

The Problematic China-U.S. Aerospace Relationship

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Opening Observations

The U.S. space program specifically as it relates to China has been called muddled.¹ And it does not help matters that the U.S. space program as a whole seems muddled. This has been the case especially since the abrupt and surprising cancellation in 2010 of the bipartisan-supported Constellation Program on which the National Aeronautics and Space Administration (NASA) had invested billions of dollars and much effort in order to return the U.S. to the Moon and beyond. A fierce critic of this stunning policy change, the recently departed national hero Neil Armstrong accordingly testified to Congress last year that the current state of the American space program is “embarrassing and unacceptable.” The last astronaut to walk on the Moon, Eugene Cernan, called the present program “a mission to nowhere.”² Indeed, the U.S. program has appeared confused and rudderless, replete with seemingly indifferent national leadership, noisome political and professional bickering, funding uncertainty, and faltering public support. Space is scarcely mentioned in the current presidential election campaign, although minimal campaign statements regarding space have only in recent days been released. Both campaigns failed to have representatives to speak as was expected at the American Institute of Aeronautics and Astronautics “Space 2012” conference in Pasadena on September 11, 2012. Currently, the U.S. lacks the means to send astronauts to low Earth orbit (LEO), much less to deeper space. Instead, the U.S. is now entirely dependent on the Russians for several years, paying Russia \$50 to \$60 million to transport each American astronaut to the International Space Station (ISS).

Meanwhile, China continues to make deliberate progress in its space program, including its human exploration space efforts. Last year, China launched Tiangong-1 and since then has successfully performed two separate docking missions with it. The first was done on an unmanned, automated basis. The other, undertaken by the Shenzhou 9 spacecraft this June, had a three-person crew that featured China’s first woman astronaut. Soon, another three-person crew will guide Shenzhou 10 to a third docking that will bring to a conclusion this experimental program with Tiangong-1. China expects to have in LEO its own completed and independent space lab by the end of the decade. Meanwhile, progress is being made in China’s lunar program as well. Last year, lunar orbiter Chang-e 2 successfully completed its mission around the Moon and is now stationed at a Lagrange point in deeper space. Next year, Chang-e 3, will be the first Chinese attempt to place on the lunar surface a lander with an autonomous rover. The lander will also sport history’s first lunar astronomical telescope.³ China aims to land an astronaut on the Moon sometime after 2020 and ultimately to have a base there. Vice President Xi Jinping who spoke at the opening of an international conference of astronomers in Beijing in late August, underscored “just how seriously China takes the quest for space exploration.”⁴

¹ See Dean Cheng, “America’s Muddled China Space Policy,” *Space News*, March 20, 2011, p. 19.

² Kerry Sheridan, “Neil Armstrong says US space program ‘embarrassing,’” *AFP, Hostednews*, September 22, 2011, and Chris Bergin, “Apollo heroes support SLS, but demand inspiration and goals,” *NASA Spaceflight.com*, September 23, 2011.

³ David Szondy, “China announces plans for 2013 Moon landing,” *Aero Gizmo*, online, July 31, 2012.

⁴ Simon Perry, “We are not alone,” *China Daily HK Edition*, Hong Kong (XNA), September 20, 2012.

This contrasting comparison, presented briefly in this way is, of course, grossly misleading, for the U.S. is still the overwhelming leader in space and will remain so for many years, even as other nations increasingly invest in space programs. The record of American pioneering accomplishments is frankly breathtaking. It is still a fact that only Americans have walked on the Moon, something that was done decades ago on a truly adventuresome basis using uncertain primitive technology. We also are currently witnessing, some 35 years after its launching, the imminent departure from our solar system of early American space probe Voyager I, outbound some 1.1 billion miles and into the threshold of interstellar space. There are many other fascinating interplanetary probes still underway, including the GRAIL mission to the Moon this year, now extended. And topping it all off has been the amazing and spectacular landing two months ago (in August 2012) of the Mars Space Laboratory, the Curiosity rover. Moreover, the excitement over recent American progress in the commercialization of space suggests that we are on the eve of an intriguingly new era in space.

