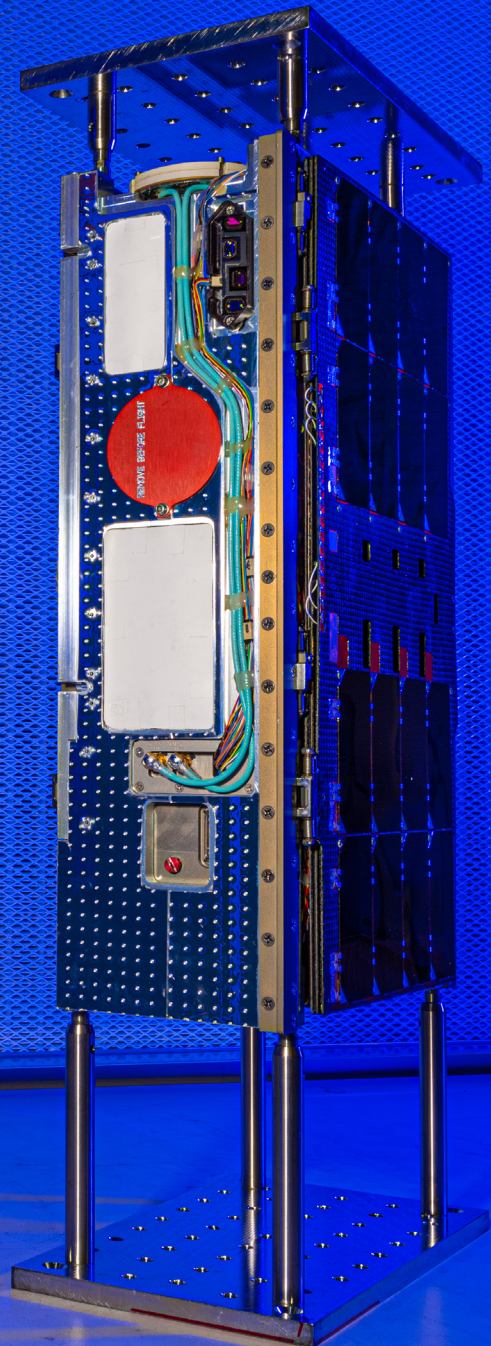


Compact Infrared Radiometer In Space

CIRiS

Small but mighty, the Compact Infrared Radiometer in Space (CIRiS) is an Earth observing instrument with on-board calibration system, all fitting in the volume of a shoebox. CIRiS achieves high performance for Earth science observations with a less complex architecture than comparable instruments. This results in low on-orbit risk and simplified manufacturing of multiple units for constellations of Earth-observing satellites. BAE Systems leverages heritage in sensor and instrument development to align our investments with customer needs to develop and deliver smaller, more capable technologies that meet the needs of tomorrow's missions.

