

National Aeronautics and  
Space Administration  
**Headquarters**  
Washington, DC 20546-0001



Reply to Attn of:

Science Mission Directorate

JUL 25 2005

MEMORANDUM FOR THE RECORD

FROM: Associate Administrator for Science Mission Directorate

SUBJECT: Wide-Field Infrared Survey Explorer Environmental Assessment

The proposed Wide-Field Infrared Survey Explorer (WISE) mission has been reviewed in accordance with the Routine Payload criteria established in the "Final Environmental Assessment of NASA Routine Payloads on Expendable Launch Vehicles from Cape Canaveral Air Force Station Florida and Vandenberg Air Force Base California," dated June 2002 and Finding of No Significant Impact (FONSI) dated June 18, 2002. After considering the enclosed Environmental Evaluation and Routine Payload Checklist for the Wise Project, I am designating the Wise mission as a NASA Routine Payload. As a NASA routine payload, the Wise mission is within the definitions established by the Environmental Assessment and FONSI. The Wise mission will have no significant impact, individually or cumulatively, on the quality of the human environment.

A handwritten signature in black ink, appearing to read "A. V. Diaz".

A. V. Diaz

Enclosures

cc:

Universe Division/Dr. Kinney

Universe Division/Dr. Montemerlo

Office of the General Counsel/Mr. Stewart

**Environmental Management Division/Mr. Kumor**

JPL/1610/Mr. Wilcox

JPL/7060/Mr. Irace



National  
Aeronautics and  
Space  
Administration

# Routing Slip

*JFB/04*

Mail Code	Name	Action
1	Mei Montemerlo <i>MDM</i>	Approval Call me Concurrence
2	Anne Kinney <i>AK</i>	File Information
3	Ken Kumor <i>KK</i>	Investigate and Advise Note and Forward
4	David Stewart <i>DES</i>	Note and Return Per Request
5	Audrey Murray	Per Phone Conversation Recommendation
6	Orlando Figueroa	See me Signature
7	Al Diaz	Circulate and Destroy
8	Genny Arbitrari <i>GA</i>	

HATS ACTION: S/2005-00289 WISE Environmental Assessment

Name	Tel. No. (or Code) & Ext.
Paul Van Damme	358-0840
Code (or other designation)	Date
	June 8, 2005

**Environmental Evaluation and Recommendation for NASA Routine Payload Categorization of the Wide-field Infrared Survey Explorer (WISE) Project**

The proposed WISE mission has been reviewed in accordance with the Routine Payload criteria established by the "Final Environmental Assessment of NASA Routine Payloads on Expendable Launch, Vehicles from Cape Canaveral Air Force Station Florida and Vandenberg Air Force Base California," dated June 2002 and Finding of No Significant Impact (FONSI) dated June 18, 2002. This review shows that the WISE mission meets the Routine Payload Criteria and therefore it is recommended that WISE be designated a NASA Routine Payload. Supporting mission description and Routine Payload Checklist documentation are attached.

  
V.S. Mowrey, Supervisor  
Launch Approval Planning  
Group

2-23-05  
Date

Concurrence:

Concurrence:

  
R. E. Wilcox, Manager  
Cross-Program Launch  
Approval Engineering

3/10/05  
Date

  
William Irace  
WISE Project Manager

3/15/05  
Date

## Description of Proposed Mission:

The proposed Wide-Field Infrared Survey Explorer (WISE), a NASA Medium Class Explorer (MIDEX) Mission, would scan the entire sky in infrared light (3.5-23  $\mu\text{m}$ ) in search of nearby cool stars, planetary construction zones and the brightest galaxies in the universe. WISE would be an unmanned satellite carrying an infrared-sensitive telescope that would image the entire sky and could provide the catalog for further detailed study by future NASA missions. The WISE telescope would scan  $90^\circ$  away from the Sun and would follow a sun-synchronous orbit at an altitude of 500 kilometers (310.7 miles). The WISE spacecraft would be launched from Vandenberg Air Force Base (VAFB) during an opportunity that begins on June 21, 2008 on-board a Delta II expendable launch vehicle. The end of the baseline mission would be January 2009.

