



June 10, 2004

Reply to Attn of:

410

## MEMORANDUM FOR THE RECORD

National Environmental Policy Act (NEPA) Compliance for Swift Gamma Ray Burst Explorer

### 1.0 Introduction

The NEPA of 1969, as amended (42 U.S.C. 4321, *et seq.*), requires Federal agencies to consider the environmental impacts of a project in their decision making process. To comply with NEPA and associated regulations (the Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA [40 CFR Parts 1500-1508] and NASA policy and procedures [14 CFR Part 1216 Subpart 1216.3]), NASA has prepared an Environmental Assessment (EA) for routine payloads launched on Expendable Launch Vehicles (ELV's) from Cape Canaveral Air Force Station (CCAFS) and Vandenberg Air Force Base (VAFB) (Ref: *Final Environmental Assessment for Launch of NASA Routine Payloads on Expendable Launch Vehicles from Cape Canaveral Air Force Station, Florida, and Vandenberg Air Force Base, California*, June 2002). The EA assesses the environmental impacts of missions launched from CCAFS and VAFB with spacecraft that are considered routine payloads.

Spacecraft defined as routine payloads would utilize materials, quantities of materials, launch vehicles and operational characteristics that are consistent with normal and routine spacecraft preparation and flight activities at VAFB, CCAFS, and the Kennedy Space Center. The environmental impacts of launching routine payloads from VAFB and CCAFS fall within the range of routine, ongoing and previously documented impacts that have been determined not to be significant. Spacecraft covered by this EA meet specific criteria ensuring that the spacecraft, its operation and decommissioning, do not present any new or substantial environmental or safety concerns.

To determine the applicability of a routine payload classification for a mission launched from VAFB and CCAFS and coverage under the NASA routine payload EA, the mission is evaluated against the criteria defined in the EA using the Routine Payload Checklist (RPC).

### 2.0 Mission Description

Swift is a medium-sized explorer (MIDEX) mission that is part of NASA's Structure and Evolution of the Universe theme. The astronomical satellites in this theme are designed to explore the structure of the Universe, examine its cycles of matter and energy, and peer into the ultimate limits of gravity: black holes. Swift's primary mission is to observe

gamma ray bursts, extraordinary explosions of matter and energy that astronomers think signal the births of black holes.

There are three scientific instruments on board Swift: the Burst Alert Telescope (BAT), the X-ray Telescope (XRT), and the Ultraviolet/Optical Telescope (UVOT). The BAT is sensitive to X-rays, a very energetic form of light. Gamma ray bursts emit X-rays when they explode, and the BAT will be the first instrument onboard Swift to detect them. Swift will then "swiftly" turn toward the burst and point the XRT and UVOT at the target. They will observe the burst in X-rays and in ultraviolet and optical light, respectively.

The Swift observatory will be launched on a Delta 7320 rocket from CCAFS in the 3<sup>rd</sup> Quarter 2004 into a low earth orbit. The observatory weighs approximately 1450 kg (3196 lbs) and measures 5.07 m (16.6 ft) high and 1.7 m (5.6 ft) in diameter. The electrical power system is comprised of a GaAs solar array and NiH<sub>2</sub> battery.

The components utilized in the Swift spacecraft and instruments are made of materials normally encountered in the space industry. Swift will use radioactive sources for on-orbit calibration of the BAT and XRT instruments. Based on the A<sub>2</sub> Mission Multiple for these sources, the nuclear launch approval requirement is at the Nuclear Flight Safety Assurance Manager level only. The A<sub>2</sub> Mission Multiple is a normalized value to identify the potential radiological risk of isotopes contained in a mission. The A<sub>2</sub> Mission Multiple determines the level of safety review necessary based on radiological risk. Swift will not use any lasers. Swift will not carry any pathogenic organisms, nor will Swift return samples to Earth. The Swift orbital debris analysis report identifies several items that will survive a re-entry through the atmosphere with a debris casualty area of 9.6 m<sup>2</sup>, exceeding the NASA guideline of 8.0 m<sup>2</sup>. All of the surviving materials are basically metals: aluminum, titanium, magnesium, stainless steel, etc., with the exception of a glass mirror. There are no anticipated environmental impacts from these materials.