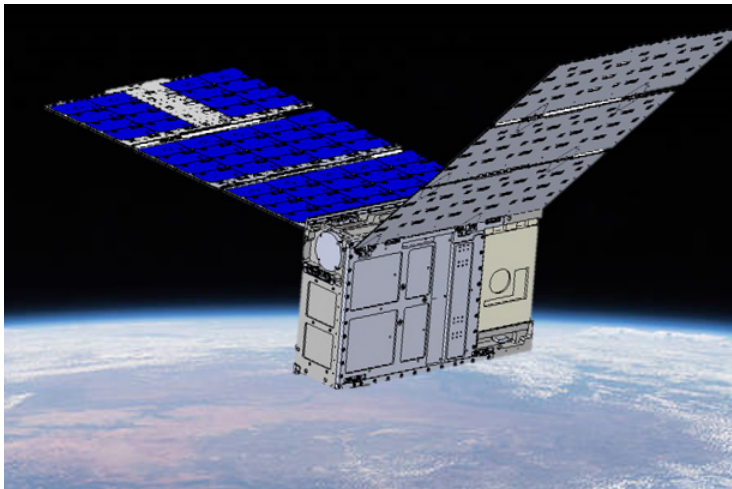


BAE SYSTEMS

Overview

Funded through NASA's In-Space Validation of Earth Science Technologies (InVEST) program, the pathfinder CIRiS mission collected radiometrically calibrated infrared images of the Earth and atmosphere from a 6U spacecraft, which is about the size of a shoe box. CIRiS demonstrated the ability of new CubeSat-compatible, miniaturized instruments to implement on-orbit calibration for scientific and operational applications. CIRiS deployed from the International Space Station in February 2020 for a three-year performance characterization and optimization mission. Data from future CIRiS instruments will enable improvements in drought prediction and crop irrigation efficiency and help scientists better understand cloud phenomena and conditions prior to extreme storms.

For on-orbit calibration, CIRiS carried two flat-panel carbon nanotube sources with performance that equaled or exceeded older, bulkier technology and an additional calibration view to deep space. CIRiS' next-generation uncooled infrared imaging detector delivered the required sensitivity to scene radiance without the need of a cryocooler—this reduced the power draw, volume, complexity and system risk. Weighing only 1.8 kg (3.9 lbs), the instrument's small size and weight dramatically reduced launch cost. Among the mission benefits are higher coverage of the Earth and shorter revisit times, providing improved capability for monitoring dynamic land, sea and atmospheric phenomena.



CIRiS instrument in a CubeSat spacecraft on orbit.

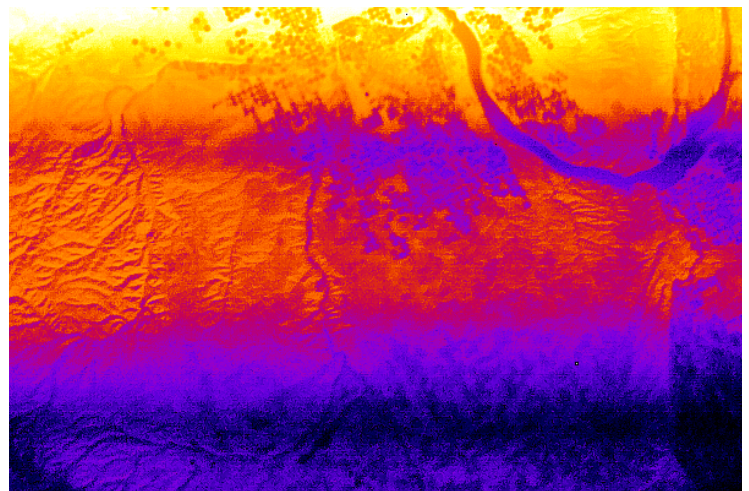
Quick Facts

- A 6U CubeSat carrying the CIRiS instrument was in low Earth orbit for three years
- CIRiS generated parallel images in three different "thermal infrared" wavelength bands
- CIRiS was the first mission to use an uncooled microbolometer infrared focal plane array (for imaging) and carbon nanotube blackbody sources (for calibration) together
- The compact three-view calibration system provided higher accuracy for the full range of Earth scenes including clouds and surfaces

Our Role

CIRiS leverages the decades of expertise that BAE Systems has developing highly calibrated instruments for environmental monitoring. The CIRiS instrument is based on the BESST radiometer, which can provide critical data on sea surface temperatures and disasters, such as the 2010 Gulf Oil spill.

We designed and built the CIRiS instrument and integrated it into the CubeSat spacecraft. BAE Systems and Space Dynamics Laboratory conducted mission operations for CIRiS. Ground and on-orbit data is analyzed and stored by us for future applications. Leveraging the success of the CIRiS program, we adapted the instrument for the NASA Artemis program. The completed and delivered Lunar-CIRiS (L-CIRiS) instrument will generate images of mineral composition and surface temperature of the Moon with unprecedented spatial accuracy <1 cm from a lunar lander.



A calibrated CIRiS image in three bands of the Columbia River near Hermiston, Oregon.