A FLIGHT PROGRAMS AND PROJECTS DIRECTORATE QUARTERLY PUBLICATION
A Newsletter Published for Code 400 Employees

INSIDE THIS ISSUE:

The Swift Mission: So You want to Study a Gamma Ray Burst

What happens when the most powerful explosions in the universe since the big bang go off? Energy equivalent to a billion trillion suns, bright enough that they become the most luminous objects in the sky in Gamma Rays. And what if you were told that there is on average one brand new Gamma Ray Burst (GRB) every day and they occur in other galaxies. And what if you were also told that the above information is just about the sum knowledge that science has about this mysterious phenomena? Well, NASA has a plan to add volumes to our understanding of GRBs and that answer will be launched later this year with a mission called Swift.

Swift is an Explorer mission selected as a Medium Explorer (MIDEX) in October 1999 and is managed by Goddard's Explorer Project Office. Project

(Swift Continued on page 4)

Taking Advantage of Change – the SOMO Example

When an organization changes how it does business, how do you minimize the side effects of the change? Often, the answer is "You don't" – development activities end precipitously, and any benefits from the development are often lost. A recent NASA example provides a different, and very bene-

(SOMO Continued on page 8)

Message from the Director Of

President Bush's recent announcement that NASA will embark on a new exploration agenda demonstrates once again that change is ever with us. The new initiative harkens back to the exciting days of the Apollo program, and excites our imagination and curiosity as we contemplate human exploration of outer space. It opens up plenty of opportunities for the creative, motivated and hard-working folks in NASA to enable great new discoveries and achieve new engineering feats. At the same time it creates uncertainty, because NASA will have to make changes to afford and execute this new program. Workforce will be deployed in new ways, and other programs will be realigned or changed to allow this new initiative to meet the President's goals. What might this require of us? Well certainly, agility and responsiveness, as we come to understand how we align with the changes in NASA. As well, we need to keep a broad perspective to understand the President's goals, and merge with them as One NASA. And equally as important to us and to NASA, we need to remember that our purpose and our success lie in meeting our current commitments, even while we look to the future. With our prolific fleet of orbiting spacecraft, and the breadth of missions that we are formulating and implementing, we are enabling extremely exciting scientific discovery. We must never lose sight of this.

Dolly

"Cultural Tidbits"

Did you know … that traditionally, Chinese businesses are held together not by binding contracts, but by family connections, friendships and mutual trust--a system that evolved over the past two millennia? In China, a person's word is considered stronger, more important and more binding than a written document. The Chinese have always held themselves in high esteem, in fact, the name of their country translates to "center of the world".

Do you have a cultural tidbit to share? Send it to the Code 400 Diversity Council c/o Andrea Razzaghi @ andrea.i.razzaghi@nasa.gov and we'll publish it in a future issue.

Andrea Razzaghi/Code 424

PERSONALITY TINTYPES

Ed Ruitberg

 work in the Hubble Space Telescope Program Office, Code 440, as the Deputy Program Manager for HST.

Born: Huntington, New York

Education: Electrical Engineering degree from Pratt Institute n Brooklyn, NY

Life at Goddard: The Apollo Program was in full swing when I arrived at Goddard as a co-op student in September 1967, and went to work in the Propulsion Group of the Delta Project. As a teenager, I was awed by the glamour of NASA, and now I was part of the team.

On Delta, it was my first chance to see how a project operates and to experience a project culture. I didn't realize it, but it was my first lesson n project management and Bill Schindler, the Delta Project Manager at the time, was a great teacher. He was the first of many I would come across. After graduation, I worked in Code 500 developing real-time command and control ground systems. I returned to the Projects Directorate in October 1981, when Ann Merwarth hired me onto the Space Telescope Science and Operations Project. I've been there ever since. Little did I know that I would work most of my career on the Hubble Space Telescope Program. Through the years I worked for some outstanding project managers: Frank Carr, Jim Moore, Joe Rothenberg, John Campbell, Ann Merwarth, and Preston Burch to name just a few. Over time I advanced in the organization in various capacities, starting with ground system development responsibilities, to project management, and finally to program management where I find myself today. I enjoy working for Preston, who affectionately calls me "Deputy Dawg."

I've been with Hubble since nearly the beginning,

(Ruitberg Tintype Continued on page 18)

Gail Regan

Gail is a Program Analyst with the Flight Programs and Projects Resources Office, Code 403, and has been in this position since February 2002. Gail first worked in the Projects Directorate in 1976-78 as a secretary to Dr. Kupperian and then to Paul Mowatt. Initially she was very involved in Goddard's Quality Management System. A career highlight was in August 2003 when the Center was certified to the new ISO 9001/2000 and especially that Code 400 passed without any nonconformances. After ISO, Gail has become more involved with safety and emergency management issues—where she draws on her 25 years experience in the Goddard Safety Office. Gail is a member of the Emergency Management Task Group, the Goddard Safety Council, The Chemical Safety Committee and the Radiation Safety Committee. She recently became the alternate Facilities Operations Manager in building 8 helping out Vince Gigliotti. Her first task was to make sure Code 400 was ready for Hurricane Isabel. There were a few glitches but Gail is confident that we will learn from those and be ready for the next emergency.

Born: Washington, DC. Raised in Prince George's County. She made up her mind in the 6th grade while on a NASA field trip that she wanted to work for Goddard. Gail has always been a "space buff" and vividly remembers when NASA landed on the moon—which occurred during the first week of her employment with Goddard.

Education: Gail started working at Goddard in 1969 right out of high school. She started at the University of Maryland at night in 1970 and finally completed her education with a BS in Business Management from the University of Phoenix. Quite a break between classes; but she managed to graduate in 2000 with a 3.5 GPA; something Gail is really proud of.

(Regan Tintype Continued on page 18)

FEEDBACK

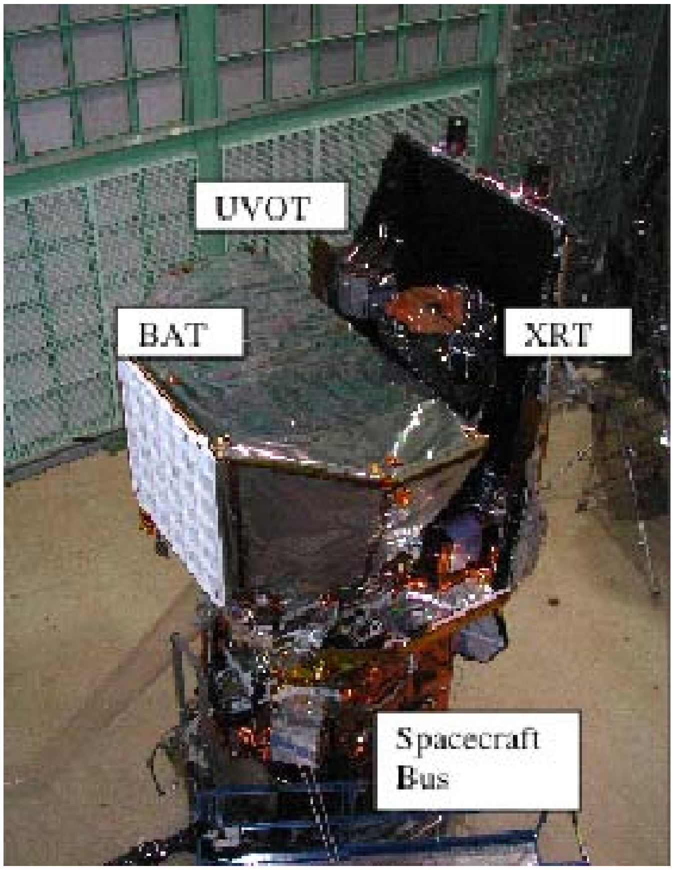
GSFC Resident Office at KSC

- GSFC payload teams, SWIFT, STEREO, and CALIPSO have attended meetings at Kennedy Space Center (KSC), Cape Canaveral Air Force Station (CCAFS), and Astrotech facility located in Titusville, Florida. SWIFT payload is scheduled to arrive at Hanger AE in July and launch is scheduled on a Delta rocket in September, 2004.
- Mission scheduled launches for 2004 are four expendable launches and two Space Shuttle launches. The Shuttle, STS-114 and STS-121, launches are scheduled to launch in the fall to test the new return to flight safety measures.
- The Space Life Sciences Laboratory was dedicated in November 2003. The 100,000 square foot facility houses labs for NASA's research efforts, microbiology/microbial ecology studies and analytical chemistry labs. This facility serves as a research hub for plant growth experiments, resource recovery and microbiology studies. Also, the labs are part of a $30 million project that also includes Space Commerce Way, the new public roadway providing access to Spaceport, NASA Causeway, and Kennedy Parkway.
- Kris Nighswonger is supporting two tasks for the next few months. She will support the SGT, Inc. Orbital Space Plane (OSP) and Crew Exploration Vehicle (CEV) organization at KSC as well as the GSFC Resident Office.
- Mary Halverstadt received an award in appreciation for hard work and