### 3.0 NASA Routine Payload Determination

The Swift mission has been evaluated against the NASA routine payload EA for launches from CCAFS and VAFB, using the RPC (see enclosed Evaluation Recommendation Package). The evaluation indicates that the mission meets the criteria for a routine payload. The radioactive sources are considered of small quantity and fall within the routine payload envelope. The mission does not present any unique or unusual circumstances that could result in new or substantial environmental impacts. Based on this review, it is determined that the Swift mission qualifies as a routine payload and falls within the scope of the reference routine payload EA. No additional NEPA action or documentation is required.

*for*   
A. V. Diaz  
Director

Enclosure

**EVALUATION RECOMMENDATION PACKAGE**

**Record of Environmental Consideration  
Routine Payload Checklist  
NEPA Environmental Checklist**

## RECORD OF ENVIRONMENTAL CONSIDERATION

1. Project Name: Swift Gamma Ray Burst Explorer
2. Description/location of proposed action: Swift's primary mission is to observe gamma ray bursts, extraordinary explosions of matter and energy that astronomers think signal the births of black holes. Swift will be launched on a Delta 7320 rocket from CCAFS into an orbit at an altitude of 600 km and an inclination of 22 degrees.

Date and/or Duration of project: Launch 3rd Q 04

3. It has been determined that the above action:

- a. Is adequately covered in an existing EA or EIS.  
Title: Final Environmental Assessment for Launch of NASA Routine Payloads on ELVs from CCAFS, Florida and VAFB, California  
Date: June 2002
- b. Qualifies for Categorical Exclusion and has no special circumstances which would suggest a need for and Environmental Assessment.  
Categorical Exclusion: \_\_\_\_\_
- c. Is exempt from NEPA requirements under the provisions of:
- d. Is covered under EO 12114, not NEPA.
- e. Has no significant environmental impacts as indicated by the results of an environmental checklist and/or detailed environmental analysis.  
(Attach checklist or analysis as applicable)
- f. Will require the preparation of an Environmental Assessment.
- g. Will require the preparation of an Environmental Impact Statement.
- h. Is not federalized sufficiently to qualify as a major federal action.

Beth Montgomery  
Beth Montgomery - NEPA Coordinator, Code 250

5/13/04  
Date

Joseph A. Dezio  
Joseph Dezio Project Manager, Code 410

5/10/04  
Date

**NASA Routine Payload Checklist (1 of 2)**

PROJECT NAME: Swift DATE OF LAUNCH: 12/5/03  
 PROJECT CONTACT: Joseph Dezio PHONE NUMBER: \_\_\_\_\_ MAILSTOP: 410  
 PROJECT START DATE: 8/98 PROJECT LOCATION: NASA/GSFC  
 PROJECT DESCRIPTION: Gamma-ray Burst Explorer

| <b>A. SAMPLE RETURN:</b>   | YES      | NO       |
|--|----------|----------|
| 1. Would the candidate mission return a sample from an extraterrestrial body?  |          | <b>X</b> |
| <b>B. RADIOACTIVE SOURCES:</b>   | YES      | NO       |
| 1. Would the candidate spacecraft carry radioactive materials?   | <b>X</b> |          |
| 2. If Yes, would the amount of radioactive sources require launch approval at the NASA Associate Administrator level or higher according to NPG 8715.3 (NASA Safety Manual)?   |          | <b>X</b> |
| Provide a copy of the Radioactive Materials Report as per NPG 8715.3 Section 5.5.2.  |          |          |
| <b>C. LAUNCH AND LAUNCH VEHICLES:</b>  | YES      | NO       |
| 1. Would the candidate spacecraft be launched using a launch vehicle/launch complex combination other than those indicated in Table 1 below?   |          | <b>X</b> |
| 2. Would the proposed mission cause the annual launch rate for a particular launch vehicle to exceed the launch rate approved or permitted for the affected launch site?   |          | <b>X</b> |
| Comments:  |          |          |
| <b>D. FACILITIES:</b>  | YES      | NO       |
| 1. Would the candidate mission require the construction of any new facilities or substantial modification of existing facilities?  |          | <b>X</b> |
| 2. If Yes, has the facility to be modified been listed as eligible or listed as historically significant?  |          |          |
| Provide a brief description of the construction or modification required:  |          |          |
| <b>E. HEALTH AND SAFETY:</b>   | YES      | NO       |
| 1. Would the candidate spacecraft utilize any hazardous propellants, batteries, ordnance, radio frequency transmitter power, or other subsystem components in quantities or levels exceeding the Envelope Payload characteristics (EPCs) in Table 2 below?                             |          | <b>X</b> |
| 2. Would the candidate spacecraft utilize any potentially hazardous material as part of a flight system whose type or amount precludes acquisition of the necessary permits prior to its use or is not included within the definition of the Envelope Payload (EP)?                    |          | <b>X</b> |
| 3. Would the candidate mission release material other than propulsion system exhaust or inert gases into the Earth's atmosphere or space?  |          | <b>X</b> |
| 4. Would launch of the candidate spacecraft suggest the potential for any substantial impact on public health and safety?  |          | <b>X</b> |
| 5. Would the candidate spacecraft utilize a laser system that does not meet the requirements for safe operation (ANSI Z136.1-2000 and ANSI Z136.6-2000)? For Class III-B and IV laser operations, provide a copy of the hazard evaluation and written safety precautions (NPG 8715.3). |          | <b>X</b> |
| 6. Would the candidate spacecraft contain pathogenic microorganisms (including bacteria, protozoa, and viruses) which can produce disease or toxins hazardous to human health?   |          | <b>X</b> |
| Comments:  |          |          |

