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Relaunching NASA

Back to the Moon by 2018—Or Sooner

Twenty months ago, President Bush announced a new "Vision for Space Exploration" that would replace the space shuttle with a spacecraft intended to take the United States "to the Moon, Mars, and beyond." Now NASA has finally announced the details: What the spacecraft will look like, what kind of rocket will launch it, and when the first missions will begin. The new "exploration architecture" was announced by

NASA Administrator Michael Griffin on September 19, 2005.

Unlike the space shuttle, a winged craft that sits beside the rockets that boost it into orbit, the new Crew Exploration Vehicle (CEV) will look more like the old Apollo spacecraft, a capsule that sits atop its rockets. It will be bigger than the Apollo capsules, with three times the volume and the ability to carry four astronauts to the Moon's surface at once, twice as many as Apollo. Unlike the Apollo capsules, the CEV will be reusable, will use solar panels as one of its power sources, and will be able to land on either water or land upon returning to Earth. And the CEV will of course have the advantage of four decades of advances in electronics, materials science, avionics, and software. But the fundamental similarity to the design of Apollo is truly remarkable. Dr. Griffin, who joked that the new design looks like "Apollo on steroids," said the similarity was due to the obvious fact that "the physics of atmospheric entry haven't changed" and should be taken as an indication that "by and large, the Apollo folks got it right."

In the new exploration architecture, two launch vehicles will carry crews and cargo from Earth into space. The smaller one, a medium-lift launch vehicle capable of putting 25 metric tons into orbit, will primarily be used for launching the CEV. The much larger one, a heavy-lift launch vehicle comparable to the giant Saturn V rocket used to put the Apollo astronauts on the Moon, is primarily intended to fly unmanned and carry cargo; it will be able to carry more than 100 metric tons into orbit or put more than 20 metric tons of cargo on the lunar surface. Both of these launch vehicles will use existing parts from the space shuttle—parts with a proven track record of dependability, parts not associated with the shuttle's universally-acknowledged safety deficiencies.

Here is how a manned mission to the Moon would work, according to the new plan. First, the heavy-lift vehicle would carry an unmanned lunar lander and a propulsion unit called an earth departure stage into orbit. Some time later, the medium-lift rocket will carry the CEV, with a crew of four, into orbit. The CEV will dock with the lander and earth departure stage, and the earth departure stage will push the entire combination toward the Moon before the propulsion unit is jettisoned. Once the CEV and the lander reach lunar orbit, the entire crew will descend to the surface in the lander. (Unlike the Apollo missions, which were confined to an area around the lunar equator, these future astronauts will be able to land anywhere on the lunar surface, including the scientifically intriguing poles.) Meanwhile, the empty CEV will stay in lunar orbit, under computer control. (This is another improvement over Apollo, when one astronaut had to stay alone in lunar orbit for days while his two comrades explored the surface below.) Once on the Moon, the four astronauts will explore the surface for days or weeks, studying the lunar surface, collecting samples,

and conducting experiments. When it comes time for them to leave, they will lift off from the surface in part of the lander (leaving the rest of the lander behind), and dock with and reenter the CEV for the trip back to Earth.

Under the timetable described by Dr. Griffin, NASA will move quickly to implement its new architecture—drafting the technical requirements and, some time next year, hiring either Lockheed Martin or a Boeing/Northrup Grumman team to be the prime contractor for the new CEV. The space shuttle will be retired in 2010, the CEV should make its first flights by 2012, and the first manned lunar mission should take place in 2018. All this should be possible, Dr. Griffin says, without asking Congress to increase NASA's budget of about $16 billion per year. Dr. Griffin estimates that the total cost over the next thirteen years (from now through the next manned Moon landing) will be about $104 billion—meaning it will cost about 55 percent less than Apollo cost, when adjusted for constant dollars.

The new exploration architecture is commendable for its frugality, its flexibility, and its farsightedness. By using shuttle parts in developing the new launch vehicles, NASA will save money. By using a heavy-lift launch vehicle, the agency will be able to accommodate a wide variety of different missions, including sending the equipment needed for long-term outposts on the Moon. And by using methane-based engines for the lunar ascent module, NASA is thinking ahead to the time when missions to Mars will be able to manufacture methane propellant out of the Martian atmosphere—a sensible "live off the land" approach that makes missions to the Red Planet economical.

