HUBBLE SPACE TELESCOPE OPERATIONAL ORAL HISTORY PROJECT
EDITED ORAL HISTORY TRANSCRIPT

RAYMOND VILLARD
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The questions in this transcript were asked during an oral history session with Raymond Villard. The text has been amended for clarification and for publication on this website.

GAINOR: OK, it is November 4th, 2016.

VILLARD: Five days 'til the election.

GAINOR: Walter Cronkite's 100th birthday, today.

VILLARD: Oh, my God!

GAINOR: And I'm at the Space Telescope Science Institute [STScI] in Baltimore, Maryland, with Ray Villard.

VILLARD: Five days to the end of the world.

GAINOR: That's right.

VILLARD: Five days before I start looking at Vancouver, probably. We're somewhere back in the 90s, and you want me to dredge stuff from my memories of the 90s.

GAINOR: We want to talk about the Eagle Nebula, which is one of the big things that really put Hubble [Space Telescope] on the map.

VILLARD: It was, you know, something I never anticipated, I was thinking about great discoveries, and looking to the edge of the universe. And so, Ed [Edward J.] Weiler called me, and Ed said, "We're going to do the Space Science Update." Those were a big deal in the early to mid-90s. Ed was relentless because we televised those things. We jumped through all kinds of hoops to support those. And he said, "We're going to a Space Science Update about Elephant Trunks [Nebula]."

And I'm like, "Are you kidding me?" Because he'd do Space Science Updates about anything. I said, "There's no—we know about that. We know what these things are. They're all over the place. They're like stalagmites. What's the news?"

And he said, "You've got to see the picture."

I said, "I don't have to see a picture. I know what Elephant Trunks look like."

He said, "No, you gotta see the picture."

And I said, "Really?" And I just thought the whole thing was just being, you know, pushing anything out the door from Hubble that he could, just for publicity. And I was more conservative. I'm like, "Well, you know, if this thing is telling us something new about the universe we didn't know before, then it's news. But pictures? Pictures of Elephant Trunks?"

So, then he came to my office with the picture, and my jaw dropped. It was a religious experience. That was a seminal moment on the project. And I've thought all these years, I've wondered why that picture is so arresting; and I think, because it looks organic. It doesn't look like what you'd expect to find in space. It almost looks like something you'd see under a

microscope. So, it's eerie in that it did make me think of how strange the universe, and life in the universe, and I think that it's just organic looking. So, so we scrambled with Jeff Hester to do the Space Science Update. Jeff came up with this silly thing, about, he called them evaporating gaseous globules, [EGGs]; we tried to make some press out of that.

GAINOR: Was he here? Or where was he at the time?

VILLARD: No, Jeff was out in Arizona [State University].

GAINOR: Okay.

VILLARD: I'll tell you a funny story about that. So, you know, these things are like buttes, right? They resist photo-evaporation erosion.

GAINOR: Yeah.

VILLARD: I think they cast a shadow, and it stays cool. So, we wanted to do a video to accompany the news release. He was out in Arizona. So we asked a film crew at Arizona State to take Jeff, to film him with a butte in the background. Now, I was thinking that they would drive up to Sedona [Arizona], because Sedona has beautiful structures like that.

GAINOR: Yeah.

VILLARD: So, they send me the footage. They took him out to the expressway, and there was a little mound in the background, and Jeff was talking to the camera. He goes, "It's like this thing behind me." You could barely see it, and there were cars going back and forth. And so that kind of annoyed me.

Jeff was good to work with on the show, and he got a lot of publicity about the evaporating gaseous globules. And of course, they got, as I remember, a lot of coverage. But the interest in that has been sustained for 20 years now. But I think it's funny, and a little silly. The Very Large Telescope just put out a press release, looking at these Elephant Trunks, and we've got a big picture down the hall of these Elephant Trunks and the Carina Nebula and these little things poking out. So to be cute, they called them the Pillars of Destruction. And I look at the picture, and I laugh my ass off. And you know, it's fuzzier than Hubble. Hubble has put out pictures of these various objects.

But the key thing—I had to make a correction on Wikipedia, because somebody wrote something completely wrong—I came up with the phrase Pillars of Creation along with the video producer we had at the time, Ginger French. Ginger walked in the office, and she said, "This needs a cool name." And, we were planning the televised press briefing, and I had the picture on the wall. We both stared at it, and she said, "This is so enthralling, it needs something to give it this sense of awesomeness."

So, we played around; we kicked words around. They're like pillars. Stars are being born. We'll just call them Pillars of Creation. Never thought to this day, that name would be everywhere. We just tried to come up with a clever sounding thing for TV. So, we cooked that up. A lot of people take credit for that, but we cooked it up, chit-chatting. And Ginger was good, because you could play with ideas, you could do word-association.

GAINOR: Was that kicked out at an AAS [American Astronomical Society] meeting, or something?

VILLARD: Oh no. It was a big, televised NASA press conference. They made a big deal, because Weiler was insistent. Weiler had this sort of sibling rivalry with Steve [Stephen P.] Maran, the AAS press officer at the time. People back then, reporters would always call Steve for commentary, because Steve was very, very glib, and very quotable. And there was a lot of jealousy, that it looked like he was stealing all the attention. But you know, as the AAS press officer, he held a position of esteem.