continued on next page

### NASA Routine Payload Checklist (2 of 2)

PROJECT NAME: \_\_\_\_\_ DATE OF LAUNCH: \_\_\_\_\_  
 PROJECT CONTACT: \_\_\_\_\_ PHONE NUMBER: \_\_\_\_\_ MAILSTOP: \_\_\_\_\_  
 PROJECT START DATE: \_\_\_\_\_ PROJECT LOCATION: \_\_\_\_\_  
 PROJECT DESCRIPTION: \_\_\_\_\_

| F. OTHER ENVIRONMENTAL ISSUES:   | YES                      | NO                                  |
|--|--------------------------|-------------------------------------|
| 1. Would the candidate spacecraft have the potential for substantial effects on the environment outside the United States?                             | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2. Would launch and operation of the candidate spacecraft have the potential to create substantial public controversy related to environmental issues? | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Comments: _____  |                          |                                     |

**Table 1: Launch Vehicles and Launch Pads**

| Launch Vehicle  | Eastern Range<br>(CCAFS Launch Complexes) | Western Range<br>(VAFB Space Launch Complexes) |
|-----------------|---|--|
| Atlas IIA & AS  | LC-36                                     | SLC-3  |
| Atlas IIIA & B  | LC-36                                     | SLC-3  |
| Atlas V Family  | LC-41                                     | SLC-3  |
| Delta II Family | LC-17                                     | SLC-2  |
| Delta III       | LC-17                                     | N/A  |
| Delta IV Family | LC-37                                     | SLC-6  |
| Athena I & II   | LC-46 or -20                              | California Spaceport                           |
| Taurus          | LC-46 or -20                              | SLC-576E                                       |
| Titan II        | N/A                                       | SLC-4W   |
| Pegasus XL      | CCAFS skidstrip<br>KSC SLF                | VAFB airfield                                  |

**Table 2: Summary of Envelope Spacecraft Subsystems and Envelope Payload Characteristics (EPC)**

|                     |   |
|---------------------|---|
| Structure           | <b>Unlimited:</b> aluminum, magnesium, carbon resin composites, and titanium<br><b>Limited:</b> beryllium [50 kg (110 lb)]  |
| Propulsion          | Mono- and bipropellant fuel; 1000 kg (2200 lb) (hydrazine);<br>1000 kg (2200 lb) (monomethylhydrazine)<br>Bipropellant oxidizer; 1200 kg (2640 lb) (nitrogen tetroxide)<br>Ion-electric fuel; 500 kg (1100 lb) (Xenon)<br>SRM; 600 kg (1320 lb) (AP)-based solid propellant |
| Communications      | Various 10-100 W (RF) transmitters  |
| Power               | Solar cells; 150 A-Hr (Ni-H <sub>2</sub> ) battery; 300 A-Hr (LiSOC) battery;<br>150 A-Hr (NiCd) battery  |
| Science instruments | 10 kW radar<br>ANSI safe lasers (Section 4.1.2.1.3)   |
| Other               | Class C EEDs for mechanical systems deployment<br>Radioisotopes limited to quantities that are approved for launch by NASA<br>Nuclear Flight Safety Assurance Manager<br>Propulsion system exhaust and inert gas venting  |

