

Spectro-Photometer for the History of the Universe,  
Epoch of Reionization, and Ices Explorer

# SPHEREx

NASA's SPHEREx mission will perform the first near-infrared all-sky spectral survey, observing hundreds of millions of objects during its two-year mission. The program will work synergistically with many existing missions and observatories to answer fundamental questions about the origin of the universe, the formation of galaxies over cosmic time, and the abundance of water and biogenic molecules in the form of ices in planetary systems. Our extensive space hardware heritage and unique suite of cryogenic capabilities made BAE Systems the best choice to build the telescope, telescope cover and small spacecraft bus for SPHEREx.

Credit: NASA/ JPL-Caltech, rendering of  
SPHEREx spacecraft bus and observatory

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## Overview

SPHEREx—the Spectro-Photometer for the History of the Universe, Epoch of Reionization, and Ices Explorer—is a NASA Medium Explorer (MIDEX) mission. During its two-year mission, SPHEREx will survey the entire sky in near-infrared light. The data from the survey will be used to study:

- The nature of physics that drove cosmic inflation in the earliest moments of the universe
- The cosmic history of galaxy formation
- The properties of interstellar ices, a key reservoir for water and biogenic material in the early phases of star and planet formation

SPHEREx will complete one all-sky survey every six months for a total of four all-sky surveys over the full 25-month mission. These surveys will have synergy with concurrent NASA missions, including identifying targets for more detailed study by missions such as the James Webb Space Telescope and setting the stage for later missions such as the Nancy Grace Roman Space Telescope, formerly known as the Wide Field Infrared Survey Telescope.

Dr. James Bock of the California Institute of Technology (Caltech) is the principal investigator for SPHEREx, and NASA's Jet Propulsion Laboratory (JPL) is the managing center.

## Our Role

BAE Systems was responsible for building the telescope, telescope cover and small spacecraft bus for SPHEREx. In addition, we integrated the mission's scientific payload onto the bus, tested the entire system, and supported launch and commissioning of the spacecraft after launch.

Using our unique suite of cryogenic capabilities, BAE Systems designed, fabricated and tested the near-infrared, cryogenic telescope, which enables the low thermal noise, critical for SPHEREx's infrared (IR) spectrometer to detect faint IR light from cosmic sources. We leveraged our cryogenic heritage from the James Webb Space Telescope to streamline development processes and ensure optical performance.

The SPHEREx spacecraft was built using our Evolve spacecraft platform to reduce cost, streamline payload accommodation and minimize delivery time. Our Evolve spacecraft are flight proven with more than 100 years of combined heritage on orbit and consistently exceed their estimated design lifetimes. BAE Systems has provided the spacecraft for other NASA explorer-class missions, including the Wide-Field Infrared Survey Explorer (WISE), which mapped the entire celestial sky in infrared.

## Quick Facts

- SPHEREx will perform the first near-infrared spectral survey
- SPHEREx will follow on the work of previous all-sky missions, several of which BAE Systems played a key role in, including the Infrared Astronomical Satellite instrument and Wide-Field Infrared Survey Explorer (WISE) spacecraft
- The mission will map the entire sky in 102 different color bands, drastically improving the color resolution of previous all-sky maps
- SPHEREx will gather data on more than 450 million galaxies and 100 million stars in the Milky Way Galaxy
- During its mission, SPHEREx will study the evolution of water and biogenic molecules (CO, CO<sub>2</sub>, and CH<sub>3</sub>OH) essential to life as we know it
- With its redshift survey capabilities, SPHEREx focuses on mapping the full sky at moderate redshifts to probe inflation, complementing surveys at higher redshift like Roman and Euclid studying the properties of dark energy



SPHEREx spacecraft bus and observatory