



## Swift Newsletter

Issue 1/ May 2005

### Welcome Message from P.I. Neil Gehrels



Swift Launch on November 20, 2004

I would like to personally welcome you to the first edition of the Swift Newsletter. We had an absolutely picture-perfect launch on November 20 of last year, thanks to the expert launch team at Kennedy Space Center, and also thanks to beautiful weather that finally rolled in after 4 hurricanes!

The job of the Swift observatory is to observe gamma-ray bursts (GRBs) - bright flashes of gamma rays that

occur randomly on the sky. Scientists have been detecting these short bursts of radiation since the 1960's, but much about them remains a mystery. It takes a spacecraft with rapid pointing capability to catch the fading x-ray and visible light following a GRB, and that is what Swift is all about. It is NASA's most dynamic space mission, pointing all over the sky with dozens of spacecraft slews every day.

Since launch, the first 4 months were spent turning the observatory on and calibrating the instruments. It has been delightful to see how well all the hardware is performing. After seven years of building this precision instrumentation, we all had our fingers crossed it would survive the launch intact - and it did. A huge effort by hundreds of people at NASA, industry, universities, government laboratories and foreign partners (see team list at [http://swift.gsfc.nasa.gov/docs/swift/about\\_swift/participants/](http://swift.gsfc.nasa.gov/docs/swift/about_swift/participants/)) made this all possible. The culmination of the work occurred April 5 when we opened our doors to the world astronomical community to use Swift data.

That is not to say that Swift has not studied GRBs before April. In fact, we have been slewing to bursts ever since late December. To date, Swift has observed 35 GRBs, at almost exactly the rate predicted ahead of time. Our beepers go off for each one and the team rushes to look at the new data.

The times are random, but it seems the beepers are always going off in the middle of the night! We will tell you about the new GRB discoveries in the next Newsletter, but a preview is that there is an amazing variety of bursts and that all aspects of them are showing surprises. In this issue you will see our results from a monstrously large flash of gamma-rays that Swift detected on December 27 - not from a GRB, but from a type of collapsed star called a magnetar.

Thanks for joining us in the adventure of discovery. We plan to have about four Newsletters per year. In the meantime, you can keep track of the Swift operations and science on the website: <http://swift.gsfc.nasa.gov/>.



### Swift Mission Operations Center

By: John Nousek

The [Swift Mission Operations Center](#) (MOC) is located in State College, PA; operated by the [Pennsylvania State University](#) on behalf of the Swift project led at [NASA's Goddard Space Flight Center \(GSFC\)](#). The MOC is responsible for safely operating Swift, and carrying out the program of discovery and follow-up of gamma-ray bursts (GRB).

Ever since 80 minutes after the Swift launch (when the satellite separated from the last stage of the rocket), total responsibility for commanding, monitoring and downloading data fell on the MOC. The MOC is only the centerpiece of a complex web of support provided by GSFC (which processes the downloaded data at the Swift Data Center), the Italian space agency (which provides the primary ground station at Malindi, Kenya), and an international team of scientists and engineers (who provide science analysis and engineering analysis from United Kingdom Data Center [[Univ. of Leicester](#) and the [Mullard Space Sciences Lab](#)] and the [Italian Data Center](#)).

Swift provides an unprecedented challenge for mission operations. The new GRBs are discovered completely randomly, and Swift must respond as quickly as possible. The initial reaction to new GRBs has frequently occurred





within less than two minutes! Even when satellites other than Swift are involved, Swift is able to respond to new GRBs (or even other Targets of Opportunity) with blinding speed. For the GRB 050408, Swift started to observe the target only 40 minutes after the burst was first seen by the [HETE-2 satellite](#).

Swift is also highly agile in making observations of bursts after they go off. The afterglow studies are planned and reviewed every working day, allowing us to make maximum use of new analysis results. In a single day Swift will conduct about 60 to 90 pointings on the sky. As a result, even though Swift is only in orbit for a little over 150 days, we have conducted more than 10,000 target acquisitions!

Through all the rapid and exciting discoveries (more than 30 new bursts, the last 20 with X-ray detections and 6 with ultraviolet/optical detections), and the work of turning on the satellite and instruments, we have kept to our schedule and made the full public release of data on April 5.

We all look forward to the continued excitement of the discovery of Swift bursts and afterglow followups. The Swift adventure has begun and we are starting to see the first sets of Swift results reaching the professional literature. It is truly exciting to stand at the verge of a new era, and it's a privilege to be part of Swift.



## Swift in the News

By: Lynn Cominsky

**1/5/05** Swift Turns On and Sees a Blast of Bursts. This HQ release announced the official first light of the BAT and the first X-ray afterglow.

**1/5/05** Swift X-ray Telescope Sees Its First Light and Captures Its First Gamma-Ray-Burst Afterglow. This Penn State release featured a beautiful "first light" image of the Cas A supernova remnant, obtained by the XRT.

**1/21/05** Swift Mission Images The Birth Of A Black Hole. This HQ release featured the first prompt x-ray detection of a burst in progress, indicating the birth of a black hole.

