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Science

NASA readies to study climate change with SAGE III

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— Before climate change debate went international, before people went green, there was SAGE.

A metallic satellite that could fit into a car trunk, SAGE began orbiting Earth and measuring greenhouse gases during the Carter administration. For decades, it and two predecessors provided insight into how humans alter the planet.

But the experiment came to a halt more than four years ago when the satellite lost power. Now, as NASA recommits itself to earth science, Langley scientists are preparing another launch of SAGE. With it comes details that scientists say are necessary to understand climate change.

"We're looking at the bits and pieces of it," said Joseph M. Zawodny, the Langley scientist leading the endeavor.

Donning a white protective suit that covered everything but his bespectacled face, Zawodny offered a rare glimpse at the latest incarnation of the satellite, dubbed SAGE III after a similar effort that ended four years ago. Built with two other satellites during the mid-1990s, SAGE III has sat in a clean room at Langley for at least a decade.

Assuming the plan is approved by Congress, NASA will launch SAGE by 2014 aboard a rocket. Astronauts will attach it to the International Space Station, where it will measure greenhouse gases and other air pollution.

Unlike another proposed Langley-led climate monitoring program, CLARREO — Climate Absolute Radiance and Refractivity Observatory — SAGE records greenhouse gases in the atmosphere, Zawodny said. The data will provide checks and balances to CLARREO, which is a broader look at climate change, he said.

Officially known as Stratospheric Aerosol and Gas Experiment, SAGE began in earnest in 1975. NASA engineers attached to a space capsule what looks like an old camera equipped with a rifle scope. The instrument enabled scientists to determine the amount of aerosols, which Zawodny described as "small particles of dust," in Earth's atmosphere. Among the first NASA projects dedicated to climate change, the instrument rests in a lunch box-sized container in the office of Larry W. Thomason, a SAGE scientist.

"That's something that should probably go to the Smithsonian," Zawodny said.

The effort prompted NASA to launch SAGE I in 1979. At the time, scientists were growing alarmed about Earth's shrinking ozone layer. Man-made chemicals called chlorofluorocarbons — used in air-conditioning units and aerosol spray propellants — were eating away at the ozone layer.

With that in mind, SAGE I measured greenhouse gases, such as ozone, in addition to aerosols. It provided scientists with their clearest glimpse yet of how pollutants affected the atmosphere. It gave way to the second incarnation of SAGE, which NASA launched in 1984. Scheduled to last two years, SAGE II orbited for nearly 21 years. Data it gathered led to an international ban on chlorofluorocarbons in 1987.

Two years later, Zawodny joined the SAGE II team at Langley. He was there in the late 1990s when SAGE II began to reveal that ozone depletion was slowing. He was there when NASA launched a third version of SAGE from Russia in 2001. He was there five years later when the power supply failed, rendering the instrument useless. And he'll be there when NASA launches SAGE III. At least that's the plan.

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SAGE flies again

SAGE III, a fourth- generation satellite that measures ozone, aerosols, and other trace gases in Earth's atmosphere, will be revived under President Barack Obama's 2011 NASA budget. Based at Langley Research Center, SAGE III will be one of several NASA programs to monitor climate change. It would employ 70 people. Details are not yet set, but NASA estimates SAGE III will cost \$100 million to \$150 million during its five years of operation.

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