## NEPA Environmental Checklist

### 1. Project/Program

Swift

### 2. Points of Contact

Project Manager: Joseph Dezio Code: 410 Telephone: 6-4443  
S/C Manager: Oren Sheinman Code: 410 Telephone: 6-2255  
Instrument Manager: Renan Borelli Code: 410 Telephone: 6-7389  
Instrument Manager Greg Frazier Code: 556 Telephone: 6-6619

### 3. Schedule

Formulation Process (Phase A/B): January 1999 to August 2000  
Implementation Process (Phase C/D): Commenced August 2000  
Launch Date: September, 2004  
Other Milestone Dates: CDR - July 2001, PER - May 2003

### 4. Current status

Observatory Environmental Test Program has Begun

### 5. Project Description

a. Purpose/Need: To determine the origin of Gamma ray Bursts (GRBs) and to use GRBs to probe the universe

b. Spacecraft/Instruments: Spacecraft is a three-axis stabilized design with one-time deployed single-axis-articulated solar arrays. The payload consists of three, co-aligned telescopes. The Burst Alert Telescope (BAT) detects the burst as it occurs, and issues a request for the spacecraft to slew so that the GRB is within the field-of-view of the other two telescopes. The X-ray telescope (XRT), and the Ultraviolet/Optical Telescope (UVOT) study the afterglow emissions of the GRB.

c. Launch Vehicle: Delta 7320-10

d. Launch Site: Cape Canaveral Air Force Station

e. Alternatives (to or for the mission): None

f. NASA's Involvement/Responsibility: Mission Project Management, Mission Systems Engineering, Optical Bench, Burst Alert Telescope, Science Center

g. Participants/Locations:

Pennsylvania State University (PSU), State College, PA - XRT, UVOT, Mission Ops Center, EPO

University of Leicester (UL), Leicester, UK - XRT, Science center

Mullard Space Science Lab (MSSL), University College London, UK -

UVOT instrument

Osservatorio Astronomica di Brera (OAB), Milan, Italy -

XRT Mirrors and Mirror Support

Agenzia Spaziale Italiana (ASI), Rome, Italy - Malindi Ground Station,  
Science Center

Los Alamos National Laboratory, New Mexico - BAT Trigger Algorithm  
Sonoma State University, California - EPO lead institution

h. Mission Life: 2 year requirement, 5 year goal

i. End of mission, Re-entry: Spacecraft to go into tumble and re-enter the  
atmosphere.

**6. Is there anything controversial about the mission?**

Not from an environmental perspective.

**7. Is there anything unique, unusual, exotic about the mission, spacecraft, and instruments?**

Not from an environmental perspective.

**8. Is there any environmental documentation for spacecraft, launch vehicle (NEPA or EO12114)?**

No

**9. Is the mission compliant with NASA policy and guidelines for Orbital Debris? (NPD 8710.3 and NSS 1740.14)**

Final report has been submitted to NASA HQ. Waiting on response from HQ.

The updated Reentry Survivability Analysis has been performed for the Swift spacecraft in accordance with the basic guidelines of NASA Safety Standard NSS 1740.14 and the GSFC work instructions for this procedure. This analysis used ORSAT version 5.5 to update and refine a previous DAS analysis, which modeled an inadequate portion of the entire spacecraft mass. The ORSAT results yield sufficient insight into the nature of the surviving objects to conclude that most likely 18 objects with significant injury potential will survive the atmospheric reentry of Swift, with a combined debris casualty area of 9.6 square meters. For a reentry in 2017, this equates to a risk of causing a significant injury of 0.0001376 (1 in 7270 odds).

**10. Has an Air Force Form 813 been completed? (Please attach copy)**

No



**11. Does the mission include or involve:**

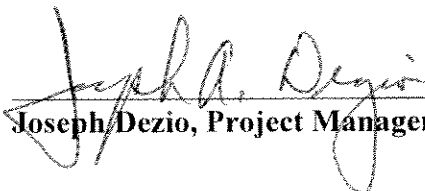
Check all that apply. If uncertain indicate with a “?”

For all that apply provide an explanation. Use the additional space below if needed.

