 30:17 31:8</p> <p>Week 24:21</p> <p>we'll 3:8,21 4:22 5:4,16,19 20:2 30:2,7 31:16</p> <p>well-funded 12:14</p> <p>we're 2:7 5:5 14:9 20:3</p> <p>we've 21:13 31:19</p> <p>whereas 29:7</p> <p>Whereupon 33:10</p> <p>whether 7:15,16 18:9</p> <p>whole 6:21 14:4 22:15,20 23:3 27:5 34:11</p> <p>who's 18:18</p> <p>wilderness 23:8</p> <p>willing 23:13</p> <p>wind 18:3,14 21:19 22:2 29:1,4,5</p> <p>WITNESS 34:12</p> <p>wondered 28:1</p> <p>wonderful 18:15 19:9,11 29:1</p> <p>wondering 22:12</p> <p>work 12:4</p> <p>worked 11:9 28:18 29:2,11</p> <p>works 3:7</p> <p>world 6:7 15:17 16:12 21:6 29:4,9</p> <p>worldwide 12:15 13:14</p>	<p>worry 14:2</p> <p>Wow 22:8</p> <p>wrangle 13:2</p> <p>wrote 32:7</p> <hr/> <p style="text-align: center;">X</p> <hr/> <p>X-ray 8:3</p> <p>X-rays 8:5,6 9:2,8,10</p> <hr/> <p style="text-align: center;">Y</p> <hr/> <p>yesterday 5:18</p> <p>yet 21:20</p> <p>you'll 30:21</p> <p>yours 2:20 5:17</p> <p>yourself 30:22</p> <p>you've 11:5 15:3,8 17:21 32:20</p>
---	---	--	---