



## Wide-field Infrared Survey Explorer

### MISSION OVERVIEW

**WISE** was successfully launched on December 14, 2009, at 6:09 am PST. Following a two-week checkout period, the aperture cover was deployed and WISE began taking data, providing the world with a first view of what WISE could do. The first image captured by WISE was of V482 in the Carina constellation. After another two weeks of calibration, WISE officially began its mission. By the end of its mission in October 2010, WISE had captured over 2.7 million images, successfully mapping the sky nearly 1.5 times. WISE discovered its first comet on January 22. As they analyze the WISE data, scientists expect to discover more previously unknown asteroids, comets, brown dwarfs, and ultra-luminous galaxies. The WISE instrument at the heart of the mission was built by Utah State University's Space Dynamics Laboratory.

### FEATURES

- 13-mirror telescope with a 40-centimeter (16-inch) aperture diameter
- Four 1024 x 1024 infrared focal plane arrays (3.4  $\mu\text{m}$ , 4.6  $\mu\text{m}$ , 12  $\mu\text{m}$ , 22  $\mu\text{m}$ )
- Two-stage, solid-hydrogen cryostat to keep the instrument below 17 Kelvin (-429° F)
- Aperture shade to protect the telescope from heat from the sun and the earth during operation
- Four reaction wheels to maneuver the satellite
- Two star trackers for precision pointing, mounted on the sides of the spacecraft bus
- Fixed solar panel
- High gain antenna for transmitting images



Images courtesy NASA; available at:  
[http://wise.ssl.berkeley.edu/gallery\\_images](http://wise.ssl.berkeley.edu/gallery_images)



**Space Dynamics**  
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### OPTICS

WISE features a 40-cm, cryogenically cooled infrared telescope with four 1024 x 1024 pixel infrared focal plane arrays covering from 2.6 to 26  $\mu\text{m}$ . A scan mirror moving opposite WISE's orbital motion effectively "freezes" the sky over the 11 seconds it takes to capture an image. The WISE telescope was manufactured by L-3 SSG-Tinsley. WISE collects about 7500 images each day; these images are sent to Earth about four times per day.

### DETECTORS

With a million pixels each, the four WISE focal plane arrays are a large technological leap over past infrared survey missions. The 3.4- and 4.6- $\mu\text{m}$  focal planes are HgCdTe detectors and were manufactured by Teledyne Imaging Systems, Camarillo, California. The 12- and 22- $\mu\text{m}$  detectors are arsenic-doped silicon (Si:As) detectors and were manufactured by DRS Sensors and Targeting Systems.

WISE can distinguish features about five times smaller than IRAS could at 12 and 25  $\mu\text{m}$  and many hundred times smaller than NASA's Cosmic Background Explorer at 3.5 and 4.9  $\mu\text{m}$ .

### CRYOSTAT

To detect infrared radiation from cool objects, the WISE telescope and detectors must be kept at extremely cold temperatures to avoid picking up their own signal. The telescope is chilled to 12 K (-438°F) and the Si:As detectors operate at less than 8 K (-447°F). To maintain these temperatures, the optics are housed in a cryostat.

The WISE cryostat, manufactured by Lockheed Martin Advanced Technology Center, has two tanks filled with frozen hydrogen. The smaller, primary tank cools the Si:As detectors. A larger, secondary tank protects the primary tank from the heat from the outer structure of the cryostat and cools the telescope and the HgCdTe detectors.



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