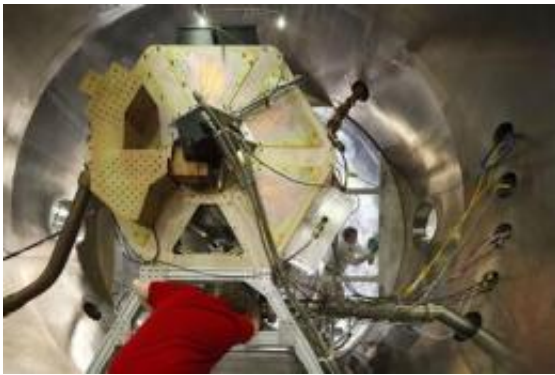


For NASA no easy answer for next space destination

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In this Feb. 18, 2010 photo, Ad Astra Rocket Company scientists Chris Olsen, foreground, and Ben Longmier test the company's VASIMR rocket engine inside a vacuum chamber in Webster, Texas. There are only a few places in space where humans can go in the next couple of decades. In the next few years, new technology should be developed enough to know exactly where. President Barack Obama plans to divert billions of dollars from the Bush moon plan toward better rocketry. (AP Photo/Michael Stravato)

(AP) -- Where to next? It's a simple question that NASA can't answer so easily anymore. The veteran space shuttle fleet is months from being mothballed and the White House has nixed a previous plan to fly to the moon.

For the first time in decades, NASA has no specific [space](#) destination for its next stop, although it has lots of places it wants to go. Future

space flight, NASA officials say, now depends on new rocket science and where it can take us.

That uncertainty may not sit well with Congress, which will be grilling NASA chief Charles Bolden on Wednesday and Thursday in the first hearings since the George W. Bush [moon mission](#) was shelved.

There are only a few places in space where humans can go in the next couple of decades. NASA wants to go to all of them, with the ultimate destination, as always, being Mars.

"The suite of destinations has not changed over time," NASA deputy administrator Lori Garver said in an interview. "The moon, asteroids, Mars - if you're going to go anywhere - is where we are going."

But with any itinerary there is a first stop. So what is that?

Check back in a couple of years. That's when new technology should be developed enough to answer that question, Garver said. President Barack Obama plans to divert billions of dollars from the Bush moon plan toward developing better rocketry.

"The best way to get anywhere... is really invest in technologies that will reduce the cost, reduce the time, reduce the risk and so forth," Garver said.

Some of those technologies seem like science fiction. The possibilities noted by experts inside and outside of NASA include the equivalent of an in-orbit gas station, electric-hybrid rockets, nuclear thermal rockets, inflatable parts for spaceships, and methods of beaming power between Earth and space.

Former astronaut Franklin Chang-Diaz, who has developed a new type

of electric propulsion engine called VASIMR that the NASA leadership mentions specifically, said this new emphasis is especially welcome because six years ago NASA killed its advanced [rocket](#) technology program.

"We clearly need the technology leap if we really want to go to Mars," Chang-Diaz said. "We are not going to Mars on chemical rockets."

Chemical rockets are what has always been used to get into space and they require carrying lots of expensive fuel. [Electric propulsion](#) would get better mileage, but versions so far don't have nearly enough thrust to get off Earth.

To some critics, however, technology isn't as important as a destination. Sen. Bill Nelson, D-Fla., who will be chairing Wednesday's Senate subcommittee hearing, plans to push for some kind of commitment and specific plan of action.

"The president is the only one that can lead the space program, and he ought to set a goal," Nelson said in an e-mail. "He needs to say where we're going and let NASA design the architecture to do it."

Former NASA associate administrator Alan Stern said he's waiting to hear what NASA officials outline in the Capitol Hill hearings, but he too has concerns about not having a precise destination.

"We need a destination and a timetable and that's really lacking," Stern said. He said that relying on technology to dictate a location "sounds like a program to nowhere."

Because human spaceflight is about inspiration, science and international cooperation, Stern said, "you need a specific destination, a proper noun, something that's capitalized."

The outline for much of NASA's future was sketched out by an independent spaceflight panel the White House appointed last year. Led by retired Lockheed Martin Chairman Norman Augustine, the panel laid out options, including canceling an immediate return to the moon and instead proposing a "flexible path."

Panel member Chris Chyba, a professor of astrophysics and public affairs at Princeton University, said just because the flexible path doesn't point to a specific starting point doesn't mean it's without a goal.

"You begin by saying what your goal is, not what your destination is," Chyba said. "And the goal is the human expansion into the solar system."

The spaceflight panel charted a possible roadmap, based on the easiest trips first, such as a flight to the moon but no landing. Next might be any of a handful of points in space where the gravitational pull between the Earth and the moon, or the Earth and the sun are equal. Such locations are places of engineering importance because future space telescopes and other science satellites are slated to go there and this would allow astronauts to repair them. But they risk ridicule as flights to nowhere, Chyba said.

Then the panel suggested landing on a near-Earth asteroid, followed by flights to and around Mars and landing on a Martian moon. The panel also noted that landing on Earth's moon is "an obvious alternative" to Mars, maybe after an asteroid mission and serving as a possible training stop for other flights. The space agency also might still opt to go to the moon before anywhere else, NASA's Garver said.

Several experts believe the most sensible place for astronauts to go first is an asteroid.

"If the goal is ultimately the human exploration of Mars," landing on an

object near Earth is a logical first step because it's easier, says Donald Yeomans, chief of NASA's near Earth object program.

What asteroids offer is a lack of gravity, making it easy to leave. Landing on larger objects, such as the moon and Mars, would require the extra but expensive thrust that chemical rockets provide, demonstrating the need for a hybrid vehicle.

Visiting an asteroid would have the appeal of some place new, would provide legitimate scientific study and could even help scientists figure out how to save Earth from some future killer asteroid, Stern said.

Another of the key points in future spaceflight will be the ability to stop in space to refuel or even switch vehicles, said NASA's new chief technologist Bobby Braun.

The future for [NASA](#) is not about future space destinations, contends MIT astronautics professor Ed Crawley, a member of the White House-appointed panel.

"It's about the journey," he said. "It's a journey of technology. It's a journey of discovery. It's a journey of capability. It's a journey away from the cradle. At some point we have to learn how to leave the planet."

More information:

- NASA, <http://www.nasa.gov>
- Outside human spaceflight panel report, <http://www.nasa.gov/pdf/396093main-HSF-Cmte-FinalReport.pdf>
- Vasimr rocket, <http://www.adastrarocket.com/aarc/>

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