Steve Maran was so gregarious, he ingratiated himself to reporters. I've got a great picture of me and Steve and all these reporters at a meeting, back in the early 90s. So Weiler did not want to see Hubble—now that got us in trouble with a later release, but he did not want to see news items at AAS. So, we would have had to go over him to have those pillars come out at AAS. So, it was a big NASA televised thing, and a lot of news coverage. That was the biggest thing for Hubble since the stories of mirror aberration and servicing mission.

That picture really put Hubble in the public mind, more than anything else. And these guys like Hester, and even Adam [G.] Riess, who I love, these guys were kids. Back in the 90s they were kids. It's like the kid gets the keys to the father's Mercedes. So, you get the key to the most powerful telescope of the modern history.

GAINOR: The father's T-bird.

VILLARD: Really. So yeah, they wanted to look at these, the H2 regions, and they knew the Eagle

[Nebula] was photogenic because you were looking at the Elephant Trunks, edge on. You weren't looking down on top of them, but you were looking from the side. They thought it's a great target. And it'll fit inside the WFPC 2 field of view, really easily. So it wasn't a big deal.

Then the picture came down, and like, holy cow! So Jeff ran to Weiler, and then Weiler came to us. It was one of the few stories where the results didn't come out of the STScI office. He went straight to [NASA] Headquarters, and Headquarters went nuts. When I saw it, I was flabbergasted, and we put together a nice Space Science Update. But that is Hubble's crowning achievement that really cemented its value with the public.

After pondering the "pillars "for a long time, the photo finally dawned on me. It goes *beyond* the imagination of what people think is out in the universe. And I think that kind of realization is fundamental to Hubble's success.

GAINOR: And it had already gotten good bounce out of SL-9 [Comet Shoemaker-Levy 9].

VILLARD: SL-9 turned a corner because people were no longer saying the broken Hubble.

GAINOR: And now a couple of things. I'm interested in Hubble and the internet.

VILLARD: Yes.

GAINOR: And I got the impression, it might be wrong, that actually the Deep Field was a bigger thing on the internet than say the Pillars of Creation, simply because, even in that short period of time between those two things, there was a big change in the number of people who had computers

that could handle graphics.

VILLARD: Yeah, you know, the internet's a funny thing. I remember SL-9 was seminal in that a lot of data were flashing across the internet. And in the back of my mind, I said, boy, this is really going to change the way news is covered. It was so new. We were still in the stone ages of instant communication. We had a photo lab. They were going to take the first impact picture, make prints. This is the JPL [Jet Propulsion Laboratory, Pasadena, California] mode of pumping out hardcopy, they were going to take that, and they were going to make prints. Then the prints were going to be released, about an hour and a half after the impact. And the AP reporter, Paul [Recer] he was really mad. He was kind of a curmudgeon anyway, he was like, "I need the picture. Where's the picture? I need the picture." Now, if I had full control over this, which they would never give me, I would have put the picture on the internet in real time. But NASA said no. Especially Weiler. Weiler kept belittling the whole SL-9 thing. He was sure that it was going to be a drop in the bucket. You wouldn't see anything. And then if we put out a Hubble picture that didn't show anything, people would begin to laugh at Hubble. It was a real paranoid thing, but that came from Weiler.

So, it was me and Don [Donald] Savage, who was the Headquarters PAO [Public Affairs Office], the two of us tag-teamed to be ready to make this a big deal, if it turned out to be a big deal. And I was pragmatic. I was like, we've never seen it before. You've always got to plan for the most extreme. But I'll tell you, with the internet, I was reluctant at first to put pictures on the internet, because now I have digital information, and somebody could pull that and do something with it. I was paranoid that astronomers would get mad because people had numbers now. They had digital now, and they could play with the digital. Given craziness I've gone through here

before, I was in the old-fashioned JPL-mode that you get a photographic print. If you want to take it up and scan it, go ahead, but us putting out digital files of Hubble pictures had me worried, and I resisted that. And then I had people complaining that we should have done that. But after that, we began to put files on the internet.

It's amazing how the success of Hubble—and I've said this several times—it is this perfect storm that you have a powerful astronomical facility coming online when you have a delivery mechanism via the internet. I'm sure you remember in the old days, before Hubble, where did you get space pictures? Where did you get space pictures?

GAINOR: Cut them out of the paper or write a letter to the observatory or NASA.

VILLARD: I was inspired to write the "Infinite Worlds" book about 10 years ago, based on a book by Willy Ley and Chesley Bonestell that came out in the 1960s. Ley, a top science writer of the time, he picks the very best deep-space photos for the book. Now there are color illustrations. But he went through and picked iconic [photos], right?

GAINOR: Right.

VILLARD: We looked at all these with Hubble, of course, they're drop dead gorgeous, [NGC] 1300 [spiral galaxy] and M [Messier] 51 [the Whirlpool Galaxy]. But that's all you had were black and white pictures from Palomar and Lick Observatories. And you had a very small selection to go with them. And I remember, it was back in *Astronomy Magazine*, in the mid-70s, and they were beginning with these digital detectors in false color. They also did the beautiful color work that

David Malin did, with photographic darkroom techniques. Somewhat garish false-color digital images took over from the 70s into the 80s. But with Hubble, you've got an explosion of color in awesome resolution. It's really visually redefined the universe.

GAINOR: Yes, because I remember when I was a kid, all this stuff was black and white.

VILLARD: Yeah.