(FeedBack Continued on page 7)

(Swift Continued from page 1)

Manager is Joe Dezio, and the PI is Dr. Neil Gehrels, code 660. The Observatory consists of three instruments: the Burst Alert Telescope (BAT) that was built in-house at GSFC, and two international instruments the UV/Optical and X-ray telescopes. Spectrum Astro provides the spacecraft bus through

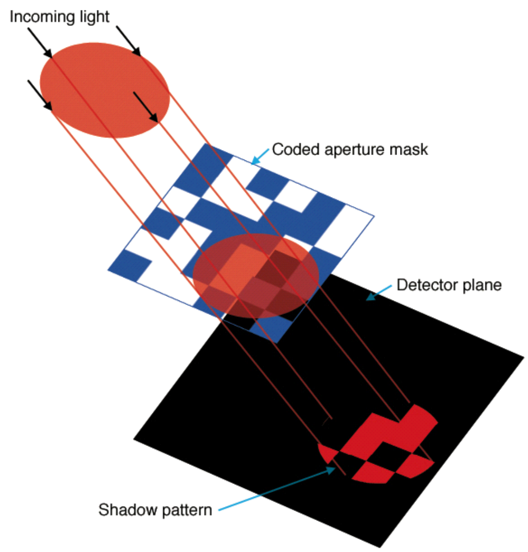


Swift Observatory

an RSDO contract. Code 543 engineered the optical bench on which the instruments are mounted.

So how will Swift resolve the GRB questions? The mission design faces many challenges. The GRBs last from a couple of seconds to a couple of minutes with a decaying x-ray and optical afterglow once the Gamma Ray emission is done. So a Gamma Ray instrument that can resolve the burst in seconds and accurately locate it was needed. The instrument also needs a very wide field of view so it could see many bursts. Then you need that instrument to send the burst location to the spacecraft and have the spacecraft get to that point within tens of seconds before the burst dies out, and send that position to ground telescopes all over the world within seconds of the initial BAT detection.

NASA's experience to date is slews of this kind usually take hours not seconds and are planned well in advance and not autonomously directed by an instrument. Then once the Observatory slews to the right spot the x-ray and UV/optical instruments must re-



Coded Aperture Imaging Technique

solve the burst from the other stars it sees and send snapshots of the burst to the ground within minutes so that larger ground telescopes around the world can further resolve the bursts. A challenging mission by any standard.

First challenge was to develop a Gamma Ray detecting instrument. But Gamma Rays being the most energetic of all electromagnetic radiation can't be viewed with a typical telescope and the current method for detecting them is not accurate or sensitive enough for Swift. A new way was needed. GSFC scientists and engineers have pioneered the

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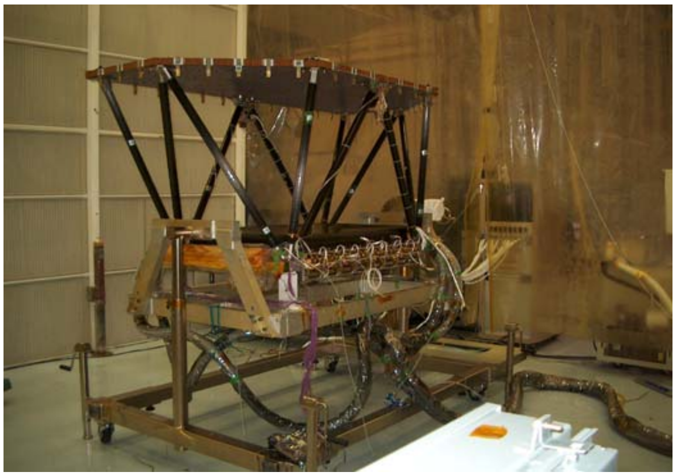
way in using a new detector technology called Cadmium Zinc Teluride or CZT. This technology is used in the medical field for imaging. GSFC



BAT instrument with mask and Detector plane

adapted the use of the technology for space flight use. But to get the sensitivity with the wide field of view you need 32,768 detectors. Ok, we have identified a detector but how can we use it to determine the location of the burst? For this a well-known technique called coded aperture imaging could be used. Essentially having the Gamma Ray cast an image of a known pattern onto the detectors and the software analytically back projecting out of the array to determine the burst position.

The coded array sitting a meter above the detector array must have 54,000 lead tiles 5x5x1mm arraigned in a known pattern to be able to determine the location of the burst to a couple arc minutes.

Now that we have the hardware identified we need to have a software algorithm that can take data from these 32,000+ detectors and analyze it in real time and determine that 1. A GRB was detected and 2. Its location. Oh, and don't forget we need to do this as quickly as possible because every second we are trying to resolve these two questions the burst is decaying. For this part of the job we use the world experts in detecting large nuclear explosions, Los Alamos National Laboratories.

As it turns out the BAT is the largest production effort ever attempted at GSFC. Hundreds of Printed Circuit boards with tens of thousands of electrical piece parts with tens of thousands of detectors and hundreds of thousands of solder joints makes BAT an instrument of impressive logistics. More importantly it is a state of the art Gamma Ray detector that will advance humankind's knowledge of the cosmos and understanding of physics in the most extreme environment nature can produce.

Although Swift would be a great mission with the BAT alone two additional instruments will partner with BAT to make it a true multi wavelength Observatory. Once the spacecraft slews to the designated target determined by BAT the X-ray telescope (XRT) and UV/Optical Telescope (UVOT) go to work. The XRT is a collaboration of Penn State, Leicester University (UK) and Brera University (Milan, Italy). The XRT refines the BAT localization to 5 arc second accuracy, and measures fluxes, spectra, and light curves of GRBs and afterglows. Emission or absorption features in the X-ray spectra may reveal information about the material surrounding the GRB source. Red shift measurements from the XRT spectra provide distances to observed GRBs. This is particularly exciting for the class of short GRBs since to-date there have been no red shift measurements for GRBs in this class.

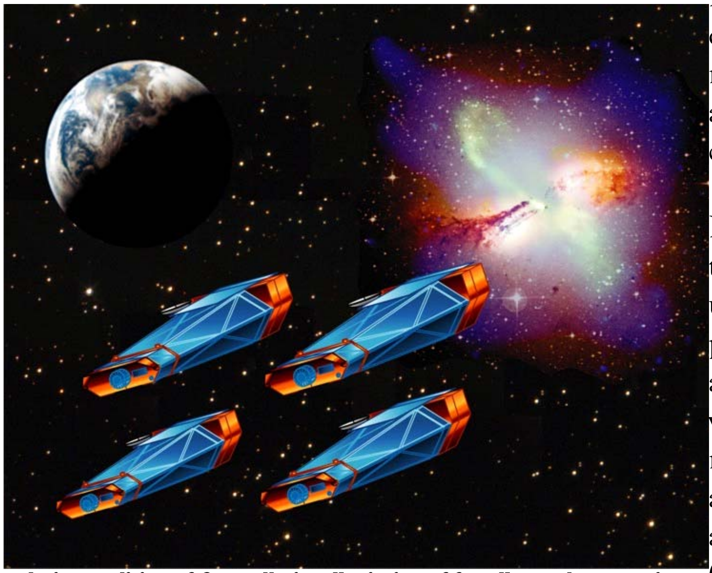
The UVOT is another international instrument collaboration between Penn State and the Mullard Space Science Laboratory in the UK. UVOT is a rebuild of the Optical Monitor on the ESA's XMM mission. The UVOT further improves the BAT and XRT localizations, giving a position to 0.3 arc second accuracy. Upon acquiring the GRB, the UVOT performs a preprogrammed series of exposures and filter combinations. This program can be altered during Swift's mission to optimize the optical/UV observations. The filtered observations re-

(Swift Continued on page 19)

Technology Corner

CONSTELLATION-X

Constellation-X is a flagship mission of NASA's "Beyond Einstein" program and is envisioned to answer key questions about our universe. Using cutting edge technology developments in large, lightweight X-ray mirrors, Constellation-X will use nearly 16,000 individual reflectors to focus the X-ray energy of distant Black holes. X-ray mirror and detector technology developments will allow the observatories to measure X-ray energy in the 0.25 to 40 keV range and provide the next level of X-ray measurement discoveries after Chandra.



