

National Aeronautics and Space Administration

NOTICE (01-)

National Environmental Policy Act; Space Infrared Telescope
Facility (SIRTF) Mission

AGENCY: National Aeronautics and Space Administration

ACTION: Finding of No Significant Impact

SUMMARY: Pursuant to the National Environmental Policy Act of 1969 (NEPA), as amended (42 U.S.C. 4321, et seq.), 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 made a Finding of No Significant Impact (FONSI) with respect to the proposed Space Infrared Telescope Facility (SIRTF) mission. The SIRTF mission would involve placing a single spacecraft (hereafter referenced as the SIRTF Observatory) into a heliocentric Earth-trailing orbit (i.e., an orbit that lags behind the Earth in its orbit about the Sun). The baseline mission calls for the SIRTF Observatory to be launched on a Boeing Delta 7920H launch vehicle from the Eastern Test Range at Cape Canaveral Air Force Station (CCAFS), Cape Canaveral, Florida, no earlier than July 2002.

DATE: Comments must be provided in writing to NASA on or before April 11, 2002.

ADDRESS: Comments should be addressed to Lia LaPiana, NASA Headquarters, Code SD, 300 E Street SW, Washington, DC 20546.

The Environmental Assessment (EA) prepared for the SIRTF mission which supports this FONSI may be reviewed at:

1. NASA Headquarters, Library, Room 1J20, 300 E Street, SW, Washington, DC 20546.
2. NASA, Spaceport USA, Room 2001, John F. Kennedy Space Center, Florida 32899 (321-867-2622). Please call Penny Myers beforehand at 321-867-9280 so that arrangements can be made.
3. Jet Propulsion Laboratory, Visitors Lobby, Building 249, 4800 Oak Grove Drive, Pasadena, CA 91109 (818-354-5179)
4. Cape Canaveral Public Library, 201 Polk Avenue, Cape Canaveral, FL 32920, (321-868-1101)
5. Cocoa Beach Public Library, 550 North Brevard Ave, Cocoa Beach, FL 32931, (321-868-1104)
6. Merritt Island Public Library, 1195 North Courtenay Parkway, Merritt Island, FL 32953, (321-455-1369)

A limited number of copies of the EA are available for persons wishing a copy by contacting Ms. LaPiana, at the address or telephone number indicated herein.

FOR FURTHER INFORMATION CONTACT: Lia LaPiana, 202-358-0346.

SUPPLEMENTARY INFORMATION: NASA has reviewed the EA prepared for the SIRTF mission and has determined that it represents an accurate and adequate analysis of the scope and level of associated environmental impacts. The EA is incorporated by reference in this FONSI.

NASA is proposing to launch the SIRTF mission, which would place a single spacecraft carrying an 85-centimeter (33.5-inch) liquid helium-cooled infrared telescope into deep space. It would carry imaging cameras and a spectrograph to conduct observations over the infrared (IR) portion of the spectrum from 3 to 180 microns (μm) (1.18×10^{-4} to 1.09×10^{-3} inches [in]). (A Spectrograph is an instrument that can disperse light waves into spectra, much like a prism can disperse sunlight into a spectrum of rainbow colors.)

Current plans call for using the Delta II 7920H, a two-stage version of the commercial Delta II with the high-performance solid rocket motor (SRM) strap-on boosters used by the Delta III. The launch trajectory would include an ascent phase and a short coast of less than 30 minutes. The second stage would then inject the SIRTF Observatory into an Earth-escape trajectory. This trajectory would place the SIRTF Observatory into a heliocentric orbit with a period of about 372 days. Since this orbital period is longer than one year, it would result in the SIRTF Observatory moving away from the Earth at a rate of 17,951,520 kilometers (11,154,600 miles) per year. Unlike planetary launches, there is no planetary alignment restriction on the SIRTF launch period. The launch date would be no earlier than July 2002.

The SIRTF Observatory would use a solar panel and battery for power, nitrogen gas for reaction control, and liquid helium for telescope and instrument cooling. There would be no propulsion

system and no radioactive material. There would be no deployment mechanism except for the dust cover that would be ejected a few days after launch. The primary mission lifetime would last from 2.5 to 5 years, depending on the usage of liquid helium that cools the telescope and the instruments. Communications with Earth would be via the existing NASA Deep Space Network (DSN). Scientific and engineering data would be stored on-board and downlinked to the DSN once or twice a day.

The SIRTF science program would be conducted by the SIRTF science center, which would be located at the California Institute of Technology (Caltech) campus. The SIRTF science center would be responsible for the selection of the SIRTF science program and for the preparation of a set of observation requests which execute that program. The SIRTF flight operations would be conducted at JPL using the Multi-Mission Operations facilities. No new or modified Government or contractor facilities would be needed to conduct launch or operations.

The top level science objectives of SIRTF are:

1) Search for Brown Dwarfs and Super Planets:

A brown dwarf has a substantial internal energy source and actually radiates to space several times more heat than it absorbs from the Sun. Therefore, brown dwarfs, while much cooler and dimmer than stars, should glow faintly in the infrared. The SIRTF Observatory, operating in a survey mode, would be able to detect brown dwarfs.

