Interview with Dr. David Hathaway
Interviewer: Troy Cline
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I'm David Hathaway. I am a solar astronomer at NASA's Marshall Space Flight
Center. My primary research interest is the Sunspot cycle, the solar interior. I actually got into it because I was more interested in stellar interiors and discovered there is a star in our backyard that flows within the sun that produce the
magnetic fields that make the Sunspot cycle. The thing that captured my interest was, first of all, realizing that the star in our backyard did so many fantastic things. And the Sunspot cycle was one of them. As far as I'm concerned, it is the longest-standing problem in solar physics as far as when it was first discovered and the fact that it still isn't figured out. And the scientist in me wants to figure
things out, so that's -- that's what certainly caught my attention was the desire to figure this thing out and to try to understand how this works and ultimately to the point where we can predict it and make it useful for humankind. didn't get involved in space weather research per se until my supervisor, Dr. John Davis, challenged me to try to predict the Sunspot cycle. And I always wanted to take a challenge. I started looking into it and ultimately did come up with methods that work at certain phases of the solar cycle, but it was primarily the challenge from John Davis that
got me started. And once I got into it, of course, once you get into any subject area, you discover all sorts of fascinating things. The turning points in my career, I started out, you know, as a high school student wanting to do stellar structure and evolution, how do stars evolve, and at that point, you know, would they collapse and form black holes.

In going through undergraduate school, I studied a lot of that. It wasn't until I got to graduate school that I found that one of the real sticking points in doing stellar structure and evolution was, how do you model the convective transport of heat? And the thing that was used then, and is often used even until today, is an engineering sort of scheme where you say that stuff rises through some fraction of a pressure scale height, and then it gets taken over by another one that carriers it higher.

I realized that that was the difficulty, and so wanted to get into stellar convection, and there luckily I had key people -- Juri Toomre at the University of Colorado and Peter Gilman at the High Altitude Observatory -- that were doing solar convection. And sure enough, here is the star in our backyard where you can actually see this going on. So that is what got me started in getting into solar physics. And, again, I already had the interest in what happens beneath the surface, the stellar interiors. So then the key things, turning points, were getting to Marshall Space Flight Center where predicting the Sunspot cycle became important.

There was another group there doing it, and we were convinced that they didn't have the physics right. And because of that, the whole method just didn't make sense, and so got into trying to predict the Sunspot cycle then, and with some success such that I often would get asked to respond to reporters. So one key moment was the challenge to try to predict the Sunspot cycle, and that led me into really doing space weather. I have always had a bit of a knack for talking to the public, so I would be frequently asked to give public lectures or talk to reporters, and realized that there is a lot about space weather that I'd better know, because questions would come up on it.

And so I brushed up a bit on what had gone on in the past, what its effects were on various components of our technology in our lives, and so that has led me to where I am today.

To my mind, the first key event in space weather was Heinrich Schwabe's discovery of the Sunspot cycle in 1844. Prior to that, we didn't know that the sun varied. And even though we saw consequences on Earth, there was no reason to connect this to the sun. So I think that's the first one is Heinrich Schwabe discovering the Sunspot cycle.

And then, shortly thereafter, 1859, Carrington and Hodgson, seeing a white light flare on the sun, and, luckily, within hours seeing effects here on Earth that were probably related to a somewhat earlier flare, but directly making the connection between something happening on the sun and something happening here on Earth. So I think that's the next key point in space weather as far as, you know, knowing that it's there first.

Then, I think you end up in about the 1930s with Bartels looking at geomagnetic activity and noting in particular near solar cycle minimum, this 27-day periodicity, and putting together what he called his Bartels diagram, every 27 days what geomagnetic activity is, and you could see the sun's imprint on that.

Moving ahead from there, there is all kinds of events as far as technology, new satellites, new observatories, and so forth. And it probably gets real thick with events.

But when I think about space weather and events, there are key events from the sun itself that come into play -- the March '89 event, that almost anyone who talks about space weather brings up the March '89 event, because it really was significant to humans on Earth, the fact that it took out power to the province of Quebec for -- where people were without power for six days in March in Quebec. People stood up and noticed. So I think the March '89 event was a key event.

More recently, since it has been observed so much better than before, there are a number of more recent events that, because they are so well studied, I think are significant. The Bastille Day event of July 14, 2000, was one, and then the Halloween events of 2003 is another one where, you know, a big event on the sun, consequences here on Earth.

And because we now had the technology to really study it and understand what was going on, and all of the connections between something happening at the sun, something propagating through the solar system, and then hitting the near Earth environment, and the consequences for the near Earth environment, I think those are significant events as well.