Artist rendition of Constellation-X mission of four X-ray observatories observing super massive Black Hole.

Key technology developments in the Constellation X Flight Mirror Assembly (FMA) will allow up to 100 times more observing power, within a particular X-ray energy band, than currently available terrestrial or space-borne observatories provide. These technologies include the development of a repeatable and reliable process to form, apply a gold coating, assemble, and precisely align each of the nearly 16,000 mirror segments (each with a thickness of about 400 microns) to sub-millimeter accuracy while maintaining the capability to survive the harsh launch environment. The ability to accomplish this successfully relies heavily on the coordination and cooperation of NASA, academia, and commercial collaborators.

Technology developments in X-ray detectors using new and innovative materials and techniques also will contribute to the success of the Constellation X mission. The X-ray Microcalorimeter will have the ability to detect individual X-ray photons with high quantum efficiency. This is possible through the use of a superconducting Transition Edge Sensor (TES) detector system assembled into a cutting edge technology cooling system (the Continuous Adiabatic Demagnitization Refrigerator) that will allow the TES to be continuously cooled to temperatures below one degree Kelvin.

The combination of the FMA and the TES detector will allow for detecting of X-rays at levels previously not possible prior to Constellation-X, and will provide the capability to answer questions about our universe only contemplated by scientists in the past.

Robert Savage, X6-1849
Con X Technology Manager

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dedication demonstrated in support of the Fast Reaction Experiments Enabling Science Technology and Research (FREESTAR) mission that flew aboard Space Shuttle Columbia, STS107, January 16, 2003.

- The Cape Canaveral Air Force Station (CCAFS) Lighthouse has been restored to original 1894 specifications. The last structure to be restored was a small facility (oil house) used as part of the lighthouse operation over a hundred years ago. It was originally constructed in 1894. The oil house was used for storing kerosene to keep the flame of the lantern lit that burned within the center of the Fresnel lens. Buckets (five gallon containers) of kerosene were carried up 167 steps to the lantern room by the lighthouse keeper to keep the wick of the lamp burning.
- Mary Halverstadt

Quotes of the Quarter

"I hold that man is in the right who is most closely in league with the future."
- Henrik Ibsen (1828—1906) -

"Be careful about reading health books. You may die of a mis-print."
- Mark Twain (1835—1910) -

"Find other lands beneath another sun."
- James Thomson (1700—1748) -

"If a little knowledge is dangerous, where is the man who has so much as to be out of danger?"
- T.H. Huxley (1825 - 1895) -

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ficial outcome.

In 2001, two key changes were made in the way NASA handles operations, communications and data systems, which for several years before that had been managed by the Space Operations Management Office of Code M. First, responsibilities for operation of certain communications infrastructure were transferred to the Enterprises. For example, the Deep Space Network was transferred to the Space Science Enterprise (Code S) and the Ground Network was transferred to the Earth Science Enterprise (Code Y). Second, SOMO decided to no longer fund certain information technology and infrastructure work that had previously been in their province, effectively transferring responsibility for that work to the Enterprises. These information technology and infrastructure tasks included a large number and variety of activities, from tail circuits to technology. There was to be no transfer of funds to cover existing activities, so many were faced with immediate cancellation.

To address this Earth Science Enterprise (ESE) challenge, a team was formed among the Earth Science Technology Office (ESTO), the Earth Science Data and Information System (ESDIS) Project, and the Earth Science Mission Operations (ESMO) Project to address technology development and mission operations for the Enterprise. An estimate of the financial impact to the ESE was close to $20 million dollars for fiscal year 2002 alone.

The approach taken was that ESMO/ESDIS would analyze the operations, mission-essential and near-term technology upgrade aspects, while ESTO would concentrate on the technology development. Ground rules were set up to help evaluate the items. For example, a set of key questions was developed. Was it an "enabling" or "enhancing" technology? Was funding available in another Enterprise to partner and hence get more "bang for the buck"? Answering these questions would allow the Earth Science Enterprise to make informed decisions and trade-offs among activities.

The process led to a joint ESTO/ESMO/ESDIS scrubbed list of items at approximately one-third the original budget impact. Both ESTO and ESMO/ESDIS re-programmed some of their funds to cover these items in the near term. ESTO then took the future requirements for the technology development effort and folded them into its Advanced Information Systems Technology (AIST) NRA for future-year coverage.

The approach has resulted in a number of successful outcomes. From a technology development perspective, all of the 26 SOMO tasks ESTO assumed in 2002 have now been completed. Of these tasks, 20 have advanced at least one Technology Readiness Level (TRL), and five of the tasks advanced more than three TRLs. But perhaps the greatest measure of the success of a technology program is that the technologies developed are actually infused into missions. The table below shows the technologies that have already been, or soon will be used in NASA missions (across Enterprises). In addition, three of these technologies were proposed to the recent 2002 AIST NRA and have been competitively selected for further development. The following table summarizes some of the major technology infusions:

*Denotes AIST NRA-02 winner

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Project Title	TRL Advance-ment		Infusion
Bandwidth Efficient Channel Coding	1	3	
High Performance Data Compression	1	3	EOSDIS
Trellis-Coding Modulation Eight Phase-Shift Keying Modulator	3	3	
Communications Requirements for Satellite Clusters	1	1	
Radiation Tolerant Ultra Low Power Space Electronics	NA		
Real-time Evaluation and Analysis of Consolidated Health (REACH)	5	6	
Image2000	6	6	
Space Internet Technologies	2	5	CANDOS (STS-107)
SpaceLan*	3	4	GPM
Formation Flying Optimization	4	6	
Automated Planning and Scheduling System (AMPS) *	3	5	
Virtual Mission Operations Control-Collaborative Environ-ment (VMOC-CE)	4	6	
SSR Playback Automation Tool (SPLAT/GOC)	2	8	Terra Control Cntr.
Visual Observation Layout Tool (VOLT)	4	6	
Formation Flying and Autonomous Navigation	3	5	
Advanced Attitude Determination, Calibration, and Model-ing	3	6	UARS, Aqua, Aura, RXTE, TRMM, FUSE, GPM, SDO, MAP, LEO, IMAGE
Advanced Mission Design	4	6	GPM, MMS
Flight Dynamics Automation	3	9	TRMM, Sampex
Finite State Modeling Study and Application	6	9	Aqua/Aura Control Centers.
Ground and Flight System Technology Demonstration En-vironment	1	3	
GMSEC Engineering	NA		
Flight Software Technology Prototypes	1	3	
Flight Software Roadmap	1	1	
IP-Compliant Operations Technology &Demos	2	3	CANDOS (STS-107)
Ka-Band Reflectarray Prototype Controller*	2	3	
Propagation Measurement & Analysis	2	4	

The Chinese have an old saying: "taking changes as opportunities". This NASA "change" could have been a disaster. But coordinated action by several ESE organizations converted this to an opportunity, and created several successful outcomes.

Note - The Space Communications and Data Systems Technology Program, funded by Code M, was instituted to continue Code M technology development.

