

Wednesday, February 11, 2004

UMBRAS: Umbral Missions Blocking Radiating Astronomical Sources

Project goal:

To study planets around stars other than the sun by using an occulter external to the telescope, enabling the telescope to directly observe the faint speck of a planet nestled deep in the light of its home star.

UMBRAS is an acronym, but it's also a derived word. We wanted our mission name to suggest "umbra", the darkest part of the Moon's shadow during a total eclipse of the Sun. An umbral shadow is the place you want to be to study the faint corona that surrounds the Sun, or to find faint comets near the Sun. Or to study faint planets near their parent stars.

Project history:

The UMBRAS project began in spring of 1998. Planning for the Next Generation Space Telescope (NGST) was going strong. The Space Telescope Science Institute (STScI), which operates the Hubble Space Telescope for NASA, had announced a symposium to discuss innovative science ideas for NGST. Al Schultz and Ian Jordan were tossing around ideas for NGST at dinner one night.

Less than 3 years earlier, planets had been discovered around stars other than our Sun. Al wondered if there might be a way to enable NGST to study these new objects. Astronomers have long used the chance occultation of a star by the Moon or by asteroids to help them study fainter companions to the distant stars. These events are rare, and depend entirely on having an asteroid in the right place at the right time. But if you could somehow fly an asteroid to the right place, you could get the benefits of an occultation any time you wanted one.

Al suggested an external occulter as a way to let NGST study planets around other stars.

Ian said, "That can't work, and I'll prove it!"

Al and Ian brought the idea to a few co-workers at the STScI. We all kibbitzed and criticized and suggested alternatives. Ian kept finding ways to do what he thought couldn't be done, and in April 1998 Al presented the basic idea at the Innovative Science for NGST symposium.

Over the years, we have studied and worked, mostly on our own time and our own dime. The idea has taken on form and substance. We have scoped out designs for the occulter, the space-based telescope, and the techniques needed to coax two independent spacecraft, flying ten thousand miles apart, to work together to observe a faint speck of a planet nestled deep in the

light of it's home star.

Several optics specialists from Goddard Space Flight Center have joined the effort, and some work has been done by associates from Al's time as a professor at the University of Nevada Reno. We've written papers and gone to conferences, and proposed for real money to help us better study the idea (but we haven't gotten any yet). And Ian still hasn't proved that it can't work.

In September 2003 we wondered if it would be possible to test the concept on the ground. Ian figured out how to scale the system for a ground test and identified a star that we could use: Polaris and its faint companion Polaris B. Stumbling block: none of us had a telescope, or a camera, or a home workshop, or access to a dark site where we could set up a test. Ian floated the idea past some friends at the Naval Observatory, but they didn't bite. Mark talked to friends in the Westminster Astronomical Society to see if they might be interested in helping out - score!

On January 4 2004, UMBRAS met with WAS to scope out the work. In a few short weeks, the WAS has found cameras, surveyed a site, and built the 3 special instruments needed for the test: a telescope mask, an occulting mask in a light shield box, and an adjustable flat mirror.

On February 11, we'll set up the equipment for the first time. Then begins the tweaking phase.

Our first goal:

get a picture with Polaris behind the occulter. If Polaris B shows up in the image, then we'll have proven that the basic concept works. After that, the work really begins!

11 February 2004, Helen Hart

The UMBRAS core group:

Al Schultz
Ian Jordan
Helen Hart
Mark Kochte
Dorothy Fraquelli

All of us are employed by Computer Sciences Corporation Science Programs, for HST Operations at Space Telescope Science Institute (Al, Ian, Mark, Dorothy) and for FUSE Operations at the Johns Hopkins University (Helen).

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umbra - the conical shadow projected from a planet or satellite on the side opposite the Sun (or star), within which a spectator sees no portion of the sun's (star's) disk.

WAS - Westminster Astronomical Society, Inc.

HST - Hubble Space Telescope

STScI - Space Telescope Science Institute

FUSE - Far Ultraviolet Spectroscopic Explorer

JHU - the Johns Hopkins University

NGST - the Next Generation Space Telescope, recently renamed the
JWST, or James Webb Space Telescope

NASA - National Aeronautics and Space Administration