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The current reviews of space policy in Europe and the United States offer an opportunity to advance human exploration as well as unmanned science missions. But to do so, President Obama and his European colleagues must chart a new route. Europe and the United States should together view space exploration not as the exclusive domain of scientists and government agencies, but of our entire societies. To engage the best of our societies in space exploration, we should return to that tested method of encouraging exploration, the prize.

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## Europe and the United States: Space Exploration the Old Fashioned (and Smart) Way

by Joseph Wood<sup>1</sup>

On December 21, 1968, Apollo 8 launched from Cape Canaveral. A few days later, on Christmas Eve, its crew became the first humans to enter the gravitational pull of another body away from the home planet. The crew's reading of Genesis from lunar orbit captivated a worldwide audience, and the astronauts brought home what may have been the most profound photograph in history until that moment—the famous “Earthrise” showing the blue planet Earth rising over the moon's desolation, suspended in the dark of space. This was a stunning moment in the history of exploration, a moment that had seen NASA pull through enormous technical challenges, with great risk and sometimes fatal failure, to lay the groundwork, or the spacework, for the Apollo 11 landing only a few months later.

On October 23 of this year, EU governments met in Prague and agreed to support a major investment in robotic and human spaceflight in cooperation with other spacefaring nations, including the United States, Russia, Japan, China, and India. The European Union deferred difficult decisions on resources for this endeavor until next year.

In the United States, with celebrations of last July's 40th anniversary of the Apollo 11 moon landing now a memory, U.S. President Barack Obama's administration is examining its own space priorities.



*Earthrise from Apollo 8 (Photo credit: NASA)*

Obama inherited a 2004 vision for space exploration announced by former U.S. President George W. Bush after the loss of the Space Shuttle Columbia. Bush charged NASA to complete the International Space Station (ISS), retire the Space Shuttle in 2010, return to the moon, and proceed with human exploration of Mars. Like the EU's decision this year, Bush's vision statement was imprecise on the resources necessary to implement his guidance.

Now, the Obama administration is pondering the recommendations of an expert panel, led by former Lockheed Martin Chairman Norm Augustine, on the way forward for U.S. manned space exploration. The panel delivered its report to the White House the day before the EU meeting in Prague. The report's authors laud the Bush vision as a “wise choice at the time” but go on to note that times have changed, especially in the area of financial resources. The panel offered the administration a range of possible courses of action, including the possibility of canceling the new Ares 1 rocket, successfully tested recently but

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seen by the panel as financially unsustainable. The idea of canceling a program just as it demonstrates technical success is not new to NASA, and it demonstrates the long-standing difficulty the United States has had in reaching rational decisions regarding how best to explore space. Nations pursue space exploration for a variety of reasons. The United States was rocked by the launch of Sputnik in 1957 and the Soviet Union's subsequent success in putting the first man into orbit. The American response, energized by former U.S. President John F. Kennedy, culminated in the Apollo moon landings. Kennedy was driven by Cold War ideological competition and the need to demonstrate that free societies were more capable than totalitarian regimes.

The Soviet-American competition was labeled the "space race." Races generally result in prizes for the winner—in this case the historic prestige of being the first nation to send its explorers beyond Earth. Nations still pursue space exploration for national prestige. China's human space flight program aims to gain for Beijing a decisive credential as a first-rank technological power. In explaining the EU's decision to increase investment in space exploration, European Commission Vice President Guenter Verheugen said, "Exploration is to open the minds of European citizens without having to answer the question: How useful will it be?" But Verheugen added, "Space exploration has never been driven by human curiosity alone. It is a symbol of global power and prestige. Other countries are rising to the challenge. Europe should not remain sidelined in this process."

The motivation of a prize as a spur to exploration was not new to the space age. European explorers were driven by curiosity as well as the prospect of money and fame. Their sponsors sought national power (treasure or military advantage) and prestige. Recalling the 18th-century prize offered by the British government to discover a means of determining longitude, NASA has recently used prizes, such as the 2009 Regolith Excavation Challenge, to encourage technology innovations. The competitors' goal was to build a robot that can "dig up and deposit at least 150 kilograms of material from a simulated lunar surface and deposit it in a collection bin." A team led by a college student won the \$500,000 prize.