Mike Pasciuto/Code 407

The NPOESS Integrated Program Office

Many folks don't know it but there is a bunch of GSFC employees, primarily from Code 400, working offsite in a fourteen story building in Silver Spring in something called the NPOESS Integrated Program Office (IPO). NPOESS stands for the National Polar-orbiting Operational Environmental Satellite System. It is meant to be the replacement for two long standing satellite systems going back to the 1960s. The first is the Polar Operational Environmental System (POES) which NASA has been developing on behalf of the Department of Commerce dating back to TIROS 1 which was launched on April 1, 1960. The other system is the Defense Meteorological Satellite Program (DMSP) which emerged from the classified world in the early 1970s. Eight different studies were undertaken in the 1970s and 1980s to merge the two systems but each failed due to differences in requirements, missions, and Agency priorities.

Convergence studies conducted in the early 1990s finally succeeded resulting in a Directive signed by President Clinton in May 1994 to merge the two programs. Formal establishment of the Tri-Agency IPO occurred on October 1, 1994 consisting of representatives from the Department of Defense (DoD), Department of Commerce (DOC) and NASA. A subsequent Memorandum of Agreement signed by the NASA Administrator, Secretary of Commerce, and Secretary of Defense divided lead agency responsibilities at the IPO. DoD was designated to lead system acquisition, DOC/NOAA to lead operations, and NASA to lead technology infusion. The IPO was able to define a program that saved $1.3 billion over a ten year period, compared to the sum of the projected costs of the POES and DMSP programs had they been allowed to proceed with separate block changes. Funding for the program is split 50/50 between DoD and DOC/NOAA.

Requirements for the program are contained in a document called the IORD (Interagency Operational Requirements Document). The first version of the IORD was signed in 1995 and covered the conceptual phase of NPOESS. The second version was signed in 1997 covering the formulation phase, and the latest version was signed by the Deputy Under Secretary of Commerce, NASA Associate Administrator for Earth Science, and the Vice Chairman of the Joint Chiefs of Staff in December 2001 to cover the implementation phase. The system is required to produce fifty-five Environment Data Records (EDRs) that cover the land, ocean, atmosphere, and near space environment to aid a diverse user community including weather forecasters, war fighters and climate researchers.

Fourteen different sensor suites are being acquired to meet these EDR requirements. About half are being developed specifically for NPOESS with contracts dating back to 1997. The other half are mainly adaptations of existing sensors requiring little "non-recurring development". The developmental sensors include a Visible and Infrared Imaging Radiometer Suite (VIIRS) being built by Raytheon Santa Barbara, a Cross Track Infrared Sounder (CrIS) by ITT, an Advanced Technology Microwave Sounder (ATMS) by Northrop Grumman Electronic Systems, a Conical Microwave Imager Sounder (CMIS) by Boeing Satellite Systems, a Global Positioning System Occultation Sensor (GPSOS) by Saab Ericsson, an Ozone Mapping and Profiler Suite (OMPS) and Space Environmental Sensing Suite (SESS) both being developed by Ball Aerospace, and a laser detection sensor by Sandia Laboratories. The leveraged sensors include an Earth Radiation Budget Sensor (ERBS) being developed by Northrop Grumman Space Technologies as the successor to the CERES which was manifested on several NASA EOS mis-

(NPOESS Continued on page 11)

(NPOESS Continued from page 10)

sions, a Total Irradiance Monitor (TIM) and Solar Irradiance Monitor (SIM) being developed by the University of Colorado Laboratory for Atmospheric Sciences and Physics (LASP) as follow on to like sensors on the NASA SORCE mission, a Radar Altimeter similar to the instrument developed by Alcatel for Jason-1, and two instruments, the Advanced Data Collection System and Search and Rescue System, that will be GFE'd by international entities as follow-ons to sensors on POES. A final instrument, the Aerosol Polarimeter Sensor (APS) was selected partially in response to President Bush's Climate Change Research Initiative and is being developed by Raytheon SBRS.

The NPOESS program will consist of platforms in three different polar sun synchronous orbits; 0530/1730, 0930/2130, and 1330/0130. A second platform for each orbit is being procured for a total of six. The platforms have a lifetime expectancy of 7 years; this will assure NPOESS coverage well past the year 2020. The sensors may be manifested on NPOESS platforms, in one, two, or all three orbits depending on frequency of coverage needed to meet EDR requirements. Twenty-five percent payload margin has been reserved on each platform for technology infusion sensors to assure that the program operates at the state-of-the-art. A prime contract was awarded to Northrop Grumman Space Technologies (NGST) in August 2002 to manage development of platforms, sensors, algorithms, command, control, and communications, data processing, and operations for the program lifetime. The ground system, referred to as SafetyNet, includes fifteen different sites worldwide that will be receiving stored mission

(NPOESS Continued on page 21)

President Bush is briefed at NPOESS Exhibit February 14, 2002 at NOAA Headquarters

JWST Microshutter Array Passes Critical Milestone

A key technology for the James Webb Space Telescope (JWST) accomplished a major milestone with the completion last month of the Microshutter Array (MSA) Confirmation Review. The MSA is a key in-house GSFC contribution to the Near Infrared Spectrograph (NIRSpec) instrument being developed by the European Space Agency.

JWST will carry out spectroscopy in the visible to near-infrared (0.6 – 5 μm) range to identify and analyze thousands of primeval galaxies formed soon after the Big Bang. These targets are compact (< 1 arc sec) in angular extent and are sparsely distributed on the sky. To accomplish this science for JWST's five-year lifetime, the NIRSpec employs a multi-object spectrometer (MOS) which can observe many candidate objects simultaneously, vastly increasing the capability of JWST for this critical science program.

In a conventional single slit spectrometer, only one object can typically be placed on the input slit for observation at a time. In a multi-object spectrometer, many objects can be simultaneously placed on the slits or apertures located at the entrance field of the instrument. For ground-based telescopes, this "aperture control" is often provided by robotically controlled optical fibers or a set of masks called punch plates, which have been drilled with a hole pattern that precisely matches the image pattern of desired targets in a specific field of view on the sky. Both techniques are too complex to implement in a cryogenic space flight application such as JWST. As a consequence, a new technology had to be developed to solve this problem. To enable this critical new capability, requiring random-access configuration of input slits in the field of the spectrometer, the concept of a Microshutter Array was developed under JWST Advanced Technology Funding. The MSA is a rectangular array of microscopic magnetically-controlled, transmissive shutters, which can be opened and closed under random access control, allowing the production of any required input slit pattern.

The enabling technology for this aperture control comes from a new area of engineering called Micro Electrical Mechanical Systems (MEMS). Techniques originally developed for fabrication of integrated electronic circuits have been applied to fabrication of microscopic machines. The MEMS solution to the problem of providing aperture control for the JWST MOS is conceptually similar to the punch plate technique described above; apertures are opened at the locations of all candidate objects. However, in the MEMS approach, the punch plates used by ground-based astronomers are replaced by the array of microscopic shutters that are actuated magnetically and selected under computer control to select targets in any field on the sky.

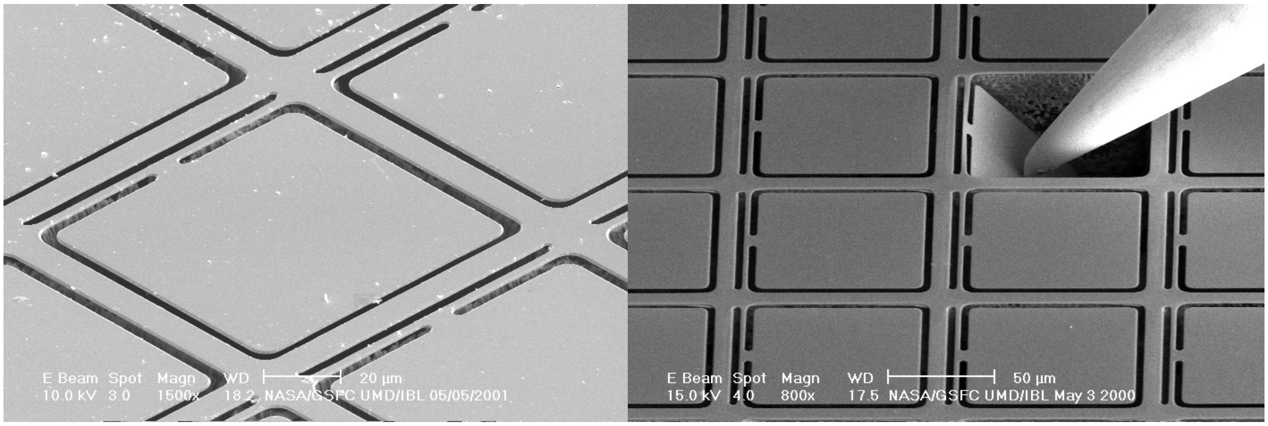
The picture below shows the set of microshutters, each which is approximately 100μm (millionth of a meter) across, about the width of a human hair.