Still, at present, there does seem to be a difference in mood and purposefulness with regard to the respective manned space programs. And this particular contrast is manifesting itself at a time when, financially, China is on the ascendant and the U.S. is at present in relative decline. The authoritative Futron Corporation's 2012 space competitiveness analysis reveals that the relative position of the U.S. in space "continues to decline for the fifth straight year as other countries enhance their capabilities while the U.S. undergoes major transitions amid significant uncertainty."⁵ Moreover, Americans suddenly find that they are the most indebted nation in history, while China, with immense foreign exchange reserves, is their largest creditor... and beginning to manifest a disquieting change of attitude accordingly.

Under such overall circumstances, this would seem to be an opportune time to begin clarifying and honing our space policy, including its applicability to China.

Let me cite an example of the awkward confusion on space policy regarding China:

The AMS-02 Anomaly

After an impressive 30-year run the American manned space shuttle program came to an end last year. This extremely expensive limited purpose program did produce a highly sophisticated fleet of Earth orbiting spacecraft. Altogether, these space shuttles carried out 135 manned missions to LEO, but no higher than LEO. Among their spectacular achievements was the placement and subsequent repair of the Hubble telescope, whose breathtaking images have transformed our appreciation of the cosmos, and the completion of the construction of the International Space Station (ISS), another marvel both of human technological achievement and of international cooperation in space. It was on the penultimate mission of the shuttle (i.e., STS-134, the final flight for the shuttle Endeavor) a year ago May that the largest, most important, and most

⁵ "Executive Summary," *Futron's 2012 Space Competitiveness Index: A Comparative Analysis of How Countries Invest in and Benefit from Space Industry*, Futron Corporation: Bethesda, MD, 2011, p.5.

expensive single scientific instrument, the \$1.5 billion, 15,000-pound Alpha Magnetic Spectrometer (AMS-02) was finally affixed to the ISS.

What is especially interesting, and ironic, about this singular accomplishment is that after years of denying Chinese participation either on the shuttle or the ISS, what is now the most important instrument aboard the space station includes no less than 400 pounds of essential Chinese components.⁶ Yet, as I understand it, and this seems scarcely believable, Chinese were excluded even from being on hand to witness the spectacular launch of STS-134 and its AMS-02!

We are reminded of this curious anomaly several times daily as the ISS tracks its orbit a couple of hundred miles overhead. As it does so, the attached AMS pursues its truly significant astrophysical mission, i.e., the processing of cosmic particles in the deeply intriguing search for dark matter, dark energy, and antimatter. For those with any interest in physics or the cosmos, it is hard to imagine a more fascinating scientific study these days...other, perhaps, than the recent zeroing in on the elusive Higgs boson at the Large Hadron Collider in Cern, Switzerland. Coincidentally, the voluminous data from the ISS is relayed to the AMS Payload Operations Control Centre (POCC) in Cern. A second such POCC was recently (July 2012) inaugurated in Taiwan, which now similarly receives such important scientific data.⁷ The principal investigator for the AMS-2 project is none other than Nobel laureate particle physicist Samuel Ting at MIT.

The lesson of the ISS experience so far is that, with effort and patience, international cooperation in space can and does work, as it has among the principals involved, i.e., the U.S., Russia, Europe, Canada, and Japan, with input from several other nations. The anomalous AMS-02 situation shows that even apparently inadvertent passive cooperation happens and can be constructive. That it actually happened at all is because, fortuitously, the responsible agency for the AMS was the U.S. Department of Energy, not NASA. Otherwise the AMS in all likelihood would not be operative today, continuously dispatching the reams of invaluable data that scientists are now anxiously poring over.

Cooperation

This thought piece is part of a continuing effort to maintain a conscious awareness of developments in Chinese aerospace, and with an eye on observing where cooperation may or may not fit in. That is, cooperating with a country with which the U.S. has a singularly important but complex relationship, but is not, at present, an ally. Accordingly, we tend to speak of “engaging” with China rather than dwell on either competition or cooperation. Even so, the intense bilateral relationship is marked with numerous examples of both competition and cooperation.

