

Post-shuttle, U.S. space explorers need not be human

Now that the shuttle fleet is permanently grounded, the U.S. space spotlight could shift toward the path-breaking astronomical science that NASA does without human beings on board.

Human spaceflight has historically grabbed most of the public's attention and NASA's budget, but robotic probes and observatories have brought the biggest leaps toward understanding the cosmos, from roaming around Mars to looking billions of years back in time to see how galaxies are born.

There was a symbolic torch-passing moment this week, when shuttle astronauts visited the White House to collect kudos from President Barack Obama for the 30-year shuttle program that ended on July 21.

At the same time, NASA announced a probe of the asteroid Vesta, a look into the dark heart of a galaxy and the upcoming launch of a spacecraft headed for Jupiter.

The proposed NASA budget for fiscal 2012 allots more than \$8 billion for manned spaceflight, compared to some \$5 billion for space science, and that's without any U.S. human-rated space vehicle in immediate prospect. Astronauts will hitch rides on the smaller Russian Soyuz capsules to get to the International Space Station through 2020.

Americans on Mars? Maybe by 2035. But robotic rovers have been rolling across the Martian surface since 2004.

Because human spaceflight requires simulating Earth-like conditions -- temperature, stability, air -- it has always been more expensive than unmanned exploration or ground-based observatories. It began in the Cold War 1950s, when reaching the "ultimate high ground" was a geopolitical imperative.

Even then, science was a top priority. The National Aeronautics and Space Act of 1958, which set up the space agency, listed as its first objective: "the expansion of human knowledge of phenomena in the atmosphere and space."

NASA's chief scientist, Waleed Abdalati, said space science may be getting short shrift when it comes to public attention.

BIG BANG FOR THE BUCK

While human spaceflight is "critical to advancing civilization," Abdalati said in a telephone interview, "I think the science we do at NASA really speaks to something at the core of the human spirit."

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Robotic probes and so-called uncrewed cosmic laboratories have done their work during the shuttle era, delivering a big scientific bang for the buck, compared to experiments done by human space voyagers.

The biggest bang of all, the theoretical explosion that gave birth to the universe, has been a focus of the Hubble Space Telescope, arguably the most important astronomical instrument since Galileo looked through a lens.

Launched in 1990 at a cost of \$3.1 billion, it has been repaired and upgraded five times by shuttle crews, bringing its lifetime cost to about \$10 billion, since each shuttle mission cost \$1 billion or more.

In its two decades of observation, Hubble has managed to look back in space-time to just 400 million years after the Big Bang, revealing some of the first galaxies formed following the initial blast. In July, scientists reported Hubble's discovery of a tiny fourth moon around Pluto. The orbiting craft could keep going through the end of this decade.

Other uncrewed NASA spacecraft have determined the age of the universe -- 13.7 billion years -- and the microwave remnants of the Big Bang. They've helped figure out more about comets and asteroids, found water ice on Mars and supermassive black holes at the heart of galaxies.

X-RAY ASTRONOMY LED TO CAT-SCANS

Not all robotic space discoveries are explained with such dramatics. Most offer unprecedented glimpses into the workings of the cosmos rather than science that can be quickly turned into Earthly profit.

"The search to answer fundamental questions in science always leads to the biggest discoveries," said John Grunsfeld, deputy director of the Space Telescope Science Institute in Baltimore, which manages Hubble. He has seen the orbiting telescope close up, as a veteran shuttle astronaut when he worked on three missions to upgrade the observatory.

Grunsfeld said X-ray astronomy led to airport scanners, CAT scans and MRIs, though that was not the initial intent: "People didn't go out and say, I'm going to find a device that's going to be able to image tendons, shoulders and knees. They were studying the properties of the nucleus of atoms."

Grunsfeld sees human exploration of space as "our destiny." But as a scientist and official at the telescope institute, he is troubled that NASA's science budget has been sliced by more than \$2 billion to divert more money to crewed space programs.

He blames poor national management for the 2010 Obama administration decision to scrap the \$10 billion Constellation program that aimed to return U.S. astronauts to the Moon by 2020. Instead, the United States would finance commercial space

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taxi services provided by private companies that are developing spaceships designed to carry people and cargo.

NASA is a frequent target of budget-cutters, with space science more vulnerable than human spaceflight. NASA projects that aim to document climate change came under fire this year, when six members of Congress urged reductions in this effort and reallocating those funds to spaceflight.

(Reporting by Deborah Zabarenko; Editing by Anthony Boadle)

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