The MSA assembly consists of the following main elements which can actuate and select the more than 250,000 individual shutters. The final MSA device is envisioned as follows:

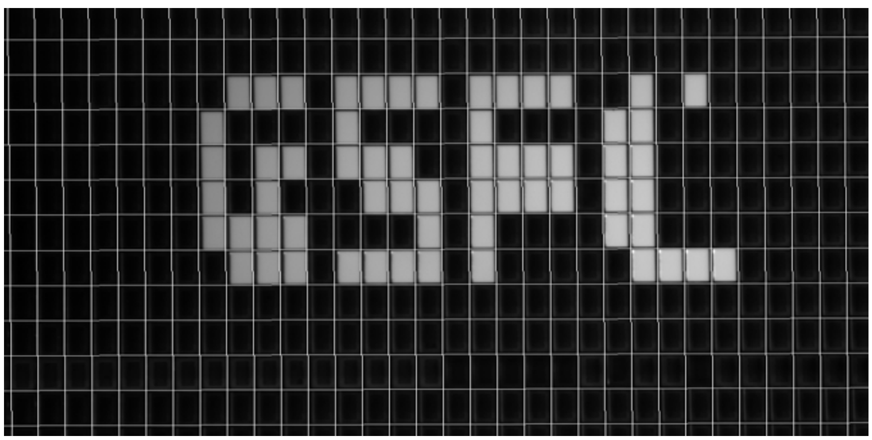
The MSA and other instrument technologies must be fully demonstrated by the time of the September 2005

(JWST/MSA Continued on page 13)

(JWSR/MSA Continued from page 12)

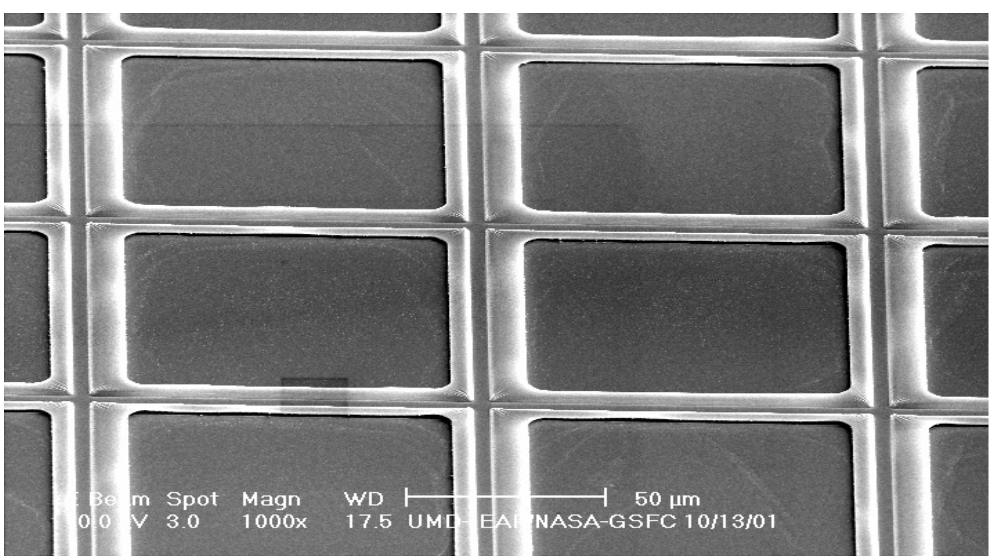


Above: Electron micrograph of a prototype JWST micro-shutter array. Light shields that mask gaps around the periphery of each shutter removed for clarity.



Above: 64 X 128 MSA array electrically addressed to display GSFC. White shutters are open.

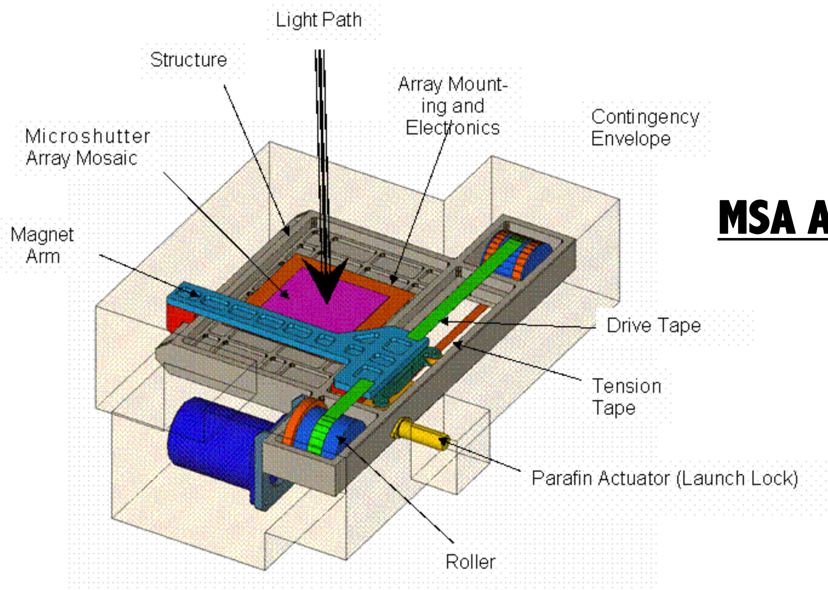
Below: Close up of 100 X 200 micron pixel size with light shields attached.



JWST/MSA Continued on page 14)

(JWST/MSA Continued from page 13)

Non-Advocate Review, then provided to ESA in April 2007 for integration into their instrument. ESA recently released its Invitation to Tender, from which the European NIRSpec instrument provider will be selected. All potential bidders have remained close to the progress of the MSA.



MSA ASSEMBY

This recent MSA milestone is the culmination of years of in-house endeavor by Dr. Harvey Moseley (Code 685) and his team to develop a flight qualified device. According to Dr. Moseley, “ the Microshutter team took a new concept for improving the capability and efficiency of JWST and has turned it into reality. Though much work remains to produce a space flight worthy system, we have passed a major milestone in the development of this key technology for tomorrow’s astronomy. ”

Dr. Matt Greenhouse anticipates that if the MSA approach succeeds as planned: “the observing efficiency yielded by the MSA approach will enable JWST to observe a sufficiently large number of primeval galaxies and population III stars that our understanding of astrophysics will be significantly advanced” He also notes that “if development of this MSA technology is successful, it will enable a number of other space science and EOS instruments – particularly in the area of Hadamard transform hyperspectral imagery, for which significant future business potential should exist”.

JWST is currently in Phase B and entering full development of its instruments. Launch is scheduled for 2011. If you are interested in more information on the MSA, contact Leroy Sparr, Micro-shutter Subsystem Project Manager, at Leroy.M.Sparr@nasa.gov.

Dr. M. Greenhouse, Code 685
Jonathan Bryson, DPM/R, Code 443

NGIN—"One Stop Shopping" for GSFC Project Management Needs

Managing configuration management (CM) and other project support functions across multiple domestic and international partners while at the same time assuring proper ITAR and proprietary controls is indeed a daunting challenge. To meet this challenge, an innovative new suite of integrated administrative tools called the Next Generation Integrated Network (NGIN), is evolving in the Flight Programs and Projects Directorate.

Building on GSFC Experience

NGIN was originally envisioned in 2001 as a means to handle the CM and data management (DM) information needs for the James Webb Space Telescope (JWST) Project. The concept was to draw from best project management systems and tools being utilized in-house to date within NASA's Goddard Space Flight Center. For example, the requirements and functionality for the CM system was drawn from two other systems, COMITS and HST COPS. Commercial off-the-shelf (COTS) software and products for CM were also benchmarked and considered for use. Further, the concept was for a web-based private platform with access by both domestic and international partners.

