CU Boulder solar instruments, experiments headed for space

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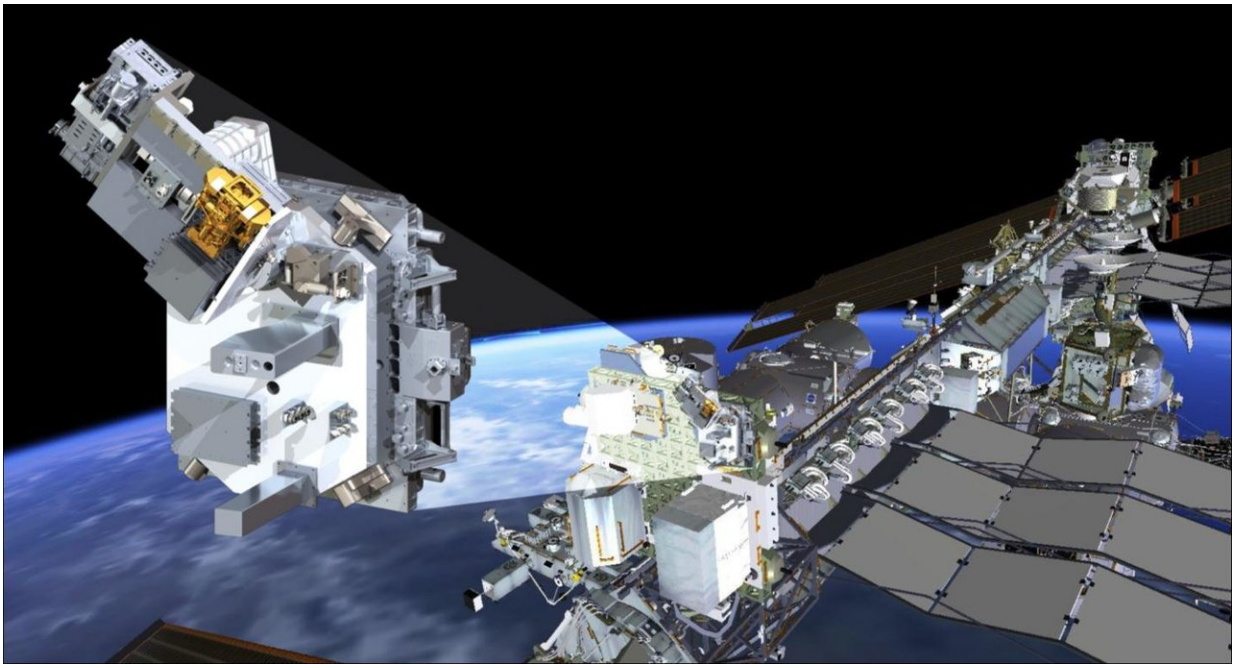

A solar instrument package known as TSIS designed and built by CU Boulder to help monitor the planet's climate is set for launch aboard a SpaceX rocket from NASA's Kennedy Space Center in Florida. Credit: NASA

A solar instrument package designed and built by the University of Colorado Boulder to help monitor the planet's climate is now set for launch Dec. 12 aboard a SpaceX rocket from NASA's Kennedy Space Center in Florida.

The instrument suite is called the Total and Spectral Solar Irradiance Sensor (TSIS-1) and was designed and built by CU Boulder's Laboratory for Atmospheric and Space Physics (LASP) for NASA's Goddard Space Flight Center in Greenbelt, Maryland. The contract value to LASP is $90 million and includes the instrument suite and an associated mission ground system on the CU Boulder campus.

TSIS-1 will launch on a commercial SpaceX Falcon 9 rocket carrying the Dragon cargo container for delivery to the International Space Station (ISS). It will monitor the total amount of sunlight hitting Earth, as well as how the light is distributed among the ultraviolet, visible and infrared wavelengths.

CU Boulder Professor Peter Pilewskie of LASP, lead mission scientist on the project, said TSIS will continue a 40-year record of measuring total solar radiation by CU Boulder, the longest continuous climate record from space.

"The sun drives all of Earth's processes, from atmospheric and oceanic circulation to chemical and biological activity," said Pilewskie, also a professor in the Department of Oceanic and Atmospheric Sciences. "Trying to understand Earth's climate without measuring the sun is like trying to balance your checkbook without knowing your income. How the atmosphere responds to subtle changes in the sun's output helps us distinguish between natural and human influences on climate."

Overall satellite measurements of the sun from space have shown that changes in its radiation over time - during periods of both high and low solar activity - is only about 0.1 percent. While scientists believe changes in solar output cannot explain Earth's recent warming, a longer dataset could reveal greater swings in solar radiation.

TSIS consists of two instruments: The Total Irradiance Monitor that

measures the total light coming from the sun at all wavelengths, and the Spectral Irradiance Monitor to measure how sunlight is distributed by wavelength. The latter is important because light at different wavelengths is absorbed by different parts of the planet's atmosphere and surface, helping to determine how the Earth system responds to solar variability.

At its peak, the project involved about 30 scientists and engineers at LASP as well as another 300 people from Colorado and around the country, said TSIS-1 Project Manager Brian Boyle of LASP. All told, more than 1,000 people worked on TSIS in the past two decades. The mission, slated to run at least five years, also has involved about 15 to 20 CU Boulder students to date.

In addition, hardware designed and built by CU Boulder's BioServe Space Technologies, headquartered in CU Boulder's Ann and H.J. Smead Aerospace Engineering Sciences department, will be launched on the same SpaceX Dragon to facilitate two biomedical experiments on ISS.

One, designed by LaunchPad Medical LLC in Lowell, Massachusetts, will carry high-tech BioServe culture plates to grow bone cells with a commercially used bone adhesive and a second, newly developed bone adhesive, said BioServe Associate Director Stefanie Countryman. Scientists know that astronauts living and working in the low gravity of space undergo the loss of bone mass over time.

The bone cell experiments will be imaged on board ISS and then returned to Earth for analysis and comparison to ground control experiments.

BioServe hardware also will be used to test a drug delivery system on ISS for combating muscular breakdown, an experiment that has implications

for both astronauts in space and for people with muscle disorders on Earth. Designed by the Houston Methodist Research Institute, the experiment will include two groups of mice: One implanted with a placebo, and the other a drug-delivery chip meant to help maintain muscle mass.

BioServe has flown experiments or hardware on each of the 14 SpaceX cargo resupply missions to ISS since they began in 2012, said BioServe Director Louis Stodieck.

Provided by University of Colorado at Boulder