Sensitive all-sky surveys in the near-infrared (1.25 - 2.17 microns) and infrared (12 - 100 microns) electromagnetic spectrum have recently been completed: the University of Massachusetts and the Infrared Processing and Analysis Center (IPAC's) Two Micron All Sky Survey (2MASS) in the near-infrared and the Infrared Astronomical Satellite (IRAS) mission in the infrared. WISE would fill the gap of the mid-infrared, mapping the entire sky in wavelengths of light from 3.5 – 23 microns during the first 6 months of the mission.

The WISE Mission's goals and objectives are to provide a full sky infrared map to observe the following types of matter that makes up most of the universe:

- Ultra-luminous infrared galaxies in the Universe - The Infrared Astronomy Satellite (IRAS) discovered a class of galaxies which are as much as 100 times more luminous in the IR than in visible light, rivaling quasars in total luminosity. These Ultra Luminous Infrared Galaxies (ULIRG's) are found in merging galaxies whose collisions lead to dust-enshrouded bursts of star formation
- Brown dwarf stars- The WISE instrument would be sensitive to radiation with wavelengths of 5  $\mu\text{m}$ , the same as that emitted by brown dwarfs
- Main belt asteroids larger than 3 km (1.8 miles) - These faint small asteroids are currently not well catalogued. Thus, WISE could provide a vast database of new astrometric and radiometric information on previously unknown asteroids

The WISE spacecraft consists of a single four-channel, super-cooled infrared instrument that would be powered by deployable solar arrays. Since objects around room temperature emit infrared radiation, the WISE telescope and detectors are kept very cold (below  $15^\circ\text{K}$  ( $-430^\circ\text{F}$ ), which is only  $15^\circ\text{C}$  ( $59^\circ\text{F}$ ) above absolute zero) by a cryostat -- like an ice chest but filled with solid hydrogen instead of ice. The WISE telescope would include the following:

- 2-stage aperture shade- would be radiatively cooled and would be used to protect the aperture from stray sun/earth radiation.
- Telescope assembly- includes a 40 centimeter (1.312 feet) afocal front end and a scan mirror, which together would be used to scan the entire sky.
- Cryostat- 2-stage solid hydrogen tank with 2 vapor-cooled shields which would be used to keep the telescope assembly cold.

WISE would be the next mission in NASA's MIDEX program of lower cost, highly focused, rapid-development scientific spacecraft. The mission of the Explorers Program is to provide frequent flight opportunities for world-class scientific investigations from space utilizing innovative, streamlined and efficient management approaches at a total costs not to exceed \$180 million.

## Statement of Purpose and Need:

For thousands of years astronomers have been meticulously mapping the sky. In modern times, astronomers use telescopes to survey the entire sky in multiple wavelengths of light. These all-sky surveys are fundamental to astronomy, providing the sources that define the normal Universe and giving the context to reveal and understand the objects within it. Sensitive all-sky surveys across the electromagnetic spectrum have recently been completed, but a major gap remains in the mid-infrared. WISE would fill that gap, mapping the entire sky in mid-infrared wavelengths of light from 3.5 to 23 microns during the first 6 months of the mission. All-sky surveys at all wavelengths have been essential for the efficient use of large telescopes and creating new fields of study. A fast, shallow survey would find more astronomical sources than a targeted search. Plus, bright, nearby sources found in an all-sky survey are easier to follow up. At the completion of the WISE Mission, the project would publish a catalogue of sources identified in the all-sky survey. This catalogue could serve as a source of targets to be investigated by future NASA missions.

The WISE Mission has scientific goals which address several prominent NASA Science Objectives or themes. These themes are:

- Learn how galaxies, stars, and planets form, interact, and evolve (Astronomical Search for Origins)
- Understand the structure of the universe, from its earliest beginnings to its ultimate fate (Structure and Evolution of the Universe)
- Explore the ultimate limits of gravity and energy in the universe (Solar System Exploration)
- Understand the formation and evolution of the Solar System and Earth within it (Solar System Exploration and Astronomical Search for Origins)

NASA's Astronomical Search for Origins (ASO) is a series of closely linked missions that build on prior accomplishments in the quest for answers to these questions and thus directly support the President's new vision to explore the solar system as well as worlds beyond. The Solar System Exploration (SSE) theme is a three-prong quest to explore the formation and evolution of our solar system, seek the origins of life and its existence beyond Earth, and chart our destiny within the solar system. The Structure and Evolution of the Universe (SEU) theme seeks to understand the cycles of matter and energy and how they created the conditions for our own existence. The WISE mission would help in identifying previously unseen dark asteroids and brown dwarfs. WISE would look for ULIRG's over the entire sky and would be able to look back at times where most galaxies were still forming. The only way to find the most luminous IR galaxy in the observable Universe is to search the whole sky, and the WISE sensitivity versus wavelength is well matched to the spectrum of these objects.