Over the next two years, NGIN moved beyond the original CM/DM concept into all areas of classic Project Support work and created a web workspace for JWST participants across the world. In addition, several Projects and some AETD organizations began developing customized versions of the NGIN system and making their own improvements. The current range of functions are utilized by Projects is:

- Project Management (e.g. organization chart)
- Top-Level Schedules
- Weekly Reports
- Library/Data Management
- Configuration Management
- Risk Management
- Action Item System
- Working Groups
- ISO9001
- Knowledge Management
- Technical Workspaces (Systems, Observatory, Instrument, Ground)

  Shared Files (pre-library drafts of working documents)

(NGIN Continued on page 16)

(NGIN Continued from page 15)

What makes NGIN unique?

There are a variety of existing standalone products that can satisfy the requirement to effectively manage each function. For example, there are excellent risk management tools and configuration management tools available as COTS products. However, it is often difficult to combine such tools to gain some degree of synergy and efficiency. As such, the utilization of an integrated suite like NGIN has the following desirable advantages:

- NGIN utilizes a single table of users that is applied across all functions. The addition and/or removal of system users is accomplished globally instead of via adjustment made to various functional user lists.
- NGIN has been customized and embedded to fit the particular GSFC and individual project cultures instead of adjusting well-established processes and practices to a COTS solution.
- ITAR, IT security, 508 Compliance and other features can be implemented and managed across all functions instead of from within each separate application. Access is managed at the item (e.g. library item, risk item) level.
- Having one central repository means there is a single library that supports DM, CM, RM and assures the Project team is using the latest document (satisfying ISO requirements).
- NGIN is also outfitted to manage technical documents, drawings, charts, etc. before they are formally entered in the Library. The website *Share File* area allows users a collaborative environment to post draft documents, drawings, or charts for comments/review prior to entering them into the Library.
- Work products requiring multiple inputs can be easily combined. For example, a document associated with a project risk can be attached to and be made part of the item file.
- With NGIN, there is a common "feel" across all applications and tools, such as search tools and e-mail notification. Navigation from the library to an organization chart and then to a risk management item is less cumbersome than when accessing multiple systems. A "My NGIN Page" feature brings all current work items tagged to a user within a single display.
- NGIN has proved extremely useful in support of both ISO9001 and NPG7120.5 audits since it allows quick access to all project management documents and assures access to only the most current files.
- As a set of DM, CM and RM repositories, NGIN is creating a centralized record of the project. Search engines are continually being improved to utilize this data.

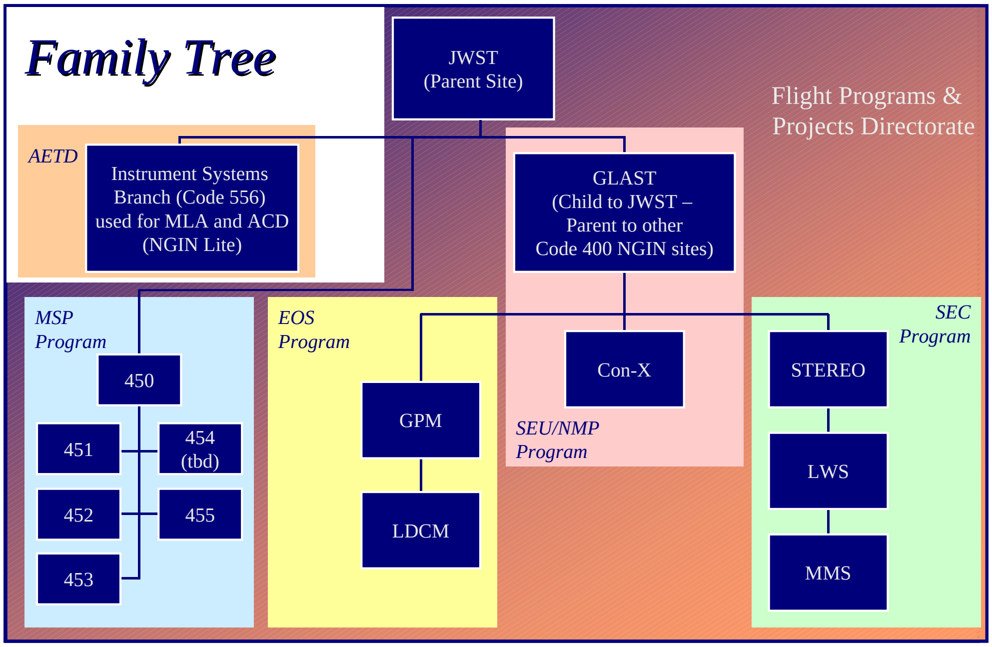
Overall staffing for these functions has been reduced versus having several Project support functional personnel each manage their own tool.

Who is using NGIN?

The JWST version of NGIN was a result of collaboration with Project Analysis and Control (PAAC I/II) contractors. The system was never envisioned to move beyond the JWST Project, but NGIN has now been adopted by a variety of new GSFC organizations that have tailored its performance features to satisfy their own individual project management needs. Current users and/or committed future NGIN users include (see chart):

(NGIN Continued on page 17)

Next Generation Integrated Network (NGIN)



In October 2003, an NGIN Working Group was established consisting mostly of NGIN programmers across various program offices. This forum has been ideal for making NGIN applications uniform and for creating a sharing and collaborative environment. NGIN is also being formally documented. Recently, the team met with Jim Frost (JWST Export Control Lead) to look for potential system improvements related to ITAR and similar issues. The NGIN Working Group also evaluates the latest web development tools, security features, and Project Support COTS applications to see how they might benefit NGIN.

<u>The Future</u>

NGIN has moved well beyond what was originally envisioned for a single Project. The NGIN Working Group is looking to develop a turnkey NGIN template which would allow quick start-up for a new project management effort of any mission size. The COTS environment is also being continuously monitored to identify opportunities for additions or improvements to NGIN. NGIN planners and developers are looking ahead to data mining, metadata, and Lessons

(NGIN Continued on page 18)

(Ruitberg TinType from page 3)

through the early development of the spacecraft and ground system. I was there during the deployment of HST in April 1990 and was a part of all 4 servicing missions. I have been a fixture in the HST Program and I wouldn't have wanted it any other way. There were many difficult times, but each time the HST team recovered from serious setbacks to become a "world class" scientific discovery machine.

The Agency now has an initiative to begin a new era of Lunar and Mars exploration. I hope this will again put us all in awe of NASA.

Family: My wife, Laura, and I reside in Davidsonville, MD. Our son Edward, Jr. serves in the U.S. Air Force. He recently completed his first tour of duty in Misawa, Japan and during the recent holidays transferred to his next assignment in Ramstein, Germany. Edward Jr. has a wife, Rachel, and a daughter, Sasha. They are our treasure.

I also have an identical twin brother, Art, who works in the Power Systems Branch at Goddard. We're not so identical anymore although we still bear a strong common resemblance. It's actually Art's picture above. Can you tell the difference?

Hobbies: I've been active in a number of hobbies including landscaping, gardening, and homebrewing. Landscaping is a never-ending job because my home is on a 2-acre lot and over half of it is still wilderness, providing somewhat of a natural preserve.

Over the last several years, I have concentrated on bicycle riding. It brings back memories of childhood when all your friends were riding bikes and eating peanut butter. That's what I'm back to, but now I have a high performance road bicycle. Every Saturday morning I ride with a group that meets near my home and at other times during the week if I can get the time. It's become addictive; to the point where my wife, Laura, has threatened to back the car right over the bicycle. Over time there have been a few accidents. While vacationing in North Carolina in late 2002, I took a spectacular fall where I ended up sprawled on the pavement, unconscious, and with a separated shoulder. I woke up finding I had no idea where I was or where I was going. After a while I figured it out, and pedaled home safely. It was a unique experience that taught me about recovery and survivability from serious setbacks. Working on Hubble we do this all the time.

(Regan TinType from page 3)

On Family: Gail is married to Tim Regan, an engineer in the Facilities Management Division. Together they have 3 sons, John, 19 and twins Patrick and Brendan, 15. Gail has a daughter, Karen, who will receive her doctorate in Plant Biology at Berkeley soon.

