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

October 21, 2002

Reply to Attn of: 850

MEMORANDUM FOR THE RECORD

National Environmental Policy Act (NEPA) Compliance for Cosmic Hot Interstellar Plasma Spectrometer (CHIPS)

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 1500-1508] and NASA policy and procedures [14 CFR Part 12160]), 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

CHIPS is a University-Class Explorer (UNEX) mission funded by NASA. The purpose of the mission is to determine how the million degree gas cloud surrounding our solar system cools, using extreme ultraviolet spectroscopy. The CHIPS spectrograph will be fabricated at the Space Sciences Laboratory of the University of California, Berkeley, and carried aboard a dedicated mini-satellite, called CHIPSat, to be provided by SpaceDev, Inc. CHIPS will be launched with ICESat, the primary payload, on a Delta II launch vehicle from VAFB in late 2002. The CHIPS mission will last 1 year.

Our solar system is located in an unusual region of space called the Local Bubble. The CHIPS mission is studying the very hot, very low-density gas in the vast spaces between the stars in the Local Bubble. The majority of the power radiated by this hot gas occurs in the short-wavelength, extreme ultraviolet region of the electromagnetic spectrum. This is a relatively unsurveyed band, centered around 170 Å. The nature of the emissions at this wavelength may contain important clues about the process of cooling that takes place in the Local Bubble Interstellar Medium (ISM).

The ISM literally contains the seeds of future stars, and all the stars we see were once formed out of the same kind of diffuse gas and dust. When the gas in the ISM cools and collapses, the gas forms clumps that can evolve into stars and planets. In fact, this is probably how our solar system was formed. One of the biggest puzzles in astrophysics is the process that turns this very diffuse, hot and cold gases and dust in the ISM into stars. Spectra from CHIPS will help us determine how the million-degree gas in the Local Bubble cools. These results will find important applications in interpreting X-ray observations of spiral galaxies, modeling of the global characteristics of the interstellar medium, and other areas of astrophysics. Depending on the nature of the observational results, CHIPS data alone or in concert with measurements from other instruments will provide key constraints on the cooling mechanisms in the Local Bubble. These findings directly support NASA's Structure and Evolution of the Universe theme and will help to answer one of the key questions posed in the recently-published Space Science Enterprise Strategic Plan, which is to "understand... the exchange of matter and energy among the stars and the interstellar medium."

CHIPSat is a 3-axis stabilized spacecraft using 4 momentum wheels, 3 torque coils (for desaturation of the wheels), a sun sensor, magnetometer, lunar sensor, and rate sensors to provide ~2° attitude accuracy and control. The spacecraft is nominally sun pointing with complete freedom to yaw about the solar array normal vector allowing the CHIPS instrument to obtain a full sky survey within a year while avoiding pointing the instrument at sun, earth, moon and orbital Ram direction. This flexible and highly capable design provides access to all points on the celestial sphere within the 1-year mission lifetime.

The CHIPSat has body mounted solar-panel array roughly orthogonal to the field of view of the spectrograph. The spacecraft weighs 93 kgs (205 lbs), and measures approximately 1 m (3.28 ft) by 1 m (3.28 ft) by ½ m (1.64 ft).

The CHIPSat structure uses a milled aluminum transition adapter and aluminum honeycomb panels with facesheets to provide the structural integrity required to survive launch conditions as well as a stable platform for the CHIPS instrument and other spacecraft components. The component configuration supports all subsystem thermal, volume and field of view needs, while minimizing wire lengths and losses.

The components utilized in the CHIPS spacecraft and instrument are made of materials normally encountered in the space industry. CHIPS does not use any radioactive materials or lasers. CHIPS does not carry any pathogenic organisms or materials extremely hazardous to human health, nor will CHIPS return samples to Earth.

3.0 NASA Routine Payload Determination

The CHIPS 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 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 CHIPS 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. Separate NEPA documentation has been prepared for the ICESat mission.

W. F. Townsend

for A. V. Diaz

Enclosure

EVALUATION RECOMMENDATION PACKAGE

Record of Environmental Consideration
Routine Payload Checklist
NEPA Environmental Checklist

Enclosure

RECORD OF ENVIRONMENTAL CONSIDERATION

1. Project Name: Cosmic Hot Interstellar Plasma Spectrometer (CHIPS)

2. Description/location of proposed action:
CHIPS is a NASA satellite-based observatory, whose mission is to study the million degree gas in the Interstellar Medium (ISM), the very hot, very low-density gas in the vast spaces between the stars in our local astronomical neighborhood. CHIPS is a dual payload with ICESat to be launched on a Delta II from VAFB.

Date and/or Duration of project: Launch – December 2002

3. It has been determined that the above action:

X 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.

Bob Montgomery — NEPA Coordinator, Code 2052 — 9/24/02 Date

David L. Lierle — Project Manager, Code 850 — 9/25/02 Date

NASA Routine Payload Checklist (1 of 2)

PROJECT NAME: Cosmic Hot Interstellar Plasma Spectrometer (CHIPS) DATE OF LAUNCH: 12/19/02

PROJECT CONTACT: David Pierce PHONE NUMBER: (757) 824-1749 MAILSTOP: 850.0

PROJECT START DATE: 10/1998 PROJECT LOCATION: UC Berkeley

PROJECT DESCRIPTION: Code S/Explorer Program/ UNEX mission to study of interstellar medium

