COMMENTARY

‘Bring the Mountain . . . ’

Asteroid retrieval may precede a visit to one

Senior NASA managers and their White House overseers are pondering whether it might be politically possible to mount a near-term mission to capture a small asteroid and reposition it in orbit around the Moon, where it could serve as a proving ground for hardware and crews en route to larger objects deeper into space.

The National Research Council says President Barack Obama’s call for a human mission to a near-Earth asteroid by 2025 has not captured the public imagination in a way that can be translated into public support for funding it. But a near-term attempt to snare a space rock, bring it closer to Earth, and use early flight tests of the Orion multipurpose crew vehicle to visit it might be just what the public-relations doctors ordered.

That, at least, is said to be the thinking at the White House Office of Science and Technology Policy and among some planners at NASA headquarters. The concept is not new, or particularly far-fetched. The basic technology is available, and—depending on the outcome of ongoing “fiscal-cliff” negotiations—the money may be too.

In April, the Keck Institute for Space Studies at the California Institute of Technology reported its conclusion that a 500,000-kg (1.1-million-lbm) near-Earth asteroid (NEA) could be discovered, tracked, captured and delivered to cislunar space by 2025 at a cost of about $2.65 billion.

Drawing on input from experts across NASA, several universities and private organizations, the Keck Institute surveyed the available technology that could be adapted to an asteroid-capture mission, and took a first look at how it would be accomplished.

“Placing a 500-ton asteroid in high lunar orbit would provide a unique, meaningful and affordable destination for astronaut crews in the next decade,” Keck concluded. “This disruptive capability would have a positive impact on a wide range of the nation’s human space-exploration interests.” Astronauts arriving at a repositioned carbonaceous C-type asteroid in the four-seat Orion could practice operating at low-gravity bodies, study the structure and composition of the object as a clue to the evolution of the Solar System and as a potential source of water for propellant and radiation shielding of deep-space crews, and perhaps begin to learn what

rays (see illustration) would use xenon-fueled 10-kw Hall thrusters to spiral out to the desired NEA—firing for a time, each with a specific impulse of 3,000 sec. As it approaches the target, it would use onboard instruments to characterize its shape and rotation, and apply algorithms developed by the Defense Advanced Research Projects Agency to match its spin. Then it would essentially lasso the NEA with a 15-meter-dia. “capture bag” that would be cinched tight over the spinning space rock.

“Since the asteroid would be much more massive than the spacecraft, it is perhaps better to think of this as the asteroid capturing the spacecraft,” the Keck report states. “Nevertheless, once the spacecraft and asteroid are tightly secured together, the spacecraft could then de-tumble the combination” using its conventional hypergolic reaction control system. The Keck-study experts calculate it would take about 300 kg of propellant to stabilize the asteroid.

After that, the spacecraft could use its solar-electric propulsion to work its way into a high lunar orbit or even one of the Earth-Moon Lagrangian points that NASA is studying as way stations that avoid fuel-consuming gravity wells en route to destinations beyond low Earth orbit.

It is hard to know whether this idea ultimately will show up in the NASA budget request next year or even how much support it enjoys in the closed-door executive branch negotiations typical of the current blackout period when the Office of Management and Budget and the federal agencies are wrangling over future funding and policy. Trial balloons, logrolling and, to put it kindly, misdirection have always been the order of the day in budget deliberations this time of year, and lately that seems particularly true of U.S. space policy.

But the idea is at least plausible. While the National Research Council found NASA’s goal of visiting a larger asteroid uninspiring, the National Space Foundation sees “pioneering” as a worthy goal for the U.S. space agency (AWST Dec. 10, p. 21). Somehow, the Keck concept seems more in keeping with the pioneer spirit of exploring and using space than just touching an asteroid to say we did it.