



Directors' Dialogue

Q: For months now, my friends and I have watched with dismay as the trees behind Building 28 were felled. Now we see what appears to be a road leading to the Perimeter Road. What's happening that's cost us so much of the wonderful green space that the Center once had in this area? We certainly hope that the Perimeter Road, which is enjoyed by so many walkers and runners, is not about to become a thoroughfare.

A: The extension of the Northern Loop Road is necessary to alleviate traffic pattern inadequacies. With the gradual increase in Center population as evidenced by the addition of the Customer Data Operations Facility to Building 28, the construction of the Spacecraft Systems Development and Integration Facility, Building 29, and the additions to Buildings 4, 5, and 10, we are trying to provide the infrastructure to keep up with the increased population and demand. The woody area along the Perimeter Road itself is not significantly jeopardized by this construction activity. The loss of trees is an unfortunate but necessary manifestation of Goddard's need to accommodate the overall program growth.

Sherry Foster, Director
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Goddard's "Satellite Doctor" Does it Again

by Susie Marucci

Henry Hoffman believes in Santa Claus. He has good reason -- he spent most of the weeks in late November and early December telling anyone who would listen, that Santa Claus was going to bring a very special present around Christmastime, 40 million miles out in space, and the problem plaguing the Ulysses spacecraft would disappear. It did, eight days before Christmas.

On November 11, 1990 -- about four weeks after the Space Shuttle Discovery was launched carrying Ulysses -- a long boom antenna, used for an experiment that measures electronic fields in space, was deployed from the spacecraft and the trouble began. Within hours the joint European Space Agency (ESA)/NASA spacecraft designed to study the polar regions of the Sun developed a wobble. Hoffman, Code 712, head of the Guidance and Control Branch, described the problem as similar to a feature in a child's toy. "If you've ever spun a top and touched it, it wobbles." That wobbling is called nutation. No one knew exactly what was causing the nutation, but it was getting worse. It was not known if the spacecraft was in danger, but it rocked so strongly, that the X-band antenna, the one relaying information back to Earth, was not usable.

Frank Carr, deputy director, Solar Systems Explorations (Code EL), NASA Headquarters, called Hoffman shortly after the problem began and asked for his help. Based on phone conversations with people at ESA in Noordwijk, The Netherlands, and NASA's Jet Propulsion Laboratory (JPL), Pasadena, CA, Hoffman thought the problem was caused by the boom antenna. "Since it was quiet for four weeks, then four hours after you put out the boom its in trouble, that doesn't prove the boom caused the problem, but circumstantial evidence is pretty strong," said Hoffman. Hoffman was convinced very early on, and later was proved right, that the culprit in this case is the Sun reacting on the long boom. In order for the nutation to be thermally induced, the antenna must have the proper angle to the Sun and must have sufficient sunlight to heat up the boom. The spacecraft must also have a slight movement to it already, a little motion to get the nutation started. Thermally induced nutation is not a very common problem, but it has occurred before, and Hoffman concluded that it was the offender. His theory was not immediately accepted by anyone. But Hoffman remembered back

to when the Small Scientific Satellite (S³) was in orbit, almost 20 years ago. It suffered from a similar problem.

The more Hoffman looked at the data, the more he was sure he understood the Ulysses problem. Soon, he was briefing NASA Administrator Richard Truly and telling people world-wide on the weekly Ulysses teleconferences that the problem would disappear before Christmas. The location of the Sun and the angle of sunlight on the long boom were changing and the nutation would be reduced and finally stop. When pressed for a date, by the NASA Headquarters program manager, Hoffman said the nutation would disappear December 17. The nutation disappeared one hour before midnight on December 17, Greenwich Mean Time.

Hoffman says the success in quickly defining the problem was because he had a good team working with him: Dr. Tom Flatley, Code 712.3, developed the equations of motion defining how the nutation would occur and Sam Placanica, Code 712.3, generated the computer curves, showing the possible problems for Ulysses in the future.

There are two potential times for problems with Ulysses remaining, both of them at the most critical times of Ulysses' mission -- when it will pass under the South Pole and over the North Pole of the Sun -- around September 1994 and August 1995.

In February and March of this year there was another potential problem period for Ulysses. But the project, when moving the spacecraft tried to be very careful not to induce nutation. It did not reoccur. That's good news, but Hoffman was hoping to see the nutation again, in order to better predict the behavior of Ulysses during the two periods of prime science in 1994 and 1995. Hoffman says, "This opportunity has now been lost and we will not know if a potential problem exists until after the fact."

Hoffman is not too worried about the Ulysses mission, because if all else fails, Ulysses can still send data to Earth by damping the nutation with Conscan. Conscan is a control technique on board Ulysses that can automatically track Earth and suppress the nutation. It cannot be used continuously because of fuel consumption, so the Conscan is only a last resort. Hoffman thinks Conscan can probably be used if required. But whether the nutation does reoccur and if it impacts on the mission is something we will now have to wait to 1994 to find out.

NASA Trivia

Space Shuttle missions use a curious numbering system. They are numbered STS (Space Transportation System) 1 through 9 then, mysteriously jump to STS 41B through STS 51L, then continue STS 26 through the current STS 39. Why?

Trivia Answer
They were numbered 1 through 9 for the first nine missions, then, when it was thought that Vandenberg Air Force Base might be used as a launch site in addition to KSC, a new numbering system was adopted. The new system used the last number of the year, followed by a 1 to indicate launch from Kennedy Space Center or a 2 to indicate launch from Vandenberg, followed by the letter that sequenced the mission for that year. For example, mission 41B was the second mission planned for 1984 and was designated to launch from KSC. This system was abandoned for return to flight when it became clear that Vandenberg would not launch the space shuttle.