**2/1/05** Swift Sees Pinwheel Galaxy, Satellite Fully Operational. This Penn State release featured the first light of the UVOT as shown in a series of images of the spiral

galaxy M101 in six different wavelength bands of visible and ultra-violet light.

**2/18/05** - First NASA Science Update - NASA Observes One Of Brightest Cosmic Explosions (SGR 1806-20 flare) ([See article by David Palmer](#)). This televised event from NASA Headquarters featured David Palmer, Bryan Gaensler, Roger Blandford and Andy Fruchter, and was moderated by Michael Salamon.

**4/5/05** - Swift Mission Nabs Its First Distance Measurement to Star Explosion. The UVOT measured its first two redshifts in bursts detected on March 18 and 19. Redshifts are used by astronomers, together with a model of how the Universe is expanding, to determine the distance to the GRBs.

For links to all of these press releases and images, see: <http://swift.gsfc.nasa.gov/docs/swift/news/>



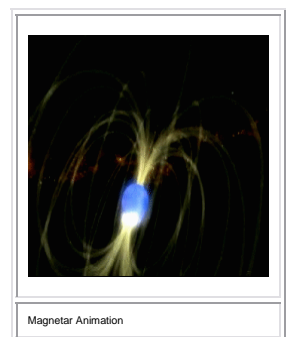
## A Whale of a Burst

By: David Palmer

So you're out on the water, whale-watching. You scan the horizon, searching for the tell-tale spout, and hold your binoculars ready for a closer view when you see one. And suddenly your whole boat is lifted into the air by a cloud of exhaled vapor as something surfaces beneath you.

That's how Swift must have felt last December 27th when it was hit from behind by the brightest flash of radiation ever seen from outside the solar system. The initial blast of gamma rays, even blocked by the spacecraft and shielding, was way more than the Burst Alert Telescope could count. For minutes afterward it saw a pattern of pulses repeating every eight seconds until this "tail emission" finally faded away.

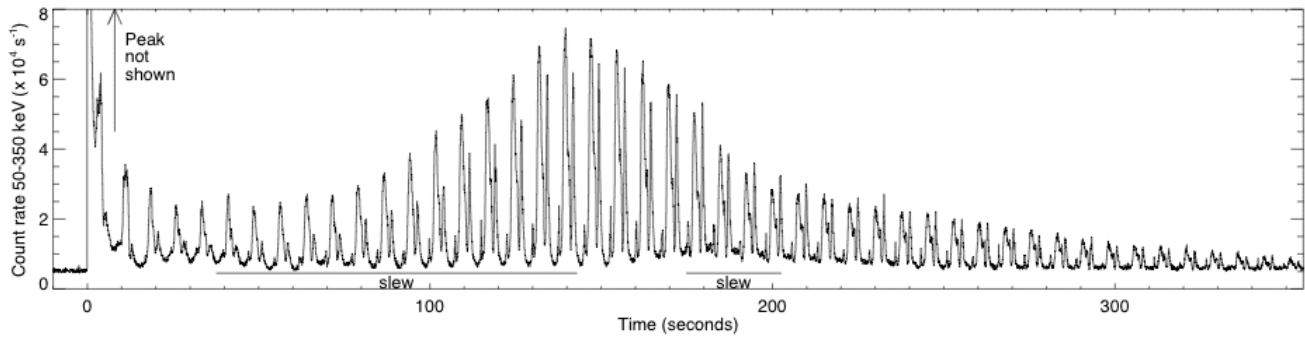
The source was a magnetar named SGR 1806-20. This is a neutron star with a magnetic field so powerful that it could erase credit cards from half the distance to the Moon. SGR 1806-20 lives 50,000 light years away, which may





seem like a long distance to you, but is in our own Galaxy, just beyond the center.

This information is quickly sent out to the community via the [Gamma Ray Burst Coordinates Network \(GCN\)](#). Within hours, more comprehensive data sets from the Swift



This is the light curve that BAT saw, showing how many gamma rays it counted in each sixteenth of a second during six minutes of observation. I didn't draw the main spike because it was 10,000 times as bright as the tail emission, and you would need a monitor a thousand feet tall to look at it.

From that close, it was like looking down the barrel of a dentist's X-ray machine. But if the same thing happened a hundred million light years away, the first tenth of second would look just like one of the shorter Gamma-ray Bursts that Swift is designed to look for. And at that distance, Swift could see the pulsing tail emission using the X-Ray Telescope, and it could see the galaxy that the SGR lives in with its Ultraviolet/Optical Telescope.

Some time in the next few months, we expect that Swift will see a short Gamma-Ray Burst, and look at it with its own "binoculars".

Will we see the tail of a distant whale, or will it be just a fluke?