⁶ Craig Covault, “AMS: Shedding light on the dark,” *Aerospace America* (June 2011): 40-44.

⁷ The POCC is located at the Changshan Institute of Science and Technology. Article by blade, “New Taiwanese centre to probe origins of universe,” *France 24*, July 3, 2012 (<http://www.france24.com/en>)

China was a serious foe for a couple of decades in the mid-20th century. Rapprochement in the 1970s and thickening connections ever since have significantly improved ties. But tensions remain and are sometimes exacerbated by aspects of China's impressive contemporary rise. So, competition is built in, particularly as China seeks to catch up technologically, by all means possible.⁸

That there has come about an exceedingly uncomfortable imbalance in the economic relationship complicates matters. The imbalance is worsened by the realization that U.S. indebtedness may be approaching an historic, perhaps catastrophic tipping point. This is serious and more so than many realize. Interest payments, currently at least \$26 billion, on the debt to China would surely cover the costs of China's space program, and soon enough maybe even that of its entire military modernization. It does bear keeping in mind, of course, that China has its own problems. Its spectacular economic growth is not necessarily predestined to continue. And if the U.S. does fall hard, China will not be unaffected. We do, in fact, seem to need each other.

The Chinese manned space program is getting wide attention for its steady accomplishments, achieved with healthy measures of self-reliance, pride, and readily available cash. There is a respectable breadth to the program, and impressive reliability. For example, the Long March rocket program has an excellent launch record and sports a wide degree of diversity in the variants of its vehicles, perhaps more than in any launch program.⁹ But there is reason to be wary of China's increasing military power, particularly at a time when strategic mutual trust seems to be deteriorating. China is increasingly assertive, especially in its own neighborhood, wherein reside some of our own allies. There remains a considerable ideological gap between our countries, and our foreign policies are at cross-purposes at critical junctures. Under such circumstances, it is incumbent upon the U.S. to seek to maintain a technological edge.

But an open society knows the value of cooperation, to the extent that it is feasible and not counterproductive. One might expect that although some technology and know-how may be conceded as a result of cooperation there may be opportunities presented that might otherwise be missed. Cooperative engagement also affords better insights into who are the specific players in the game and what they are doing and thinking. This is information that is especially desirable amidst rapid institutional change in such a dynamically charged country as is China these days. Finally, it is good to think of our relationship as a more enduring one with the Chinese people and not just with their current political leadership structure and its uncertain ideological bent.

It is important to recognize that what is happening in Chinese aerospace is itself spectacular. As Andrew Erickson puts it "Chinese aerospace capabilities are improving in

⁸ See, e.g., David Wise, *America's Secret Spy War with China*, New York: Houghton Mifflin Harcourt Publishing Company, 2011.

⁹ Marco Caceres, Teal Group, "Balance of space launches shifts," *Aerospace America* (September 2012): 20-21, 43.

a rapid, broad-based fashion that can properly be described as a revolution.”¹⁰ It is not a uniformly even development or revolution. But some aspects of the phenomenon have done especially well. This distinction has become a matter of some importance, particularly as China’s capability to deny access to their airspace is enhanced and as it is able to project its power eastward, enveloping Taiwan and reaching beyond into the Western Pacific. The formidable DF-21D missile and latest generation stealth-enabled aircraft, the Chengdu J-20 and the yet newer Shenyang J-31, although all are still in development, are game-changing weapons. Any U.S. carrier battle group and American forward bases must increasingly take into these into account. Chinese anti-satellite capabilities are similarly a potential threat.

Of course, China cannot be denied the acquisition of such military capability, which is in keeping with the legitimate commercial and strategic interests of a formidable economic continental and maritime power. But the opaqueness of this military development program, a symptom of a self-acknowledged temporary relative weakness, remains a matter of concern for American observers, as it does for American allies in East Asia. This is particularly so as China becomes consciously more assertive and less respectful of American power.

