Eyes on the Sky

Penn State researchers look to unlock the mystery of gamma ray bursts—and possibly the universe itself.

By DAN MORRELL

HIDDEN BEHIND A COUPLE OF CAR DEALERships in a nondescript two-story beige building in a nondescript office park a few miles from the University Park campus, John Nousek commands the controls of a $250 million machine that could solve one of the most important astronomical puzzles of the century.

Nousek, a Penn State professor of astronomy and astrophysics, is the mission director for NASA's Swift satellite mission, a project launched from Cape Canaveral in November. Swift's goal is to collect data from gamma ray bursts, large flashes of radiation that many scientists theorize represent the birth of black holes. The collapse of supernovas, stars many times larger than our sun, form black holes, and in the process, produce gamma ray bursts as something of a dying gasp. The force created by these bursts is hard to calculate in Earthly terms, but compared to the energy of an atomic bomb, a gamma ray burst trumps it by more than a trillion times.

The satellite's daily passes—the brief periods during which it transmits data back to Earth—create a bit of a frenzy here at mission control in State College. As Swift finishes relaying its info to a tracking station in Malindi, Kenya, a ▸▸

Photograph by AP/BOEING, CARLETON BAILIE crew sits glued to banks of ordinary-looking PCs in a busy room that could be mistaken for a Wall Street office if not for the casual attire. A dry-erase board on the wall notes daily successes under the heading of MAL (for Malindi): Passes 9, Good 8.

A couple of doors down the hall, a large projection screen tracks Swift, which is finishing its pass over the east coast of Africa and heading over Madagascar. It's another successful transmission, and there is a general exhale. "MAL: Passes 10, Good 9."

In addition to coordinating the data transfer from the satellite to State College, the team also manages the daily operations of the Swift: keeping the vessel on course and ensuring the onboard instruments and systems are functional. Even before the satellite launched, Penn State had invested years into developing the technology at work on the craft. Both the UV optical telescope and the X-ray telescope—two of the three major systems at work in the Swift—were developed by Penn State researchers in collaboration with Italian and British teams.

As of today, Day 12, Swift was only sending back what Nousek calls "housekeeping" info—data about the satellite's temperatures, voltages, and instruments on board. But Nousek expects that once the satellite begins to transmit data about gamma ray bursts, his team should see about two to three of these bursts a week, or more than 100 a year.

While the primary goal of the Swift mission is to study these bursts and determine their cause, Nousek knows that a clear view of astronomical phenomena that occurred billions of years ago can lead to much deeper revelations about the evolution of the universe. "For most gamma ray bursts, the light has been traveling for half the age of the universe, sometimes as much as 80 to 90 percent of the age of the universe before it gets to us," says Nousek. These lights from the universe's past—from as long ago as 15 billion years—offer researchers a look back in time.

"The hydrogen and helium were made during the Big Bang," says Nousek, "but everything else—and that includes the stuff people are made of: carbon, oxygen, nitrogen, iron—everything else has been made since then. And so, by studying that period of the universe, we might learn more about the processes of stars that gave rise to people being here."

"Here" for now is a plain beige building, where Nousek and his team watch carefully as both the past and the future unfold.