Chris GAINOR: I think even on the deck of the Starship Enterprise, maybe they threw in a dash of color. I think a lot of people were watching in black and white, too, so it didn't even matter if they did. And then you started getting these pictures that were in color, but they're kind of muddy, right, because the printing wasn't that good. And of course, resolution wasn't that good, because it was from the Earth. And, then all of a sudden, you have huge monitors, and you got a Hubble picture on that, and bang!

VILLARD: Yeah. I think I mentioned to you, so you know, we're at the mid-90s, we begin to start putting all this out on the internet. Me and my deputy, Cheryl Gundy, we went to JPL in 1989 to see how major space missions are covered. People were getting into fist fights over these prints of Neptune. And it was arcane. Looking back, it was arcane. It really was. It just shocks the hell out of me. And you had to beg, borrow, or steal in order to get your hands on some pictures. But by the 90s, you just open the floodgates, and everybody in the world can access these, can download them, put them on coffee cups, t-shirts, screensavers, book covers. So, it was an incredible piece of timing that you have extraordinary new views of the universe that you can

distribute. A democratization And it was something I worried about when I saw the fuss at JPL.

We had a huge photo lab here. We had an incredible photo lab, and we would make tons of prints, which we would mail out. And we continued that well into the 90s, although we have the digital files. But it was just tradition to make prints available. So the internet and home computers and all of this came of age in parallel with Hubble.

GAINOR: And when did you really notice it picking up?

VILLARD: What, internet traffic?

GAINOR: Was there a day when you went to your boss and said, "You know, our web servers are going crazy with these pictures."

VILLARD: What brought down the web servers? You know, we did put out a picture of Mars in 2003 that brought the servers down. Because everybody loves Mars. We had to fight tooth and nail to get them to look at Mars. And you know, the history of the Eagle Nebula, I lobbied for years to revisit the Eagle, and [John M.] Grunsfeld said it was boring. Been there, done that. So, for the 20th anniversary, I had Matt Mountain almost convinced to do it, then Grunsfeld came in and said, "Oh, why are we looking at that again?"

And it wasn't even our official picture for the 25th anniversary. They picked some nebula, but Heritage was able to ask for orbits. We should look at the Eagle anyway, and the Eagle came out at the [2015] AAS meeting. And of course, [Jeff] Hester got mad, because he was involved in the original release. He's not even in astronomy anymore. This bothered me because look, again,

it's the kids with the keys to the T-bird. You got to look at this. You couldn't have done this without the multi-billion-billion dollar Hubble, right?

GAINOR: Right.

VILLARD: It's not that you're some genius like [Albert] Einstein, who went into a corner and came up with these great ideas. You just got your hands on the most powerful space camera ever built, and you were like a kid in a candy store.

I will tell you a funny Hester story, though. We had, in the mid-90s, Robert O'Dell. O'Dell claimed he saw protoplanetary discs. I think these have been seen in radio wavelengths, but with Hubble, in visible light, seeing is believing. So O'Dell and I got all excited about this. And I wrote this release that said, "Hubble's found the embryonic construction of planets, throughout the nebula, and this increases the chances for life in the universe." And Weiler threw a fit. He said, "Take that out." But I was just extrapolating. If there's lots of planets, then you've got lots of chances for life right there. There are minimally 100 million planets in our galaxy.

Hester picked on O'Dell because Hester didn't believe that these were discs. He thought the Elephant Trunks are cone shaped. So, on projection, it looked like a cross-section across a cone. On projection it looked like an ellipse. And he belittled O'Dell, right here at STScI. He thought the proplyds were a misinterpretation, and he was just looking at Elephant Trunks at funny angles. So, I relish this story.

I was down at Headquarters with Weiler. We were planning a Space Science Update about O'Dell's proplyds, and somehow Hester was there. I don't know how he got involved. And I said to him, "Do you still believe these are just Elephant Trunks in projection?"

He goes, "Yeah, yeah,"

"Well, take a look at this photo," an edge-on proplyd, that looked like a hamburger, right?

GAINOR: Yeah.

VILLARD: And Hester's face dropped. [chuckling] And he goes, "Well, okay, maybe some of them are." But I relish that. It was such a zinger.

GAINOR: I've got to ask a little about what the process, because with you folks and NASA around releases, I guess I've been assuming that most releases come out of here and get blessed or not blessed by NASA. I don't know how many actually come out of there.

VILLARD: No, all the Hubble stuff has come out of here. The vast majority, the astronomers come directly to us. Or we hear about something—we're going back to the 90s now. We'll do this timeline.

GAINOR: Right.

VILLARD: We hear about something, and contact them, and in Hester's case, he went straight to Headquarters, and Headquarters assigned us to make it into a story. So, there's never really been a Hubble science release that came out of Headquarters. So many people are using Hubble, there can be science releases from any number of other observatories. And the challenge I have today is we only put out 30 to 40 releases a year. We only have so many seats on the bus, and I can't

waste resources on stories that, in my judgement, aren't really worth the effort. You know, a lot of the stuff that we get is very esoteric. And I have my "Dear John" letter that I send to people. We have a drop box where they can propose for a new story. And it breaks my heart to turn anything down. But boy, because when we do a story, the thing that is extremely difficult is that we write it here. The researcher, who can be anywhere, you know, we've done a number of stories with the globular cluster guy at UBC [University of British Columbia], Harvey [Richer].

We have an outreach scientist who's assigned to our group, look at it, and say, "Alright, I think it's okay." But then it goes to NASA Goddard [Space Flight Center, Greenbelt, Maryland], and their project scientist has to look at it. When they're done with it, then it has to go to Headquarters, and a whole bunch of people look at it, and it can be an endless negotiation, and then they can really chew things up. It's very tough. But the process is frustrating and long.