## Swift Data Are Publicly Available (April, 2005)

By: Padi Boyd

On April 5th, 2005, the check-out phase of the Swift mission ended, and normal science operations began. From that moment on, all data taken by Swift have been available immediately to the community through the [Swift Data Center's Quicklook Facility](#) Goddard Space Flight Center as soon as they have been processed. This includes Swift's abbreviated alerts about a new GRB, the GRB position, and an image of the sky at the location of the GRB, all of which are relayed through satellites and beamed down to Earth.

instruments are received on the ground. Software then automatically runs on the raw data to produce standard astronomical files, including sky images, light curves, and spectra.

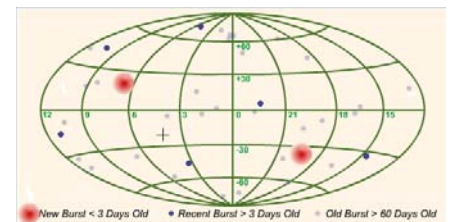
After about one week, the observations are transferred to the three Swift long-term archives, which opened on April 12th 2005. See the Swift Web site at <http://swift.gsfc.nasa.gov/> for information on Swift data and results, and instructions on how to analyze Swift data. The site also includes links to the Swift archives in the UK and Italy.



## Sites to See - Swift E/PO

By: Phil Plait

Swift has been detecting GRBs at a rate of about 2 per week. Have you wondered where on the sky those bursts have been? Then point your browser to <http://grb.sonoma.edu/>. [NASA Education and Public Outreach](#) (E/PO) Information Technology Consultant Tim Graves, with input from the other Swift E/PO professionals, has created this dynamic webpage which automatically plots the positions of the bursts detected by Swift, as well as those seen by HETE-2, INTEGRAL, and the Konus-WIND experiment.





The GRBs are plotted on an equatorial Aitoff map, with the newest bursts appearing as a flashing icon. There is a wealth of further information about each burst, including its position, burst time, constellation in which it lies, light curve, Digitized Sky Survey visible light images with the burst position marked, and a public-level write-up about the burst that is updated in near real-time.

The page was designed to be used for museum kiosks, but it has turned into a useful tool both for scientists to get up-to-date information on the latest bursts, as well as for educators who can use it to excite students about cutting-edge astronomy.

The GRB site is part of a fleet of websites created and maintained by the NASA E/PO group at Sonoma State University. The Swift education site (<http://swift.sonoma.edu/>) is another one-stop shopping place for information on Swift, including the latest news, press releases, images, animations, and video. This site can be reached directly or through the Education and Public Info button on the main Swift site, <http://swift.gsfc.nasa.gov/>.

Educators will find a treasure trove of useful resources at the Swift E/PO site. The E/PO group, funded by Swift, has created a large number of award-winning educational materials for use in the classroom. Among these are: the [GEMS guide "Invisible Universe: From Radio Waves to Gamma Rays,"](#) with information and activities designed to introduce middle-school students to the electromagnetic spectrum; the [Gamma-Ray Burst Educators Guide](#), which uses GRBs to teach high school students about math, science, and technology; a [model booklet](#) that provides users with the patterns to assemble a paper model of Swift, and much more. Most of these materials can be ordered by educators through [the website](#) and will be sent to them free of charge.

Drop by and see what's new!



## Joint AAVSO- 3rd HEA Workshop for Amateur Astronomers A Success

By: Phil Plait

In March of 2005 the [American Association of Variable Star Observers](#) (AAVSO) held the third annual High Energy Astrophysics (HEA) meeting for educators and amateur and

professional astronomers. Held in Las Cruces, New Mexico, the meeting was co-sponsored by Swift and the [Gamma-Ray Large Area Space Telescope](#) (GLAST) to help promote the [Global Telescope Network](#) (GTN), a loose association of amateur and professional astronomers who observe high-energy astronomical targets to help support GLAST science. Swift funds were obtained from NASA by Chryssa Kouveliotou to directly sponsor the meeting, the third in a series originated by the BATSE team in 2000. Swift is also a co-sponsor of the GTN, supporting observations of gamma-ray bursts through participating amateurs and students.



The HEA meeting was held in conjunction with the spring AAVSO meeting. About 90 people attended, including nearly the entire Education and Public Outreach group from Sonoma State University. Lynn Cominsky, SSU E/PO Group director gave an [overview of Swift](#), including highlights of the GRBs observed to date. Other talks about GRBs were given by James Rhoads (STScI) and Jerry Fishman (MSFC). Chryssa Kouveliotou showed the incredible results on the "super-flare" from SGR 1806-20 ([see accompanying article](#)). SSU professor Gordon Spear gave a talk on observing blazars, and E/PO Education Resource Director Phil Plait gave a talk on how the attendees can join the GTN. Information Technology Consultant Tim Graves demonstrated the SSU robotic telescope GORT (for GLAST Optical Robotic Telescope), and gave a well-received workshop on basic photometry methods. For more details about this meeting's preceding see: <http://www.aavso.org/aavso/meetings/archivespring05.shtml>

By all accounts, the meeting was a huge success. Several of the amateur astronomers at the meeting have joined the GTN, and the education workshops were rated highly by the educators. We're all looking forward to the next meeting!