Military Aviation

With regard to military aviation, there is no real US-China relationship at all, to speak of. But it is worth remembering that there had been a very promising such connection in the first half of the twentieth century, i.e., in the first decades of the history of powered flight itself. Sun Yat-sen’s first air force prominently included Chinese-American pilots, one of whom, Young Sen-yet, a Chinese-American from Hawaii, Dr. Sun dubbed the “father of Chinese aviation.” The first military plane to be entirely designed and built in China, with American help, was a variant of the venerable Curtis Flying Jenny. It was christened “Rosamond,” the American name of Madam Song Qingling, Dr. Sun’s wife, who actually flew in the aircraft. Later, Claire Chennault’s Flying Tigers fought with distinction for the Republic of China when the chips were seriously down. And Americans courageously and successfully undertook the highly significant and exceedingly dangerous mission of regularly and massively transporting personnel and materiel across The Hump in support of China and the anti-Japan effort in WWII.

But this special aviation relationship came to an end with the victory of communism in China. At which point, the Soviet Union, which had earlier played a role as well, took over as China’s military aviation partner exclusively. For the most part, the Russians have been profitably cooperative over the years, but they, too, don’t always find cooperation with China easy, and also try to limit technology sharing.

Meanwhile, in recent years, there have been only occasional China-US military aviation exchanges and discussions. None have gone very far. There is no real

¹⁰ Andrew S. Erickson and Lyle J. Goldstein, eds. *Chinese Aerospace Power: Evolving Maritime Roles*, Annapolis, Maryland: Naval Institute Press, 2011, p. xii.

cooperation at present and the prospects are not promising, despite the visit of Chairman of the Joint Chiefs of Staff Admiral Mike Mullen to China last year. Only a month before that visit there had been another incident of an American reconnaissance plane shadowed by Chinese jets¹¹. Despite the cordial Mullen visit, marked by a photo of him in a Su-27 cockpit, a demand by Beijing for discontinuing such reconnaissance flights off the Chinese coast was explicitly rejected by the Pentagon. Even so, a subsequent Pentagon annual report to Congress on military and security developments involving the PRC urges stronger U.S.-China military-to-military relationships, as “a critical part of our strategy to shape China’s choices as we seek to capitalize on opportunities for cooperation while mitigating risks.”¹²

Then there is the matter of Taiwan’s request for new F-16C/Ds, a request that is not in itself an unreasonable response to China’s rapidly modernizing air fleet and especially the ever improving array of missiles adjacent the Taiwan Strait. Washington has bent to pressure from Beijing and withheld the F-16C/Ds from a disappointed Taiwan, although it mollified the latter with a better alternative F-16A/B upgrade package.¹³ Beijing protests this arrangement as well, but seems to grudgingly put up with the compromise, particularly as it perceives that its coming military dominance in the area appears more and more assured. As of the summer of 2012, the US and Taiwan have come to an agreement to have the US Air Force evaluate Taiwan’s 128 F-16A/B fighters. The upgrades will be done in lots of 24 at a time beginning in 2016.¹⁴ This means that for some time fewer fighters will be available to deal with any threat that materializes. Thus is kept alive justification for further requests for F-16 C/Ds and perhaps for F-35s. Taiwan Deputy Defense Minister Andrew Yang had already revealed this likelihood last year.¹⁵

In light of all this, it is an interesting irony these days (with regard to military-related aviation) that a new training aircraft to be used by the U.S. Air Force Academy is the Cirrus SR20, which is manufactured by formerly financially strapped Cirrus Aircraft in the United States, a company that is now owned by China Aviation Industry General Aircraft (CAIGA). CAIGA provides the same training aircraft to the Civil Aviation Flight University of China.¹⁶

Civil and General Aviation

¹¹ See Michael Auslin, “The Growing Threat from China’s Air Force: Two advanced Su-27 fighters recently chased an American reconnaissance plane over the Taiwan Strait,” *The Wall Street Journal online*, August 24, 2011.