Now I was talking to my colleague out at the NRAO [National Radio Astronomy Observatory] and what does he do? He writes it; the researcher looks at it; researcher says okay, and they publish it. [chuckles] NSF [National Science Foundation] could care less. But Hubble is one of the most visible things NASA has. People know about NASA; they don't know about NSF. But it's an insane level of oversight, that just clogs up things.

GAINOR: And how long does that usually take? Because it can depend on if you come up with something really sensational. I suppose things can move faster? But that begs the question, are we going to have a big event rather than just kicking out a release?

VILLARD: Well, they're getting out of this just doing stuff overnight. Though I will say, an interesting case study was the case of the plumes on Europa.

GAINOR: Yes, very recently.

VILLARD: And you know, the data are marginal, but they believe they see plumes. Anyway, so, the kind of a dilemma is that it's a big story, because it's Europa and its astrobiology. We know it's a big story, but the data are marginal. So, what we worked out is, we waited for a paper to be accepted. But I had a lot of pushback here, with the director, "I don't believe it. Are we putting out crummy data?"

And I said, "It's an accepted paper, and it has news value." And so I had to get NASA involved, promoting this. And since they wanted to have a media telecon, they had a whole advisory committee, a whole bunch of scientists who think they know what the public needs reviewed the data, asked tons of questions. NASA really embraced this. It cut across divisions. And it was one of the biggest stories of the year. So, my director said, "It's the case of the most crummy piece of data being widely publicized." So. It's a painful process, trying to get this stuff all signed off. There's too many cooks. It's a problem.

GAINOR: Right, but if I'm some researcher, at the University of Pennsylvania or something, and I get the Dear John letter, in my Hubble time, can I just go out on my own?

VILLARD: I encouraged them. I said, "We honestly don't think it's newsworthy. That said, I encourage you to work with your press office, and we can even offer some review or resources." We're just not going to put it out of this office and get into the whole NASA review stuff. If I didn't have the NASA review, and it was an issue of writing something, like a I write something,

press a button and it's out there, then our throughput could be much greater. The other problem is that you begin to lose credibility if you put out mediocre stuff.

Because reporters tell me, when we see it comes from STScI they conclude it's newsworthy. I guess reporters might have half a dozen to a dozen news stories a day, and they look at the source. If the source is the Institute, we have a high enough credibility with them, they know it's going to be a good story, that we want to be able to filter and package and explain it. It is Hubble, but it's a good story that goes with it. That's my biggest worry on this job, that we don't get diluted with media over stuff. So, I will turn people down. And I've been surprised by some things which got big news. I didn't think they'd get big news. There are other things which I thought were exciting, but people could care less. It's also a matter of timing. But everybody comes to us. There's no shortage of stories or potential stories. Let me put this up and I'll show you—I just did this yesterday. Oh, you know what we're working on? This is cool. You remember the Einstein general relativity experiment?

GAINOR: Yes.

VILLARD: Well, we repeated it beyond the solar system. This is the Einstein one, where the sun and the eclipse and all that business. But we looked at a white dwarf, and the white dwarf displaced the background star's position due to general relativity. Hubble has resolution to do that, and so it'll be a fun story.

So this is how I track it through news services, this is how I track coverage of—and again, it's number of stories in the vertical column. And I'm just looking what got attention, what didn't get attention. Putting out a picture of Aurora on Jupiter, and then the coverage of Juno probe—

people kept talking about Hubble. So, this was our picture; this was the Juno mission [to Jupiter]. So just this, this measures how often is Hubble measured, how often is Hubble mentioned in the press?

So, Chris, that was our biggest story of the year. It's not the ground-breaking science, but it is planets, and it's a mission to a planet, and it's Hubble's supporting role. Clearly Europa because it is a planetary body with astrobiology. It was a huge story. The one that we did a couple weeks ago, there were ten times as many—that went everywhere.

That's another long story. The nearby exoplanets that we probed? At about the same time, the new Kepler Catalogue came out, so I think these data are intertwined. And of course, anything that's superlative, so, what was then the farthest galaxy, and what was then the brightest supernova. These are the biggest bites and these are other news stories. So, what I'm looking at is what got people excited? Scientifically, this was a big deal. Scientifically, that was a big deal. Actually, that's a big deal. The Aurora was not a big deal, but people got excited about it. It opened the door to curiosity. I tracked this, and that gives me kind of a feel for what I think will work and what will not work.

GAINOR: Now, on the other side of the coin, you've occasionally been accused of overselling things.

VILLARD: Yeah.

GAINOR: Not you, personally, but generally.

VILLARD: And without getting defensive for a minute, we have never oversold anything. And I would be the first to admit, if I thought that were the case. But like I said, the big thing to me is credibility. Let me explain to you the most legendary story of oversell. So, back in the (I forget the year, probably '97, but you can look it up) Bob [Robert] Williams forwards me an email from Susan Terebey, who's a young researcher. She told him that she thinks Hubble photographed an extrasolar planet, which for the mid-90s would have been incredible news. And I was very skeptical. She's going to present it at the summer AAS meeting of that year (and I think it was '96). There's a little arc in the picture, there's a little bright thing, and there's a star.

GAINOR: Yeah.