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

PROJECT NAME:	<b>Wide-field Infrared Survey Explorer (WISE)</b>	DATE OF LAUNCH:	June 21, 2008		
PROJECT CONTACT:	James Colvin	PHONE NUMBER:	818-354-8834	MAILSTOP:	179-206
PROJECT START DATE:	September 27, 2004	PROJECT LOCATION:	JPL		
PROJECT DESCRIPTION:	The WISE mission will perform a survey of the entire sky in the mid-infrared with 500 to 500,000 times the sensitivity than previous survey.. The instrument is a cold 4- cm telescope with 4 bands between 3 and 26 micrometers operating in a sun synchronous earth orbit at the terminator.				
<b>A. SAMPLE RETURN:</b>				YES	NO
1. Would the candidate mission return a sample from an extraterrestrial body?				<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>B. RADIOACTIVE SOURCES:</b>				YES	NO
1. Would the candidate spacecraft carry radioactive materials?				<input type="checkbox"/>	<input checked="" type="checkbox"/>
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)?				<input type="checkbox"/>	<input type="checkbox"/>
Provide a copy of the Radioactive Materials Report as per NPG 8715.3 Section 5.8.3.					
<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?				<input type="checkbox"/>	<input checked="" type="checkbox"/>
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?				<input type="checkbox"/>	<input checked="" type="checkbox"/>
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?				<input type="checkbox"/>	<input checked="" type="checkbox"/>
2. If Yes, has the facility to be modified been listed as eligible or listed as historically significant?				<input type="checkbox"/>	<input type="checkbox"/>
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?				<input type="checkbox"/>	<input checked="" type="checkbox"/>
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)?				<input type="checkbox"/>	<input checked="" type="checkbox"/>
3. Would the candidate mission release material other than propulsion system exhaust or inert gases into the Earth's atmosphere or space?				<input checked="" type="checkbox"/>	<input type="checkbox"/>
4. Would launch of the candidate spacecraft suggest the potential for any substantial impact on public health and safety?				<input type="checkbox"/>	<input checked="" type="checkbox"/>
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).				<input type="checkbox"/>	<input checked="" type="checkbox"/>
6. Would the candidate spacecraft contain pathogenic microorganisms (including bacteria, protozoa, and viruses) which can produce disease or toxins hazardous to human health?				<input type="checkbox"/>	<input checked="" type="checkbox"/>
Comments: <b>Item 3: Solid hydrogen cryostat carrying approx. 16 kg of frozen hydrogen at launch. Helium cycled through cryostat to maintain frozen hydrogen on launch pad (pre-launch). No hydrogen venting on ground or in atmosphere. Hydrogen vents in space.</b>					

continued on next page

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

PROJECT NAME:	<b>Wide-field Infrared Survey Explorer (WISE)</b>	DATE OF LAUNCH:	June 21, 2008		
PROJECT CONTACT:	James Colvin	PHONE NUMBER:	818-354-8834	MAILSTOP:	179-206
PROJECT START DATE:	September 27, 2004	PROJECT LOCATION:	JPL		
PROJECT DESCRIPTION:	The WISE mission will perform a survey of the entire sky in the mid-infrared with 500 to 500,000 times the sensitivity than previous survey.. The instrument is a cold 4- cm telescope with 4 bands between 3 and 26 micrometers operating in a sun synchronous earth orbit at the terminator.				
<b>F. OTHER ENVIRONMENTAL ISSUES:</b>				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 (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 or -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	<b>Unlimited:</b> aluminum, magnesium, carbon resin composites, and titanium <b>Limited:</b> beryllium [50 kg (110 lb)]
Propulsion	Mono- and bipropellant fuel; 1000 kg (2200 lb) (hydrazine); 1000 kg (2200 lb) (monomethylhydrazine) 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 <sub>2</sub> ) 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