Life Outside of Work: For relaxation, Gail enjoys reading of all kinds. She loves to write and someday she would like to write a book about Goddard. She is active around the house with gardening and taking care of the family dog, Honey. Recently, her daughter became engaged and she's very involved in planning the perfect wedding.

(NGIN Continued from page 17)

Learned/Knowledge Management capabilities to support projects. For more information concerning NGIN capabilities, contact Bill Gallagher at bgallagher@hst.nasa.gov.

Jonathan Bryson, DPM/R, Code 443
Bill Gallagher/PAAC II Manager, CSC, Code 443

(Swift Continued from page 5)

veal the behavior of the burst and afterglow over time in different colors. In addition, if the burst is at a red shift greater than one, these observations may also provide red shift measurements.

The ground system is a multinational effort as well. The Mission Operation Center will be located at Penn State, the main science center is at GSFC with other science centers in the UK and Italy. The Italian Space Agency (ASI) is supplying the Malindi, Kenya ground station for the data telemetry and commanding. TDRSS will be used for the quick alert messages that the instruments will generate.

Launch of the Swift will be late summer of 2004 on the Delta 7320.

So there you have it, the GRB scientists' dream spacecraft. Everything you need to revolutionize your understanding of extreme physics and a powerful exploration tool for NASA.

By the way Swift is not an acronym. It is a descriptive name of the mission.

For more Information about the Swift Mission check out the Web Page
http://swift.gsfc.nasa.gov/

Tim Gehringer/ Code 410

What Other People Think

The Erickson Tribune, a nice little publication of a group of retirement homes in the Baltimore area recently concluded a poll on America's space program. The results, arrived at before the President's program about Moon and Mars was announced, provide a bit of insight on how older folks view NASA.

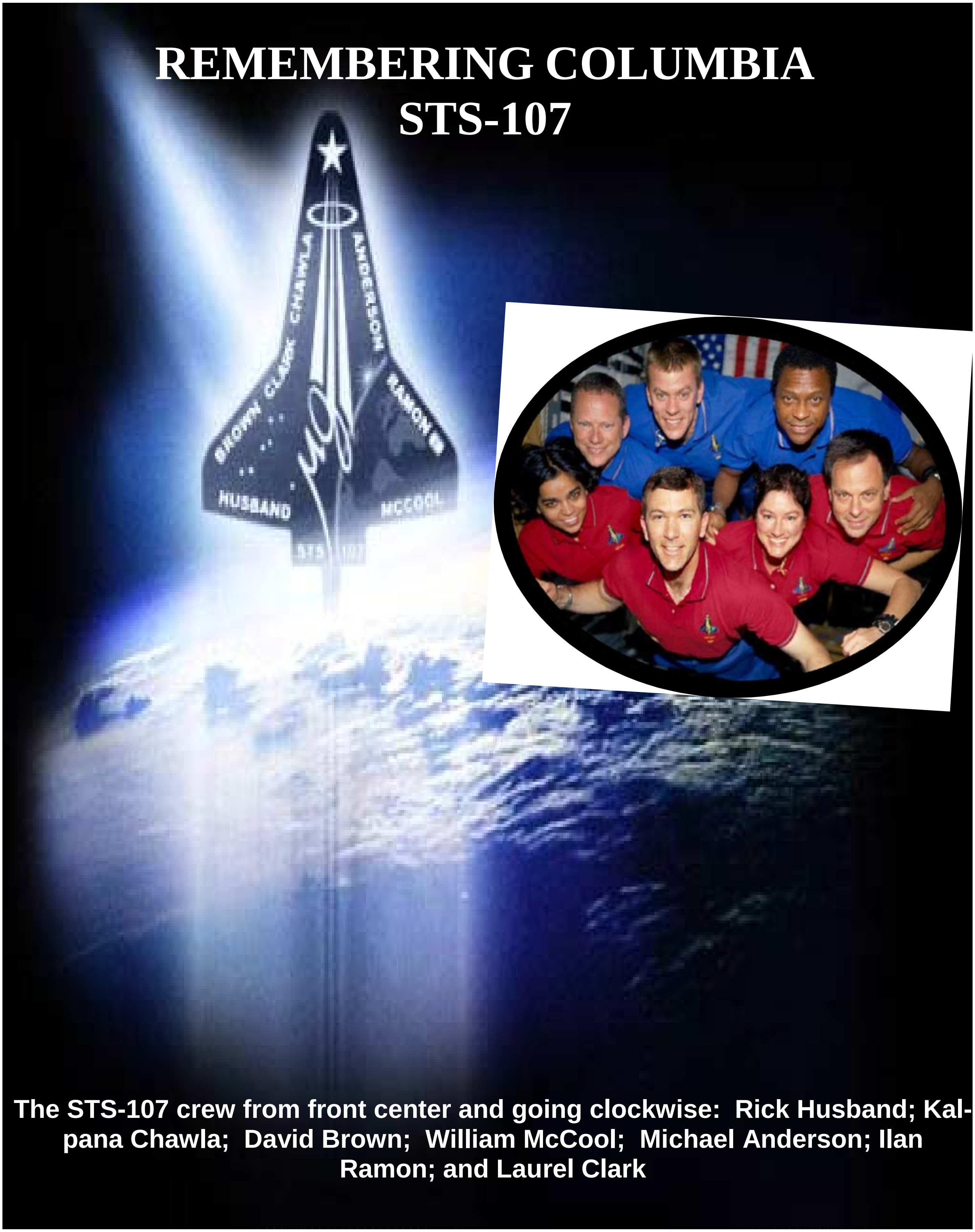
- Do you think NASA has relevance in today's world?
  60% Yes **40% No**
- Do you think the benefits are worth the risk and the cost?
  53% Yes **47% No**
- Should we increase the budget to continue manned space flight?
  41% Yes **59% No**
- Should America continue to fund the International Space Station?
  52% Yes **48% No**
- Would the space program benefit from more privatization?
  37% Yes **63% No**
- Do you think the space program has an impact on your life?
  56% Yes **44% No**

The publication noted that it received many impassioned responses beyond the questions asked, ranging from the belief that space exploration is the most important endeavor for the human race, to those who think it's a waste of time.

With China and the European Space Agency committing to more daring explorations of the solar system many added that it was imperative that America maintain its competitive edge.