VILLARD: . So Weiler said, "Maran's not getting this." Now, again, it was unpublished. It's okay to put out unpublished work at the AAS, because it's work in progress. But then Weiler made a big deal when we did pull the story together. It was a huge story. When we did pull the story together, Weiler had an introduction in the televised Space Science Update, and he said, "You know, this is so important, we did our own *internal* scientific peer review." And that statement got everybody mad. I think *Nature* wrote something where they lambasted it. Anyway, it was a huge story. He pre-empted the AAS. But we were, tarred and feathered for putting out something without peer review. [Release date: May 28, 1998]

About six months later, her paper, in fact, was refereed successfully and published, and the reviewers thought the hypothesis, which was a little clunky, is that this planet was ejected and that somehow it did make this tunnel through the nebula, that you see is a thing. It's kind of ad hoc. It was accepted research, but I think that's considered the most glaring sample of us overstating,

or hyping, and again, it was offered to Headquarters. And a friend of hers was Anne Kinney, who was involved with Weiler. Anne Kinney pushed this really hard, I think to showcase the young researcher.

I'll be perfectly honest, Chris, I am pragmatic. If it's a good story, it's a good story, but there's no motivation to sell the telescope. My motivation is if I can find some really cool discoveries that tell me something about the universe that we don't know about, I feel obligated to do that. But there is a stereotype that if you have a PR [public relations] office—and we're not. You can call it PR, but I treat it as a science communication office. And a PR office will go out of its way to make something more than it is. We have never, ever consciously done that.

GAINOR: I was surprised. A few months ago, I was going through all the stuff that *Sky and Telescope* had about Hubble, and I forget when this was; this is at least 15 years ago. There's a letter from my friend John Hutchings complaining about something being overhyped. [Letter in November 1999 S&T complained about an S&T article's characterization of HST role in Quasar discovery].

VILLARD: I remember the name.

GAINOR: And he was like the chair of STUC [Space Telescope Users Committee. Like, he's no disgruntled outsider. I haven't talked to him about that letter yet. But he's from the DAO [Dominion Astrophysical Observatory].

VILLARD: I wouldn't even call him disgruntled. The act of simplification may make something

look like it's inaccurate.

GAINOR: Yeah, and that's always a struggle.

VILLARD: But to me, it's credibility. If we start putting out stuff that goes way over. You can argue with the Terebey thing; there was no proper motion. It could have been a projection effect. But statistically, they argued against it.

But the Terebey thing was funny, because a few years later she said that she made a mistake, and it was a background star. But there are papers now where this is considered some weird, anomalous thing, that's a companion to the star, with a very strange light curve. So, the object is still a mystery. But to claim you have the first image of a solar planet is a big freaking claim.

GAINOR: Right.

VILLARD: But we were running so hot with Hubble news, we figured, hey, in every place we saw something new. So, yeah, Hubble can see extrasolar planets.

There have been other things where people have complained, but I think it gets into the eye of the beholder, it's the perception, in the act of simplification. In the mind of a scientist, it's the issue of accuracy *versus* precision. But you can really get into the weeds when it comes to precision. But is the basic story correct? And I consider myself my own worst critic. I'm very worried, I ask all the hard questions, and I wasn't that convinced about the Terebey thing, but everybody else got on the bandwagon: "This is great. We're doing this." Space Science Update, and Steve Maran is not getting that story.

There is one we had, and this is a minor thing, because nobody ever made a big deal out of it. We got a picture of Lagoon Nebula, and the researcher called the structure a twister. Now, there was no dynamic information that it said it was actually acting like a tornado, but she hypothesized that it was.

We got yelled at for that. But then again, that came from the researcher. And, in terms of NASA, the one story that we should not have been picked on, and again, this was Ed Weiler. In 1995 we were at the winter AAS meeting, John Bahcall came down to the press room , and said he found "naked quasars." In other words a quasar is embedded in the center of a galaxy, because it is the central black hole. And Hubble had imaged these in the mid-90s. But Bahcall, in one of his programs claimed that he found quasars without any accompanying nebulosity. So he gave a talk here a month before the AAS. I sat through the talk and when I came out of the talk everybody was scratching their head, and I said, "Oh, John did not convince us."

But at AAS, he went to Ed Weiler, and said, "I'm going to be announcing tomorrow, naked quasars." And Ed's like, "Oh, there's no way. Well, if you're going to be announcing it, we have to do a press release." And he ran to Steve Maran, in this case. They scheduled an impromptu press conference, and I worked overnight to write the press release. We ran to Kinko's to get hard copy photos. And this news item was done overnight. [HST Release, Jan. 11, 1995] And it was presented at the AAS; there was news coverage of naked quasars. Dead wrong. It was not a refereed work.

Now a lot of people pick on NASA, and I've defended NASA to the jeers of some of the audience at this one meeting on science visualization at MIT [Massachusetts Institute of Technology]. I thought they did a good job with possible biotracers in the Martian meteorite [ALH84001 in 1996], in that the paper was coming out, and the scientists laid out the case for it.

NASA said it was suggestive. They had a critic on the panel that said, "You know it's interesting stuff, but I don't believe it." And I thought NASA handled that very well, but again the astronomy community picked on it for years. They accused NASA of hyping it. And in my opinion NASA did not hype that at all. They were obligated to report on the paper, and I think they showed appropriate caution.

GAINOR: Now these stats on things. Do you know, like the average member of the public, who wants to look all this stuff up? How often do they go to the NASA site, say, as opposed to the Hubble site?