After the Apollo era, America's efforts in space robotics have seen some spectacular successes. Images captured by the Hubble Space Telescope have contributed enormously to scientific understanding of the universe, but they have filled billions of people with awe as well. A series of orbiters and landers have conducted extensive investigations of Mars. As the European Union and the United States considered manned space flight this year, NASA investigators announced that by using data from Hubble and from a second spaceborne instrument, the Spitzer Telescope, they had detected

a second planet beyond our solar system with the basic chemistry thought necessary for life.

These are examples of high-cost, high-risk (in financial terms), high-payoff science efforts that the normal private sector capacity for research could not undertake. They are the kinds of projects that NASA, the European Space Agency (ESA), and other governments can at least finance and perhaps execute.

Meanwhile, the U.S. manned spaceflight program has been stuck in low earth orbit. The Space Shuttle was originally intended as a low-cost workhorse that would make spaceflight routine. Its record has been instead one of high cost and a much lower launch rate than anticipated, including two accidents that resulted in multi-year stand-downs. Combined with the ISS, which has also consumed enormous funds for limited science gains, the Space Shuttle by the time of Bush's announcement in 2004 had become a self-tying bureaucratic knot supported in Congress mainly by members with NASA jobs in their districts.

In both unmanned and manned exploration, space cooperation between Europe and the United States has been uneven. The ESA and other national space programs have contributed instruments to U.S.-led robotic missions, and vice versa. In human spaceflight, Europe built a major part of the ISS and has sent astronauts on the Space Shuttle. In September, NASA and ESA signed a new memorandum of understanding for human space transportation. And for the first time, an ESA astronaut took the rotating command of the ISS in October.

But ESA and NASA view each other as sometimes unreliable partners, and both have good reasons for doing so. ESA and Europe have, as Verheugen candidly put it, remained sidelined as a junior partner. NASA has used its partnership with ESA to justify continuing the ISS when its prospects were doubtful, claiming that failing to fund the ISS would let down America's partners. As state-controlled agencies, both NASA and ESA face the limitations of politically-driven constraints and inconsistent budgets.

No longer the NASA that fulfilled Kennedy's commitment to put a man on the moon, but blessed still with many great engineers and scientists, NASA as a whole has become one of the least stellar bureaucracies in Washington. Many of its unmanned successes have come out of the Jet Propulsion Lab (JPL) in Pasadena, California. JPL, with its long tradition of high-risk, high-payoff science, is a lab run by the California Institute of Technology under a NASA contract, rather than a NASA-operated center.

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The current reviews of space policy in Europe and the United States offer an opportunity to advance human exploration as well as unmanned science missions. But to do so, Obama and his European colleagues must chart a new route. Europe and the United States should together view space exploration not as the exclusive domain of scientists and government agencies, but of our entire societies. To engage the best of our societies in space exploration, we should return to that tested method of encouraging exploration, the prize.

Most of NASA's human exploration budget, and as much as Europe can contribute, should be pulled from government-run programs and put into a fund for major space exploration prizes. Over the course of a few years, money would be available for prizes on the scale of tens of billions of dollars or euros. For example, the United States and Europe could jointly offer a prize of \$30 billion for a successful manned lunar mission and \$75 billion for a successful Mars mission. Another possible goal would be a visit to an asteroid. This would attract teams of individuals and corporations whose drive for exploration exceeds by far the motivation of the security of a government job.

NASA and ESA would continue to work on the common infrastructure that all prize-contenders would need, such as launch facilities, communications, and life support. But the energy and creativity, and the risk-taking mindset, that must all come together to advance human exploration would come from American and European societies in partnership. Meanwhile, ESA and NASA would be able to focus on financing the kinds of high-cost, high-payoff science that have succeeded (and occasionally, by the nature of risk, failed) in recent years.

Five years ago, a team led by Burt Rutan and financed by Microsoft Co-founder Paul Allen took aim at the Ansari X-Prize of \$10 million. Established in 1996 by Peter Diamandis with funds from several foundations, corporations, and individuals, the prize called for successfully launching a reusable manned vehicle on a sub-orbital spaceflight twice within two weeks. During the Rutan team's first flight, the vehicle reached space but unexpectedly tumbled at the top of its trajectory. The team's engineers analyzed the data carefully. Then, rather than announcing a multi-year delay for expensive modifications, they told the public that they believed they understood the problem, that the risk was acceptable, and that they would launch again as planned. On the 47th anniversary of the Sputnik launch, they took home their prize. This year, some of their successors have claimed a \$1 million Northrop Grumman prize for a working lunar lander model. These adventurers can give Europe and America a bright future of space exploration.

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