A. SAMPLE RETURN:	YES	NO
1. Would the candidate mission return a sample from an extraterrestrial body?		X
B. RADIOACTIVE SOURCES:	**YES**	**NO**
1. Would the candidate spacecraft carry radioactive materials?		X
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)?		
Provide a copy of the Radioactive Materials Report as per NPG 8715.3 Section 5.5.2.		
C. LAUNCH AND LAUNCH VEHICLES:	**YES**	**NO**
1. Would the candidate spacecraft be launched using a launch vehicle/launch complex combination other than those indicated in Table 1 below?		X
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?		X
Comments:		
D. FACILITIES:	**YES**	**NO**
1. Would the candidate mission require the construction of any new facilities or substantial modification of existing facilities?		X
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:		
E. HEALTH AND SAFETY:	**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?		X
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)?		X
3. Would the candidate mission release material other than propulsion system exhaust or inert gases into the Earth's atmosphere or space?		X
4. Would launch of the candidate spacecraft suggest the potential for any substantial impact on public health and safety?		X
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).		X
6. Would the candidate spacecraft contain pathogenic microorganisms (including bacteria, protozoa, and viruses) which can produce disease or toxins hazardous to human health?		X
Comments:		

NASA Routine Payload Checklist (2 of 2)

PROJECT NAME: Cosmic Hot Interstellar Plasma Spectrometer (CHIPS) DATE OF LAUNCH: 12/19/2002

PROJECT CONTACT: David Pierce PHONE NUMBER: (757) 824-1749 MAILSTOP: 850.0

PROJECT START DATE: 10/1998 PROJECT LOCATION: UC Berkeley

PROJECT DESCRIPTION: Code S/Explorer Program/ UNEX mission to study of interstellar medium

F. OTHER ENVIRONMENTAL ISSUES:	YES	NO
1. Would the candidate spacecraft have the potential for substantial effects on the environment outside the United States?		X
2. Would launch and operation of the candidate spacecraft have the potential to create substantial public controversy related to environmental issues?		X
Comments:		

Table 1: Launch Vehicles and Launch Pads

Launch Vehicle	Eastern Range (CCAFS Launch Complexes)	Western Range (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 0r -20	SLC-576E
Titan II	N/A	SLC-4W
Pegasus XL	CCAFS skidstrip KSC SLF	VAFB airfield

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

Structure	**Unlimited:** aluminum, magnesium, carbon resin composites, and titanium **Limited:** beryllium [50 kg (110 lb)]
Propulsion	Mono- and bipropellant fuel; 1000 kg (2200 lb) (hydrazine); 1000 kg (2200 lb) (monomethyhydrazine) Bipropellant oxidizer; 1200 kg (2640 lb) (nitrogen tetroxide) Ion-electric fuel; 500 kg (1100 lb) (Xenon) SRM; 600 kg (1320 lb) (AP)-based solid propellant
Communications	Various 10-100 W (RF) transmitters
Power	Solar cells; 150 A-Hr (Ni-H_2) battery; 300 A-Hr (LiSOC) battery; 150 A-Hr (NiCd) battery
Science instruments	10 kW radar ANSI safe lasers (Section 4.1.2.1.3)
Other	Class C EEDs for mechanical systems deployment Radioisotopes limited to quantities that are approved for launch by NASA Nuclear Flight Safety Assurance Manager Propulsion system exhaust and inert gas venting

NEPA Environmental Checklist

1. **Project/Program**
   Cosmic Hot Interstellar Plasma Spectrometer (CHIPS)

2. **Points of Contact**
   Principal Investigator: Dr. Mark Hurwitz/UC Berkeley Telephone (510) 642-1579
   Project Manager: Mr. Mike Sholl/UC Berkeley Telephone (510) 643-2098
   S/C Manager: Jeff Janicik/ SpaceDev Telephone: (858) 375-2042

   Other: GSFC Mission Mgr David Pierce Code: 850 Telephone: (757) 824-1749

3. **Schedule**
   Formulation Process (Phase A/B): Completed December 2000
   Implementation Process (Phase C/D): Began January 2001
   Launch Date: ~~May 15, 2002~~ December 19, 2002 (as of 9/25/02)
   Other Milestone Dates: Pre-Ship Review ~~March 15 2002~~ October 9, 2002 (as of 9/25/02)

4. **Current status**
   Fabricating spacecraft Flat-Sat and Instrument. Completing Environmental Testing of spacecraft (as of 9/25/02)

5. **Project Description**
   Purpose: Extreme ultraviolet spectroscopy to determine how the million degree gas cloud surrounding our Solar System cools.
   Spacecraft/Instruments: CHIPS Spectrometer
   Launch Vehicle: Delta II Dual Payload with ICESat - ~~May~~ December 2002 (as of 9/25/02)
   Launch Site: VAFB
   Participants/Locations: University of California/ Berkeley, CA
   SpaceDev , Poway, CA
   Mission Life: 1 year 3/04 (as of 9/25/02)
   End of mission, Re-entry: ~~7/15/05~~, r-entry is TBD

6. **Is there anything controversial about the mission?**
   No

7. **Is there anything unique, unusual, exotic about the mission, spacecraft, and instruments?**
   No

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

_____

_____

_____

9. **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 page if needed.

_____a. Fuels_____
_____b. Radioactive Material_____
_____c. Explosives_____
_____d. Chemicals_____
_____e. Hazardous Materials/Substances_____
_____f. Lasers (Class, Earth Pointing)_____
_____g. Disease Producing Pathogenic Microorganisms_____
_____h. Construction of a New 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_____
_____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_____
_____t. Other Issues of Potential Environmental Impact_____

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

No_____

David Pierce _____ 8/8/01

GSFC/CHIPS Mission Manager **Date**

Explanations for Question 9.

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