¹² Kate Brannen and Wendell Minnick, Washington and Taipei, “Pentagon Report on China Urges Closer Military-to-Military Ties,” *Space News*, September 5, 2011, p. 14.

¹³ See, e.g., Leithen, Francis, Taipei, “Mission Impossible: With China in mind, U.S. unlikely to sell new fighters to Taiwan,” *Aviation Week & Space Technology (AWST)*(August 15, 2011): 26-27 and Wendell Minnick, *DefenseNews* online (August 14, 2011).

¹⁴ Greg W. Aldron, Singapore, “US and Taiwan in \$3.8bn F-16 upgrade deal,” *Flight*, online, July 23, 2012.

¹⁵ Deputy Defense Minister Andrew Yang already made this clear last year: “In the future, Taiwan will need F-35s.” Staff writers, AFP, Taipei, “Taiwan may seek US-made F-35 stealth jet,” *Sino Daily* online, September 19, 2011.

¹⁶ Sarah Brown, “Cirrus lands China training deal,” AOPA Online, July 27, 2011.

In civil aviation, the US-China relationship is mostly a commercial one. China is a leading global buyer of commercial airplanes, but it is determined to manufacture its own increasingly sophisticated aircraft and has made it a matter of national focus and pride to do so. Thus it is that even as Americans and others vigorously compete with each other in the lucrative China market, they have little choice but to help an upcoming indigenous competitor gain the knowledge and wherewithal that is needed to realize priority Chinese objectives.

Similarly, in the sub-field of general aviation, the Chinese are also systematically learning from the increasing manufacture of foreign aircraft in China, from coproduction arrangements with foreigners (such as Cessna), and from outright acquisition of established American general aviation companies (such as Epic Aircraft, Teledyne Continental, Cirrus Aircraft, Hawker Beechcraft, and Glasair). Nowhere was the vibrancy of this phenomenon better symbolized than at the world's premier annual general aviation event (Airventure) at Oshkosh, Wisconsin last year. For the first time ever, the gargantuan event that boasts more than a half-million visitors each August featured a China Pavilion.

Americans and others have been generous in providing assistance, tactfully tendered, in the development of China's civil aviation and this has clearly been beneficial to China. In recent years there have been numerous visitations by Chinese officials and specialists to American aviation manufacturing, service facilities, and universities.¹⁷ The American Pilots and Owners Association (AOPA) co-sponsored with AOPA China the latter's first convention in Beijing a year ago September, with more than 400 people attending the two-day event. The AOPA China Summit focused on providing prime opportunities for dialogues and networking among the Chinese government, general aviation organizations and industry members worldwide. Accordingly, Chinese officials conceded that the Civil Aviation Administration of China (CAAC) needed AOPA China as a strategic partner for every step of the nation's general aviation development.¹⁸

What the Chinese are energetically accomplishing in both civil and general aviation these days, the latter in the face of formidable domestic obstacles, is impressive. The story is told insightfully in James Fallows new book *China Airborne*.¹⁹ Yet, sad to say, despite all the popular interest, government support, and availability of funding at the moment there is still concern as to whether general aviation in China ever will genuinely take off on a satisfactorily sustainable basis. The incubus of the Chinese military and state bureaucratic system remains a formidable obstacle.

It also bears noting here that given the uncertain nature of U.S.-China relations, there is concern about undue technology transfer on the civilian side as well. In fact, the U.S.-China Economic and Security Review Commission (USCESRC) in its 2010 report

¹⁷ For example, the Aerospace Department of Middle Tennessee State University, hosted the first National Conference on General Aviation Trends in December 2010, with U.S. and Chinese officials participating. *Daily News Journal*, Murfreesboro, TN, November 27, 2010.

¹⁸ *AVweb*, Vol. 9, No. 37, September 28, 2011.