Still, the plan has many detractors. At the fringes are those critics who think all manned spaceflight is a boondoggle, and those perpetual pessimists whom the press frequently turns to for comment on space matters. (One of the latter breed—Alex Roland, a former NASA historian who reflexively said he doesn't think the new NASA plan will succeed—has been so discredited by his outspoken and unfounded criticism in recent years that the media's continuing reliance on him for sound bites is a source of constant astonishment among informed observers of the space community.)

More serious criticism of the space program comes from those who believe the new exploration architecture should make more room for private enterprise and competition. Those in this camp were hoping the space agency would reinvent itself radically, questioning its basic assumptions and rebuilding itself from the ground up. They want massive layoffs, commercial bidding, and several major technical changes to the exploration architecture. In a word, many of the changes that they want are simply unfeasible. This does not mean that the Bush administration or the NASA leadership is unsympathetic to their views—indeed, the Bush administration has been strongly supportive of commercial space enter-

prise. But the bottom line, as Dr. Griffin put it, is that "it is not acceptable for a publicly funded program not to have a way of meeting its mission requirements in the event that commercial operators do or don't materialize. So, the architecture that we have advanced allows NASA to meet its mission requirements, but also allows NASA to concentrate its resources on other more advanced activities if commercial providers can emerge in the next five to seven years."

The most serious criticism of the new NASA exploration architecture comes from concerned supporters of the plan—those who support President Bush's vision for NASA but who worry about some of the specifics of the new plan. For instance, these friendly critics have pointed out that the new architecture will require two separate rocket launches for every mission to the Moon, meaning that a problem with either launch could ruin the entire mission. (Still, this is a notable improvement over a plan NASA was considering last year that would have required *four* rocket launches for each lunar mission.)

The most important problem with the plan as it stands now, however, is not technical. It is political. The plan calls for the space shuttle to keep operating through 2010, and delays the development of the heavy-lift launch vehicle until that time. But President Bush will leave office in January 2009, and there is no guarantee that his successor won't pull the plug on this architecture before work has even begun on the new heavy-lifter. The next president could well decide to keep NASA tied to the shuttle, or alternatively, to confine the agency to a go-nowhere future in which endless missions to low Earth orbit are conducted using the CEV.

There are two ways that the Bush administration and Dr. Griffin could lock the new plan into place. The first option would be to phase out the three space shuttles in the next few years, so that only one shuttle remains in operation when the next administration begins. Under such a circumstance, the new president would have no choice but to retire the last shuttle on time in 2010 and stick with the new architecture.

But a wiser move might be to retire the entire shuttle fleet much sooner, all at once, before the end of 2007. The only reason the shuttle is still operating is because President Bush decided, in announcing his new vision for NASA, that we would use the shuttle to finish building the International Space Station. But is that really necessary? The remaining components of the space station could easily be carried into orbit by the new heavy-lift launch vehicle that will be developed under the new architecture. So NASA could use the shuttle now for a minimal number of final critical missions—like a mission to service the Hubble Space Telescope—before retiring the fleet. Then, instead of spending more than $20 billion on shuttle missions to finish building the space station, that money could be invested immediately

into developing the rockets for NASA's new architecture. Those rockets could finish building the station and have us back on the Moon by 2015 if not sooner.

This approach would save time and money, and would spare the public from repeatedly having to endure the kind of agonizing speculation about the safety of the shuttles that plagued the recent mission of the shuttle *Discovery*. More importantly, it will spare NASA from having to face a difficult prolonged transition into the post-shuttle era. As currently planned, NASA will transfer personnel from the shuttle program to work on the new architecture during the next few years. But these transfers will be very tricky, since they will have to avoid the danger of leaving the shuttle understaffed on its last few missions. (When asked about this transition, Dr. Griffin said, "Well, it's a little bit like the old joke about how do porcupines mate—you know: 'very carefully.'") It would be far better and far safer to keep the shuttle fully staffed for a small number of final missions, and then shut it down all at once.

After three decades of drift, NASA now has purpose and direction. It has the support of a president who has articulated a bold new vision for the agency's future, it is led by a technically competent engineer who is serious about results, and it now has a plan and a schedule for returning to the Moon. The current transition for the agency may seem, at times, to be a period of great confusion and turmoil, but it is worth remembering that things are looking up for NASA, and that its greatest achievements are still ahead. This is all the more reason to begin the work of the future today and avoid the risk of shifting political winds that could halt the exploration of the "Moon, Mars, and beyond."