VILLARD: That's a good question. We have numbers here, but I don't have numbers on the NASA site. We get a big bunch of traffic. I don't know how that balances out with NASA. But our site is a highly visible, trusted site.

GAINOR: Right. Did you have any adventures during the Servicing Mission 4 cancellation era?

VILLARD: That's a really good question. You know, I'm the first one who found out about it.

GAINOR: [laughs] Okay.

VILLARD: I am. I was up late at night, and I was going through some news stories, and the Washington Post's science reporter Kathy Sawyer wrote a story about the Hubble servicing. And I sent that to Steve Beckwith the next day, and he's like, "What?" So, it caught everybody by

surprise.

GAINOR: I met him about a month ago. I was down in California.

VILLARD: Okay. Did he tell you a similar story?

GAINOR: Yeah.

VILLARD: They tried to keep us isolated. It would be terrible if it looked like the news office was propaganda arm of the director here.

GAINOR: Yeah. And weren't you one of the first people phoned by the media when that came out? I think you had to do some tap dancing.

VILLARD: I don't remember. I do remember the spherical aberration. I had to do a lot of tap dancing. I had no warning on the aberration. I told the NTY [*New York Times*], "Of course, we're disappointed." [laughter]

GAINOR: That's right. I got it mixed up with aberration.

VILLARD: So, Steve was good. He was doing all kinds of politicking. We stayed squeaky clean in terms of looking like we were not going to propagandize, promote Servicing Mission 4.

GAINOR: And that reminds me, I was going to ask you about your most nervous moment in a servicing mission.

VILLARD: Oh, I can tell you that, it was the most nervous moment in my entire tenure here, which is thirty years now. So we're down in Houston [Texas] and having trouble with that bolt.

GAINOR: This is Servicing Mission 4.

VILLARD: Yeah.

GAINOR: It wasn't Servicing Mission 1; we're talking Servicing Mission 4.

VILLARD: No, no heart stop. Servicing Mission 4 was the heart stop, because that bolt holding the WFPC2 [Wide Field and Planetary Camera 2] in place wouldn't turn. And it's something you can identify with. We all do home projects and you got a stuck bolt, and things could really go bad.

GAINOR: Yeah. And this is to get WFPC 2 out.

VILLARD: Yeah, I think it had been over-torqued. Story [Musgrave] should have been able to tell you all about that. I think he over-torqued it. Anyway, it wasn't moving, and as I remember, Mission Control said, "We'll take off the torque limits; just do it as hard as you can." And the astronauts were like, "Excuse me?" And they're like, I'm paraphrasing, if it breaks, it breaks. But it's all we can do at this point. If the bolt won't turn, we're going to have to over-torque it.

Now, one of my favorite curmudgeons on this project was Rob Navias [NASA Johnson Space Center Public Affairs Office]. Rob has a face for radio. [chuckles] He was walking back and forth with his authoritative radio voice, going, "Yup, end of mission. This is end of mission. This is it. The camera's not going to come out." Now you've got a huge PR disaster, right?

GAINOR: No more pictures, basically.

VILLARD: Well, see, you keep the WFPC 2, but the whole idea is that you're going to replace it. The whole idea of the servicing mission was that you had this new camera that was going to give even better pictures, in infrared and to say that they went up to the Hubble, the bolt broke, and they brought the new camera back would be—first, it would reinforce the idea that Hubble was really aging. Pieces were breaking; you can't even loosen a bolt. But my heart was thumping. That was the scariest. And we did some video. Fortunately, you can find it online. Our Hubble video was called Access Hubble. I had my video producer back in the flight ops, where all the Goddard people were, you know supervising all the work on the telescope, and so she's got footage of their faces, and it's like a funeral. And then I just got the video of Dave [David S.] Leckrone raising his hand in angst, that's the scariest moment because I thought it was going to break and just kiss it off. No more servicing missions. No nothing. And then of course, they said, "Oh, the bolt is turning!" But that doesn't mean anything. All that means is that the linkage might have broken.

During Hubble's 1990 deployment there was trouble with the solar arrays unfurling like pulling down a window shade. That was very scary. The Discovery [Space Shuttle] astronauts suited up to go EVA [extravehicular activity] and hand-crank the solar arrays open. Fortunately it turned out to be a software glitch on the deployment limiting sensors that was quickly corrected in

real-time. The solar array problem got me very scared.

Then after launch, every time the telescope twitched, it would be big news. The vibration was from thermal stress going in and out of shadow along the orbit.

GAINOR: The jitter.

VILLARD: I'll tell you a funny anecdote about that. And if I've told you before, I'll stop. But, so one night, somebody called here, and they got the front desk, and there was a reception that night, it was a caterer down in the cafeteria. And what the caller said, "I want to talk to somebody about Hubble."

And the guard said, "Really, it's after hours. Nobody's here."

"Well, I just had a really simple question. What about the gyros?"

And the guard said, "I don't think they're serving those tonight."

GAINOR: [laughs]

VILLARD: We planned the early release program. Remember, the early release program was something scuttled at launch. Eric Chaisson talks about that. John Bahcall screamed and wagged his finger at Eric Chaisson: "I'll kill you if you look at that." I would have never believed that mild-mannered Bahcall would ever do that if I hadn't witnessed it. I later hear that in another meeting that he put his fist through the plate glass on an overhead projector.

But we did plan here, an early release program, and the scientist that I worked with was Bill [William B.] Sparks, who did the research on Europa. And he said, "You know, we should

look at some of these targets. We need to look at some of these targets now, so we get a before and after."