The quest for planetary systems outside our own is part of the fundamental motivation for astronomical exploration. Recent detection of Jupiter-sized companions to fifty nearby solar-type stars indicates that many types of planetary systems will be found, and the SIRTf Observatory could play a crucial role in continuing this search.

2) Discover and Study Pre-planet Formation and Planetary Debris Disks (remaining after planet formation):

It is believed that the formation of stars and planetary systems begins with a small concentration of interstellar gas and dust. Due to a gravitational effect, more gas and dust particles condense and collapse, eventually becoming a star. This condensation and collapse is thought to occur within dense clouds that are impenetrable to optical and ultraviolet radiation, but can be penetrated by infrared observations. The SIRTf Observatory would be able to study star formation and the environment at all evolutionary stages of development. Of particular importance would be searches for evidence of debris disks surrounding stars within which planets may be forming, and the remains of such debris disks after a solar system has been formed.

3) Study Very-bright Galaxies and Active Galactic Nuclei

Understanding Active Galactic Nuclei (AGN) has been a major thrust of modern astrophysics for three decades. AGN are very compact, very bright objects outside the galaxy containing highly excited gas molecules. It is generally thought that AGN are

powered by the gravitational energy released as matter condenses onto massive black holes, but many details of this picture remain uncertain.

SIRTF would be a unique observatory to explore bright infrared galaxies, and would clarify the relation of these systems to AGN discovered via other techniques, as well as address the deeper question of the relation of AGN to the evolution of galaxies in general.

4) Study the Early Universe:

The SIRTF mission would allow exploration of the distant past. The expansion of the Universe means that more distant objects are moving away at higher velocities, and the finite speed of light implies that we see more distant objects as they were at earlier times. The speed of recession creates the redshift. As a result of this redshift, infrared observations can probe the past by studying starlight from very distant and very young galaxies. The SIRTF Observatory would be used to carry out a survey of a small region of the sky with the aim of detecting galaxies as they appeared when the Universe was about one-tenth of its present age.

This area is one of many in which SIRTF's scientific programs could overlap those of the other Great Observatories, particularly Hubble Space Telescope (HST) and Chandra X-Ray Observatory (CXO). In this case, the recently completed HST deep-filed survey contains many distant galaxies that would appear in

the SIRTf Observatory's deep images of the same field. Comparing infrared (e.g., SIRTf) and visible (e.g., HST) data on these galaxies would provide important insights into galaxy evolution and would establish a context for the interpretation of the data on more distant galaxies that might be seen only by the SIRTf Observatory.

Alternatives to the SIRTf mission that were evaluated include:

(1) No-Action (i.e., no SIRTf mission); (2) other launch vehicle options, including the Space Shuttle, Taurus, and Atlas configurations, as well as other Delta configurations; and (3) alternative launch sites.

Of the launch vehicles evaluated, the Delta II 7920-Heavy (7920H) launch system most closely matches the SIRTf mission requirements.

Expected impacts to the human environment associated with the mission arise entirely from the normal launch of the Delta II 7920H. Launch accident scenarios have also been addressed. Air emissions from the exhaust produced by the graphite epoxy motors (GEMs) and first stage primarily include carbon monoxide, hydrochloric acid, aluminum oxide in soluble and insoluble forms, Carbon dioxide, and deluge water mixed with propellant by-products. Air impacts will be short-term and not substantial. Short-term water quality and noise impacts, as well as short-term effects on wetlands, plants, and animals, would occur in the vicinity of the launch complex. These short-term impacts are of

a nature to be self-correcting, and none of these effects would be substantial. There would be no impact on threatened or endangered species or critical habitat, cultural resources, or floodplains.

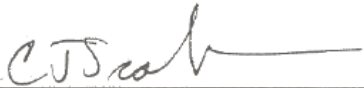
The second stage would be ignited at an altitude of at least 111 km (69 mi). After burning its propellant to depletion, the second stage would escape earth. The SIRTf mission has followed the NASA guidelines regarding orbital debris and minimizing the risk of human casualty for uncontrolled reentry into the Earth's atmosphere. No other impacts of environmental concern have been identified.

The level and scope of environmental impacts associated with the launch of the Delta II 7920H vehicle are well within the envelope of impacts that have been addressed in previous FONSI's concerning other launch vehicles and spacecraft. No significant new circumstances or information relevant to environmental concerns associated with the launch vehicle have been identified which would affect the earlier findings.

Failure to undertake the SIRTf mission would disrupt the progress of NASA's Great Observatory and Origins Programs. The SIRTf mission is the culmination of more than a decade's planning to extend our knowledge of our solar system, our galaxy, and the Universe. Failure to implement the SIRTf mission would eliminate or delay the acquisition of scientific knowledge of our solar system, our galaxy, and the Universe. While minimal environmental

impacts would be avoided by cancellation of the single launch, the loss of the scientific knowledge and database that could lead to future technological advances would be substantial.

On the basis of the SIRTf EA, NASA has determined that the environmental impacts associated with the mission would not individually or cumulatively have a significant impact on the quality of the human environment. NASA will take no final action prior to the expiration of the 45-day comment period.



2/26/02

Edward J. Weiler

Date

Associate Administrator for Space Science