- a. Fuels
- b. Radioactive Material - Instrument Calibration Sources (see explanations)
- c. Explosives
- d. Chemicals - Ammonia, Ethane, Propylene (see explanations)
- e. Hazardous Materials/Substances
- f. Lasers (Class, Earth Pointing)
- g. Disease Producing Pathogenic Microorganisms
- h. Construction/Modification of a Facility
- i. Discharges of any substances into air, water, or soil
- j. Generation/Use/Storage/Disposal of Toxic or Hazardous Substances
- k. Generation of Hazardous Wastes
- l. Generation of High Noise Levels
- m. Sample Return to Earth
- n. Generation of Ionizing or Nonionizing Radiation Instr. Cal. Sources
- o. Impact on Local Social or Economic Conditions
- p. Removal of Vegetation or Destruction of Habitat
- q. Impact/Affect on Minority or Low Income Populations
- r. Affect Any Threatened or Endangered Species
- s. Affect Areas of Historical or Cultural Significance
- t. New or Foreign Launch Vehicle
- u. Other Issues of Potential Environmental Impact

**12. What hazards are associated with the mission?**

None, other than those delineated above.

  
\_\_\_\_\_  
Joseph Dezio, Project Manager, Code 410

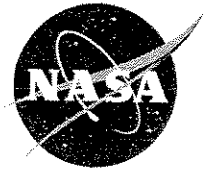
5/10/04  
\_\_\_\_\_  
Date



## Summary of Swift Subsystems

|   |  |
|---|--|
| Structural Materials                            | Aluminum, Graphite Epoxy, Titanium, Inconel, Stainless steel, INVAR, Magnesium                                   |
| Propulsion                                      | None   |
| Communications                                  | TDRS 4 <sup>th</sup> Generation Transponder 5.62 Watts<br>4 Hemispherical Omni Antennas<br>S-band communications |
| Power   | 2100 W GaAs Solar Array<br>80 A-hr NiH2 Battery  |
| Science instruments                             | Gamma-ray Burst Alert Telescope<br>X-ray Telescope<br>Ultraviolet/Optical Telescope                              |
| Other<br>(include dimensions and weight of s/c) | Mass: 1450 kg<br>Maximum dimensions (With solar arrays deployed):<br>5.57m x 5.41m x 2.45 m                      |

National Aeronautics and  
Space Administration  
**Goddard Space Flight Center**  
Greenbelt, MD 20771



February 23, 2004

Reply to Attn of: 250

TO: NASA Headquarters  
Attn: QS/Nuclear Flight Safety Assurance Manager

FROM: 250/Radiation Protection Program Manager

SUBJECT: Request for Nuclear Launch Safety Approval

In accordance with NASA Procedural Requirement (NPR) 8715.3, Chapter 5, a request for approval is hereby submitted for the launch of radioactive material to be launched on a Goddard Space Flight Center sponsored project.

The radioactive sources reports are enclosed as required by NPR 8715.3, Chapter 5, paragraph 5.4.

If you have any questions, please contact me at (301) 286-5605.

A handwritten signature in black ink, appearing to read "Patrick Hancock", written in a cursive style.

Patrick Hancock

2 Enclosures

cc:  
250/Ms. Montgomery  
250.9/Mr. Simmons

661/Dr. Hartman

**MINOR RADIOACTIVE SOURCES BEING  
LAUNCHED ON GSFC SPONSORED PROJECTS**

| Vehicle/<br>Spacecraft | Planned<br>Launch Date<br>(Mo/Yr) | Launch<br>Site | Number<br>of<br>Sources | Isotope                              | Total<br>Activity<br>(Curies) | A <sub>2</sub> Limit for<br>Isotope (Ci) | A <sub>2</sub> Multiple for<br>Isotope | Remarks/Disposition   |
|------------------------|-----------------------------------|----------------|-------------------------|--------------------------------------|-------------------------------|--|--|---|
| Delta 7420             | October, 2004                     | KSC            | 5<br>2                  | <sup>55</sup> Fe<br><sub>24</sub> Am | 0.00014<br>0.00000016         | 1000<br>0.005                            | 0.00000014<br>0.000032                 | Sources are used for ground testing and on-orbit calibration. They will be launched as part of the XRT and BAT instruments in the Swift-observatory. The Swift observatory is expected to remain in orbit until approximately 2010, when it will re-enter and burn up in the atmosphere. These sources will burn up with the observatory. |
| Mission Multiple →     |                                   |                |                         |                                      |                               |  |  | 0.00003214  |