So, we looked at the core of M [Messier]-100 [spiral galaxy]. And to me, it didn't look bad. I hope the repair looks a lot better! Of course, there was a world of difference. And that was funny. And then Senator Mikulski went to Goddard to declare success. So, I sat up, I made a bunch of pictures on foam core that she could hold up. I wrote a little caption on the backs. Sat over my dining room table. So I was her little caption god. Of course, she called it the Wild Field Planetary Camera. [laughs] She had me scared. When she gave a talk to the staff after the O'Keefe thing, she was very sober. And I think we all thought that it was the end of the road for any more visits to Hubble. She was very sober. She said, "Look, it's a Republican Congress." She said, "I'm just going to do the best I can. This is too expensive an instrument just to let it go. I want a second opinion." All that stuff. And I'll tell you a funny story about that. Joe [Joseph N.] Tatarewicz, was the—you must have heard his name.

GAINOR: Oh, yes. Absolutely.

VILLARD: Okay, so Joe came to me, after the O'Keefe cancellation. You know, the O'Keefe thing was like a death in the family. So, Joe came to me and he goes, "This telescope has been near death so many times," he says, "don't think it's over. Hubble has a history of bouncing back from the dead." And I thought he was just being kind. He was just trying to soften the blow. I was totally convinced, given [George W.] Bush and the whole Republican thing, but Joe was right. Due to all the politics and getting the new administrator.

GAINOR: So, you interact with the public. What's the kookiest that you've come up against?

VILLARD: Oh. There're are lots of them. I get a lot of theories. And it's all based on theoreticians, and a lot of them are based on some sort of fluid dynamics, or pressure. So my joke is that they write me and say, "Either the universe sucks or blows."

GAINOR: [laughs]

VILLARD: But the funniest guy, a guy from Israel kept writing me, and (actually, I've got two examples). A guy from Israel kept writing me. He wanted to look at the sun with Hubble. And I said, "Sir, you don't understand; we would turn a $2 billion telescope into a $2 billion solar collector." Just "No, no, no!" He was, at first, "Oh no, no, no, no, no. You put a piece of glass. You look through a piece of glass."

But the strangest guy was from Chicago area who has sent me tons of stuff. And he would make little origami things. He'd do cutesy things, but his whole thing was, "I am the discoverer of the center of the universe. So, every Hubble result he would say, "it supports my theory." And what I thought was funny about Mr. Sven was, we're not at the center. We're near it, but we're not quite there. Did not understand his thinking about this. And he would build these things, and he would say, "cc: Bill Clinton, The White House." And I'm like am I going to get on some list, because they're getting crank emails where this guy is writing to the Institute? But he was persistent for years.

I'll tell you the scariest thing about that. He actually came here for a meeting. He was in the building and trying to find me, and I said, "Look, tell him I'm not here." But we don't, we

don't turn anybody away from these meetings. He came, paid a registration fee and he sat through the meeting. But to make a long story short, after that meeting, one of the nights I had an evening class for Hopkins people in the auditorium, and, and so he was in the front row with a dozen questions. And I didn't recognize him. I didn't recognize that he wasn't with my class. And I'm like, "Wow, this guy is really smart."

And he comes up to me and [introduces himself.]

I'm like, "Oh no!" He starts getting into his physics. I said, "Look. I am not an astrophysicist. I just write about this stuff."

"Well, that's what I want. You can write about all my scientific research."

So, I've got this weird little fantasy that he is an eccentric millionaire. And in his will, he'll say, "I leave my papers to Dr. Villard, and a couple million dollars to publicize my research now that I'm gone." That's my fantasy. So, the center of the universe, and you want to look at the sun.

GAINOR: A lot of people have a lot of trouble wrapping their minds around the center of the universe, or the lack thereof.

VILLARD: Oh yeah, you've just got to give up all common sense when trying to figure out the universe in everyday terms.

GAINOR: We have all these cosmology lectures. There's always a question about that.

VILLARD: You know, I think it's a kid, but I may be wrong. This one person keeps emailing me,

and you know, I don't want to just blow somebody off. I was so mad at him this morning; my reply was in all caps.

GAINOR: Oh.

VILLARD: Because I lectured him, "You need to go to trusted sources on the internet." And he writes back this morning. I love this, he goes, "Is it true that we're having more solar eclipses now because the planet Nibiru is coming?"

GAINOR: The planet what?

VILLARD: Nibiru. That's a rogue planet. It's legendary. If you do a Google search, Nibiru. So, people take these stupid pictures, solar lens flares. I told him, "There is no such thing as Nibiru. Stop reading that junk. Nothing affects solar eclipses aside the geometry and dynamics." So, I try to be patient, but I emailed him.

But I will tell you, going back to Pillars of Creation. I got a call from a nurse in California, and she said, "I want to get a copy of that picture."

And I said, "Okay, I'm sure we've got a print we can send you."

She said, "Look, I could care less about astronomy. I don't follow astronomy." She said, "My husband subscribes to Astronomy Magazine." And she said, "I was flipping through it, and I saw that picture." She said, "It changed my life. It made everything else seem so trivial, just looking at that, and thinking about what's out there. It made all my other cares go away." And she was dead serious.

So, yes, that has a pseudo-spiritual, religious something. It's just that it's a very visceral picture.

GAINOR: All right. Anything you think that should be said that we haven't talked about?

