

As shuttle's career nears an end, NASA turns focus to satellites

December 26 2009, By Mark K. Matthews, The Orlando Sentinel

NASA heads into 2010 with the bittersweet assignment of retiring the space shuttle after nearly three decades. But that's not all the agency has planned: There are also launches of three new satellites aimed at better understanding the Earth's climate and oceans, and the sun.

Two of the probes will examine Earth _ specifically the concentration of salt in the world's oceans and the presence of aerosol particles, such as soot, in the atmosphere. A third mission will study the sun and its effect on space weather including solar flares that can disrupt communication on Earth.

All three come at a critical time for NASA. Data from the two Earth probes will likely influence global-warming research, and the trio of launches could serve as bright spots in a year otherwise dominated by debate over the future of the agency's [manned space program](#).

"They are extraordinary timely," said Michael Freilich, head of NASA's Earth-science division, of the two Earth probes. "It is a quest for understanding of the Earth system and (to improve) our ability to predict how our wonderful environment and our planet is going to change in the future."

Combined, the three missions will cost more than \$1.5 billion.

SOLAR DYNAMICS OBSERVATORY:

- Launch: Feb. 3 from Cape Canaveral Air Force Station
- Cost: \$844 million
- Mission duration: At least five years
- Overseen by: Goddard Space Flight Center in Maryland
- SDO's mission: Study how the sun works and its effect on space weather.

Predicting weather in space can be tricky. Scientists hope this satellite can help astronomers better anticipate the solar flares, sunspots and magnetic storms that come from the sun and can jeopardize astronauts in space and electrical communications on Earth.

The Solar Dynamics Observatory will carry three instruments meant to meticulously document solar activity: a high-speed camera, a device that will record the sun's ultraviolet brightness and an imager that uses sound waves to map the sun's interior _ similar to how an ultrasound produces fetal images.

The aim is to better understand the sun's magnetic field, which influences the development of sunspots, solar flares and magnetic storms, called coronal mass ejections. That in turn should enable better forecasting of solar eruptions, in much the same way hurricane forecasters use broad climate conditions to estimate the number of storms each season.

The key is learning more about the sun's solar cycle, which every 11 years or so flips the star's magnetic pole from north to south (or back again). This change triggers intense solar activity and blasts cosmic rays toward Earth that can disrupt cell phones and cause widespread blackouts.

"The sun hasn't changed very much. But human technology has. So it's more important to understand the sources of the ways these changes

affect Earth," said Barbara Thompson, SDO deputy project scientist.

AQUARIUS:

- Launch: TBD in 2010 from Vandenberg Air Force Base, Calif.
- Cost: \$273 million ([NASA](#) contribution only; this is a joint U.S./Argentine mission)
- Mission duration: At least three years
- Overseen by: Jet Propulsion Laboratory in California

Aquarius' mission: Provide global measurements of saline levels in seawater and how that relates to Earth's water cycle.

For the past 100 years, scientists have relied on ships and buoys to provide estimates on how salt is distributed throughout the world's oceans. The readings were incomplete, however, and didn't provide timely readings of changes in salinity.

The Aquarius satellite could change that. Using three onboard radiometers that can detect small changes in salt levels, it will enable scientists _ for the first time _ to build a global map of ocean-surface salinity and track how salt moves through ocean currents.

The new data could be critical in learning how ocean circulation and weather patterns such as El Nino, respond to global warming. Fluctuations in salt levels generally result from fluctuations in rainfall and evaporation, said Gary Lagerloef, the project's principal investigator.

For instance, the readings could give oceanographers a better idea of how fresh water from melting polar ice caps is being distributed globally.

Aquarius will be carried aloft by the SAC-D spacecraft, built by the Argentine Space Agency. Argentina, whose coastline approaches Antarctica, will use data to monitor salinity _ and melting ice _ off its southern coast.

"We want to utilize this data to improve our climate models. ... We don't know what the fate of the water (from melting polar ice caps) is," Lagerloef said.

GLORY:

- Launch: Oct. 9 from Vandenberg Air Force Base
- Cost: \$419 million
- Mission duration: At least three years
- Overseen by: [Goddard Space Flight Center](#) in Maryland

Glory's mission: Observe the effects of aerosolized particles on the Earth's climate.

One of the big questions in global-warming research is the effect of aerosolized particles _ from smog, auto exhaust, factory chimneys, volcanic eruptions and myriad other sources _ on Earth's temperature.

It is thought that aerosols could counteract the effects of greenhouse warming caused by growing levels of carbon dioxide by deflecting some of the sun's rays. Major volcanic eruptions, for instance, have lowered global temperatures for several years by flinging sulfur dioxide into the atmosphere, which acts as a kind of sunscreen.

But scientists have been unable to accurately measure the influence of aerosols _ or even say with certainty that all of them have a cooling effect. Some climatologists have suggested that black-carbon aerosols _

such as soot _ actually absorb the sun's heat, rather than reflect it, and result in a warmer Earth.

The Glory probe will try to catalog the different types of aerosols in the atmosphere. Understanding the composition could help scientists better understand their net effect on climate change.

"We know that aerosols are having a significant effect, but we don't know the magnitude of that effect," said Michael Mishchenko, the project's chief scientist.

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Citation: As shuttle's career nears an end, NASA turns focus to satellites (2009, December 26) retrieved 27 April 2024 from

<https://phys.org/news/2009-12-shuttle-career-nears-nasa-focus.html>

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