Abstracted from The Erickson Tribune (Feb., 2004) - Jered Rasmussen, Researcher

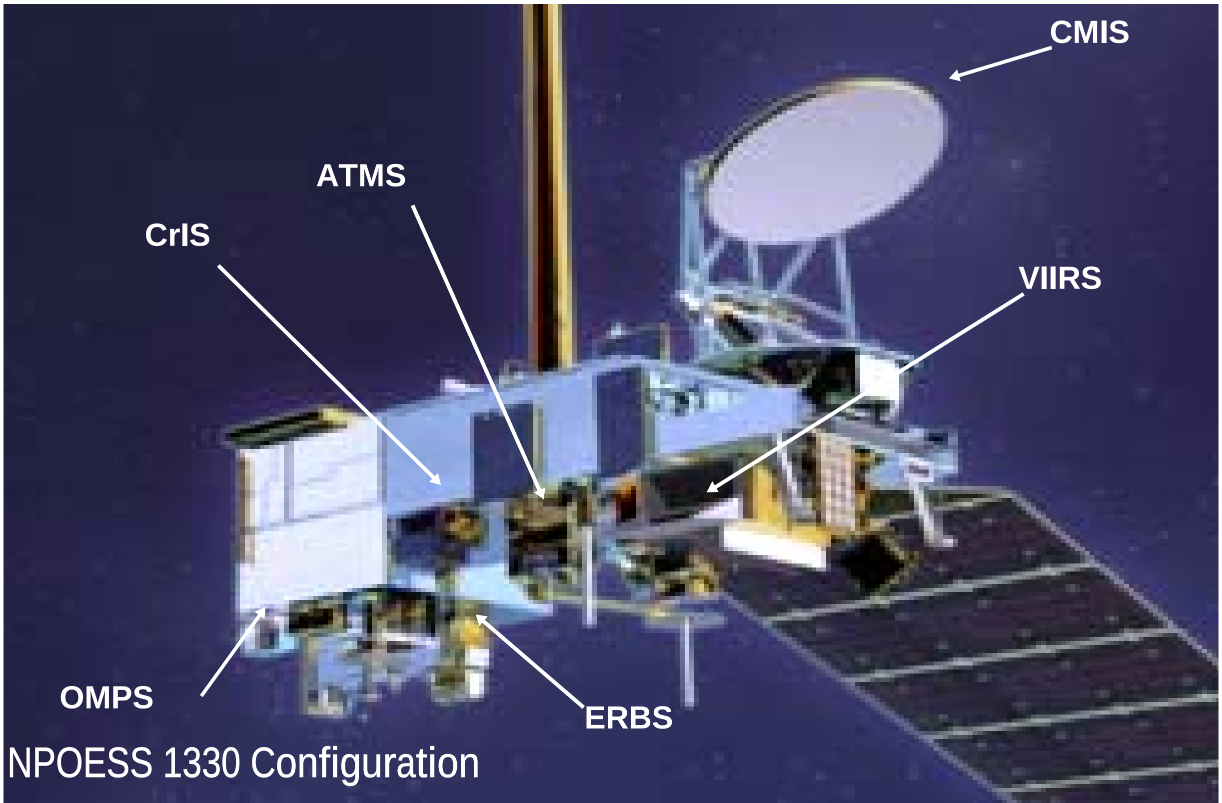
REMEMBERING COLUMBIA
STS-107



The STS-107 crew from front center and going clockwise: Rick Husband; Kalpana Chawla; David Brown; William McCool; Michael Anderson; Ilan Ramon; and Laurel Clark

(NOPESS Continued from page 11)

data in Ka band and transmitting it back to the United States via optical fiber so that users can get required products in less



Single satellite design with common sensor locations

than 30 minutes after satellite observation. The value of the prime contract is approximately $5 billion (out of total program cost of approximately $6.5billion) and involves a unique government/industry partnership referred to as Shared System Program Responsibility (SSPR).

The NPOESS satellites will be launched to replace the last of the POES and DMSP satellites. Only two more POES satellites and four DMSPs remain to be launched. In order to assure that the NPOESS sensors perform to specifications, and the users are ready to assimilate the resultant data products, a robust risk reduction program has been developed in which the new NPOESS capabilities are phased in over time. An NPOESS Airborne Sounder Testbed (NAST) with airborne versions of the CrIS and ATMS has flown over 600 hours in twelve different campaigns over the last several years. The IPO partially funded Digital Ion Drift Meter (DIDM) was launched on the German CHAMP satellite in 2001 to demonstrate NPOESS SESS capabilities, and the GSFC-developed Shuttle Ozone Limb Sounding Experiment/Limb Occultation Retrieval Experiment (SOLSE/LORE) flew on STS 87 and the ill-fated STS 107 in demonstration of the NPOESS OMPS. A joint mission between the IPO and the Navy, termed Windsat Coriolis was launched in January 2003 and is demonstrating a passive microwave technique for deriving ocean surface wind vectors that will be utilized by the NPOESS CMIS. The IPO is monitoring NASA's efforts in the recently designated Glory mission which will serve as a demonstration of the NPOESS APS capability in the 2006/2007 time frame.

The flagship of the NPOESS risk reduction program is the NPOESS Preparatory Project (NPP) which is scheduled to launch in late 2006 with four NPOESS sensors; the VIIRS, CrIS, ATMS, and OMPS. The

(NPOESS Continued on page 22)

(NPOESS Continued from page 21)

NPP mission was devised in 1998 to serve the dual purpose of NPOESS risk reduction and providing continuity for key climate observations for the NASA EOS program. The NASA part of NPP is managed by GSFC Code 429.

The NASA members of the Integrated Program Office include Stan Schneider who serves as Associate Director for Technology Transition and Senior NASA official at the IPO. Dr. Jim Duda manages the IPO's Operational Algorithm Teams (OATS) for NPOESS sensors which consist of over a hundred representatives from government stakeholder agencies including a number of individuals from GSFC's code 900. Jim McGuire keeps track of activities relating to the IPO's leveraged sensors; ERBS, TIM/SIM, and the Radar Altimeter. Chuck Naegeli looks after spacecraft interfaces for all 14 sensors on NPOESS. Dr. Michael Lee is involved in planning for both NPP and NPOESS operations, and is the IPO's expert on Attitude Control Systems. Finally, Jennie Baldwin provides administrative and secretarial support to the full time NASA team at the IPO as well as invitational travel support for the many GSFC scientists and engineers who support the IPO on an as-needed basis. The above individuals comprise Code 402, with Stan Schneider as supervisor. Dr. Lee is matrixed to the group from GSFC Code 581.

The NASA team residing at the IPO considers themselves to be ambassadors for the Agency and have a high esprit de corps. We invite our GSFC and Code 400 colleagues to visit the IPO and get to know us and the NPOESS program better.

Stanley R. Schneider/Code 402

History of Valentine's Day

Every February, across the country, candy, flowers, and gifts are exchanged between loved ones, all in the name of St. Valentine. But who is the mysterious saint and why do we celebrate this holiday?

The history of Valentine's Day -- and its patron saint -- is shrouded in mystery. But we do know that February has long been a month of romance. St. Valentine's Day, as we know it today, contains vestiges of both Christian and ancient Roman tradition.

So, who was Saint Valentine and how did he become associated with this ancient rite? Today, the Catholic Church recognizes at least three different saints named Valentine or Valentinus, all of whom were martyred. One legend contends that Valentine was a priest who served during the third century in Rome. When Emperor Claudius II decided that single men made better soldiers than those with wives and families, he outlawed marriage for young men — his crop of potential soldiers. Valentine, realizing the injustice of the decree, defied Claudius and continued to perform marriages for young lovers in secret. When Valentine's actions were discovered, Claudius ordered that he be put to death. Other stories suggest that Valentine may have been killed for attempting to help Christians escape harsh Roman prisons where they were often beaten and tortured.

According to one legend, Valentine actually sent the first 'valentine' greeting himself. While in prison, it is believed that Valentine fell in love with a young girl — who may have been his jailor's daughter — who visited him during his confinement. Before his death, it is alleged that he wrote her a letter, which is signed 'From your Valentine,' an expression that is still in use today.

The History Channel

Comings & Goings

Comings:

Kristina Beverly joins IFMP/405 from 903
Andre Dress joins GOES-N/416 from NOAA
Michelle Renaud joins GPM/420.2 from 903
John Decker joins JWST/443 from 540
Kim Tann joins Space Network/452 from 210
Linda Layton joins Ground Network/453 from 157
Linnette Morales joins STEREO/463 - CO-op converted to permanent
Eric Grob joins SDO/464 from 545

Goings:

Bruce Clark retired from Code 406
Don Margolies retired from Code 410
Dorinda Bailey retired from Code 420.2
Dan Blackwood transferred to HQ, from Code 443
Larry Christensen retired from Code 463
Sandy Phillips retired from Code 480

THE CRITICAL PATH SOCIAL NEWS

Best wishes to Carol Dibble-Wooten (Code 410) on the new addition to her family. Her second daughter, Alayna Rae, was born on December 16, at 5:17pm. She weighed 7 lbs., 12 oz., and was 21 in. long.

Norman and Nathalie Rioux were blessed with the birth of their daughter Christine at 12:36 AM January 27th, 2004. She weighed 5 pounds, 9 ounces and was 19 1/4 inches long. Norman (Code 594) is the Mission Systems Engineer for the GLAST Project. Mother and new daughter are both doing fine. Two year old daughter Fiona is adjusting to her new status as a big sister.

FUTURE LAUNCHES CALENDAR YEAR 2004	
AURA	JUN
SWIFT	SEP
CINDI	NOV
GOES N	DEC

ATTENTION INTERNET BROWSERS:

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If you have a story idea, news item, or letter for The Critical Path, please let us know about it. Send your note to Howard Ottenstein via Email: Howard.K.Ottenstein@nasa.gov, Mail: Code 403, or Phone: 6-8583. Don't forget to include your name and telephone number. Deadline for the next issue is April 30, 2004.