VILLARD: The one thing I've been delighted to see over my tenure here is a culture change in the astronomy community. When I started here, it was a bunch of middle aged, and older, gray haired, male scientists. Now, some of them were really enthused, but others really looked down their nose and they always had allegations of hype, which, if I sincerely thought we hyped something, I'd be the first to admit it. But today's generation's young people, it's more diverse. A lot more female astronomers. And they love publicizing what they do. They're fun to talk with.

The other thing, too, when I joined the project, and thinking back to the Palomar telescope I just thought, we've got a cool telescope. You're going to get amazing pictures of galaxies, and our planets. I couldn't begin to imagine the kinds of things that the telescope would uncover. It is way beyond imagination.

So Hubble's road, and everything that's happened, humbles me. I was joking with somebody. When I come to work, I feel dumber, because somebody tells me about something new they saw. Every day! And it's been like that ever since the telescope went up. It's like, *really*? I never thought of that.

GAINOR: One thing I want to talk about in the book is just how astronomy has changed over the last twenty-five or so years. I mean, Hubble isn't the only thing driving that, but it's different people, as you say, and they're doing it in a different way. Those old, middle-aged guys you had

when you first walked in here, that's kind of where they came from, right? Like the Far Side cartoon, with the guy with the big beard, and all the data belonged to him and all that.

VILLARD: That's a key point. From the point of the public, well the internet in general, but for astronomy it's a democratization that pictures and information flow freely. But I will tell you a very funny thing, which I guess some people would call hype, but you know, the bigger you are, the harder you fall.

GAINOR: Yes.

VILLARD: You get people trying to rain on our parade, and the big thing is the colors are phony, for PR purposes. And that drives my friend, Zolt [Zoltan Levay], our imaging guy, crazy. And I'm like, you know, they're going to say that. That's just an urban legend.

GAINOR: Yeah, there was that *LA Times* thing. [In 2003]

VILLARD: Yes. And that *LA Times* thing was disgraceful. And I talked to the reporter about that. Her editors wanted an angle that said we played sneaky ways with this. She came here. Zolt showed her exactly how we do what we do. And the thing that really got me angry is back in the early 90s, Zolt and I said, "You and I need to write the definitive article on how we do image processing."

GAINOR: Which was in *Sky and Telescope*. [September 2002]

VILLARD: Yeah. And I handed that to her, and she plagiarized it. And you plagiarize it, and then you write something that says we're, ladi la, ladi ladi la. So, that article was disgraceful, and she was apologetic that her editors put pressure on it to put it in a more bad way, that we go out of our way to—and the irony with that is Zolt is religious about giving respect to the quality of data. Any joker with photoshop could pull these pictures and do all kinds of stupid stuff, and I've seen other observatories do stuff like that.

But one thing I'm very proud of, we had a sanctity to how we do these things. Now, that said, I will confess, during one of the early release programs—I think it was in 2002—we photographed the Cone Nebula. I think it was the Cone Nebula, and we were just playing with colors. It's hydrogen emission. And we played those, so you could focus on the green emission, or more likely the pinkish emission. So, the reporter called me, and I was so pumped up on the success of that mission, I said, "Yeah, we looked at this picture; we turned it green, but that looked like puke. And then we decide to turn it red, and we thought that really worked." It sounded so crass. And I made some offhand comment about NASA, and I was very embarrassed that it got printed. And it looked a little cavalier. But you know, I was being a little over-confident, and a little cocky. Thankfully NASA didn't get horribly upset.

I think it's been a struggle, and this is going to sound self-serving. I don't mean to sound like that. But I do take pride in trying to shepherd this story telling through all these years, trying to find that balance between what is exciting and engaging. And I've been told more than once, "What are you? Crazy?" But to package something, this comes from my Planetarium, Astronomy Magazine film background, to make something exciting and engaging. It doesn't make any difference how accurate it is if nobody pays attention. And I was told this by a Pulitzer prize

winning writer for the *Baltimore Sun*, Jon Franklin, many years ago.

Actually, I'll tell you, this is a great anecdote. You know how this came up? So, he came to visit when Eric Chaisson was here. And I'm sorry, but many of the astronomers are one-dimensional, because they are obsessed with accuracy and precision. And I was the news deputy at the time. Well, we were in the STScI lunchroom, and Chaisson was pounding on the table. Chaisson's going, "We make sure things are accurate. You've got to be accurate."

GAINOR: Okay.

And Jon looked at me like, "What?" And then Jon looked at Chaisson and says, "It doesn't make any difference how accurate it is if nobody reads it." And so, that's been my mantra. And there's one from Carl Sagan. (This was about the Super Colliding Super Conductor) "If you're asking the public for billions of dollars for a device of no practical value, you sure as hell better go out of your way with colorful writing and nascent graphics." I could frame that and put it up on the wall.

So, I'm proud that I think I have shepherded this through, and you know, been a pivotal role in going through all the crazy steps and the craziness from everybody involved in this process. I think somebody different in this job may not have done as well. And I can imagine there are people who might have been even more effective. But if you put more of the hard-core scientist type in here, I think their conservatism would kind of suck the imagination out of some of the stuff we've done.

And that's what I'm very proud of. I think I've held onto my childlike enthusiasm, and just relentlessly push ahead with good stories, and maybe I've been a little cavalier about what I

think it takes to make a good story.

GAINOR: Okay. Well, thanks very much.

VILLARD: Okay!

[*End of recording*]