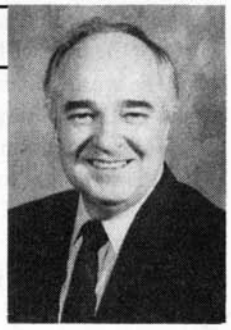
Interview: Fred Wojtalik



Problem with Space Telescope's mirrors remains a mystery

As EIR *reported last week in our Science & Technology section, the media and some politicians have gone way out on a limb, in their pronouncements about the flaws in the mirror system of the Hubble Space Telescope. Space scientists are still sorting through voluminous data to find out what went wrong, and most are confident that, despite the setback that the malfunction represents, the Hubble can still be made to function adequately, and will yield much valuable scientific information.*

Fred Wojtalik is Space Telescope Project Manager at the Marshall Space Flight Center in Huntsville, Alabama. He was reached at the Hubble Control Center, Goddard Space Flight Center, Greenbelt, Maryland on July 3, by David Cherry of 21st Century Science & Technology.

Q: Is it true that the exact amount of spherical aberration in the mirror system is not yet known?
Wojtalik: Yes. We are working on determining that right now, but we also have other aberrations—a little bit of coma and astigmatism—that we are also working to correct.

Q: To get rid of coma and astigmatism, do you change the tilt of the secondary mirror, to make it more perfectly parallel to the primary?
Wojtalik: Yes. We can move on two axes and any angle to those axes. We have actuators on the secondary mirror. So you are tilting the mirror, not moving it forward or backward as you do for focus.

Q: When do you expect to have the final measure of how much spherical aberration there is?
Wojtalik: We are currently generating data in that regard, but we expect that we will be done with correcting the other two aberrations by the middle of July. Sometimes we are not completely successful in the uplinking of commands, and so this estimate is based on the assumption of a relatively successful overall operation. Our current estimate is that we should be done with all of the secondary mirror motions by the middle of July.

Q: Do you have any experience as a manager in the business of designing a mirror and seeing it go from specs to construction?
Wojtalik: No, I don't. I am an electrical engineer by trade, and I have been in the management field for 15 years or so. I know enough about optical manufacturing to ask good questions, but I am not an optical engineer.

Q: Do you know how many people would be involved in arriving at specs?
Wojtalik: Marshall Space Flight Center identified the overall specifications for that particular mirror system. It had to be a certain size to fit into the Space Shuttle. It was going to be a Ritchey-Chretien optical system, and there are other requirements such as reflectivity. Once those requirements are established, an optical engineer can then design the curvature of the mirrors—the prescription. There were probably about five people who were very intimately involved in it.

In the production phase, I am told NASA had at peak about 50 people at Perkin-Elmer [former name of Hughes Danbury Optical Systems—ed.]. There are machines designed to rough-grind to the prescription, and then there is fine-grinding and polishing. All along you are doing metrology, a measurement technique to determine precisely the figure of the mirror. When you decide that you've got the figure right, the mirror goes into the coating process to put a reflective coating on it, and an overcoat of magnesium fluoride.

While those steps need to be done by people who know what they are doing—and we believed and still believe we had such people—these are all rather straightforward steps. Everything in this program was pretty much wide open to a lot of people, and I believe everybody who looked at how things were done did not see any fault at that time in what was done.

We currently do not, and I need to stress this, do not understand where the fault actually lies. Our indications are that it is in the Optical Telescope Assembly, but as far as precisely the source of it, we haven't got that nailed down yet.

Q: Let's come back to the formulation of the prescription. The numerical values that were necessary to specify curvature for each of the Space Telescope's mirrors—were they

formulated by Perkin-Elmer people, or by Marshall people?
Wojtalik: Marshall gave the requirements in the contract, and they were then converted by Perkin-Elmer, but were cross-checked by several different organizations including Marshall. Those equations still exist. They are going to be looked at again now—several times, I am sure. But I personally do not think they are in error. They were done meticulously by good people.

Q: Let's think for a moment about the hypotheses that might arise if it turns out that those mirrors was specified correctly and ground to specs. Is there any way in which the large primary mirror, if correct, could have changed shape while waiting eight years on the ground?
Wojtalik: You've got me into the realm of speculation. I really don't want to get in there. I personally don't think that would have happened in that amount of time. We have a very uniform spherical aberration, and I would have a hard time believing that any such process would be all that uniform.

Q: But gravity is uniform. Do you happen to know whether, during storage—all the time the primary mirror had to wait—was it sitting in the Optical Telescope Assembly or was it sitting fully supported on the ground?
Wojtalik: When I got into the program, it had been in various positions at Perkin-Elmer waiting to be put into the Optical Telescope Assembly. When it was delivered to Lockheed, and started to get integrated into the vehicle, about 1984, it mostly sat in one orientation—the vertical. That would be from 1984 until we moved it out of there in late 1989. By vertical, I mean the shiny surface is up—the axis is vertical.

The only times that it wasn't in that position were when we were taking it to acoustic testing, thermal vacuum testing, and prior to shipment. Maybe three-quarters of a year all told it was in the horizontal position.

Q: Once the mirror is mounted in the Optical Telescope Assembly, it is no longer everywhere supported, but only supported at certain points on its periphery, is that correct?
Wojtalik: That's correct.

Q: And when did it get mounted?
Wojtalik: It got mounted, I would suspect, sometime in 1983. It was delivered to Lockheed in 1984.

Q: Once it is mounted, and hence not everywhere supported, you cannot expect a uniform deformation from gravity?
Wojtalik: That would be my assumption. It's my personal opinion that it is not deformed from being on the ground for some length of time. And I am not sure either mirror *is* deformed, let me make that clear. So we have a mystery on our hands. But we do know we have some spherical aberration, the exact amount is not known yet.

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