¹⁹ Published by Pantheon Books in 2012.

to Congress explicitly recommended monitoring the transfer of such technology and know-how from China's commercial aviation sector to its military. Also of concern is the impact that "new cooperative production, technology-sharing or other arrangements by US or foreign firms might have in promoting China's civilian and/or military aviation production capabilities."²⁰ Nevertheless, in its report the next year (late 2011) the USCESRC had to concede that several western aviation firms had "established or deepened ties to Chinese state-owned aviation firms in 2011."²¹

Indeed, the lure of China market share is powerful. General Electric, whose CEO is Jeffrey Immelt, the head of an Obama Administration panel on U.S. jobs and competitiveness, signed an agreement with Aviation Industry of China (AVIC) to provide cutting edge avionics on China's new C-919. GE Aviation Systems executives claim that "the deal was too important to pass up, even at the cost of sharing the avionics technology."²² Ultimately, the C-919 and/or its successor China-built aircraft will compete with Boeing commercial aircraft in China and in all likelihood elsewhere as well.

This August, Senators Carl Levin and John McCain called public attention to the admission by defense contractor Pratt and Whitney that it had violated export rules by selling military software to China. Specifically, this transfer was of help in developing the Z-10 attack helicopter. Apparently hundreds of violations of the International Traffic in Arms Regulations agreement were involved on the part of just this one company. The senators termed the matter "deeply troubling," and indicated that it raises the possibility of systemic deficiencies with the oversight and enforcement of federal export controls.²³

This is not encouraging. However, the larger point here is that this is still an arena characterized by both competition *and cooperation*, however qualified, between Chinese and foreigners, including Americans. The numerous instances of cooperation in civil and general aviation would seem to constitute tangible precedent for cooperation elsewhere in the overall field of aerospace. After all, it is only in military aviation that there is no real cooperation and even here there are recurrent efforts to maintain a dialogue.

Space

The foregoing review of the realm of aeronautics reveals the key complication with regard to promoting cooperation between the American and Chinese space programs: China's program is dominated by the Chinese military. Of course, the U.S. military had a principal role at the beginning of the American space program as well, but in the United States the military has its own separate space program. That is, it is distinct from NASA, which from its beginning under President Dwight Eisenhower has been

²⁰ U.S.-China Economic and Security Review Commission. *2010 Report to Congress*. Washington, D.C.: U.S. Government Printing Office, November 2010, p. 107.

²¹ *Ibid*, November 2011), pp. 156-157.

²² Howard Schneider, "GE 'all in' on aviation deal with China," *The Washington Post online*, August 22, 2011.

²³ "Chinese military troubles Levin, McCain," Washington, *UPI.com*, August 7, 2012.

explicitly a civilian agency. There is an effort in the United States to maintain the civil-military distinction in space, although there are instances of overlap, and financial exigencies may dictate more such overlap ahead. But in China the apparent equivalent to NASA is the lightweight China National Space Agency (CNSA), which takes a backseat to the military and in recent years has been further reduced in importance.

Much of the high-end technology involved in the space program is dual-use and of strategic security significance. Therefore, it is not as easy in the space program to define areas of cooperation. Rockets that heave huge payloads into space can also swiftly deliver seriously destructive precision strikes upon an adversary on earth. Moreover, we all have become so dependent upon space satellites that we are instinctively aware of the need to protect such vitally important space-related assets. Nowhere is this more important than in safeguarding the operational viability of our armed forces, either as engaged in war or in observing an ever greater concentration in China of modernized weaponry, especially missiles. All of this makes it imperative to try to stay technologically ahead of the competition, especially of a rising power that is perceived as a possible or latent threat. This is particularly so if that rising power is so obviously in the business of acquiring sensitive information by intensive spying, of which we are recurrently reminded.²⁴

Perhaps if the U.S. had better counter intelligence capabilities with regard to what the Chinese are doing, it is said, there might be more of a disposition to go forward with cooperative space ventures. This is the gist of an important joint commentary by the former NASA administrator Michael Griffin and former national counterintelligence executive Michelle Van Cleave who fear that without robust counterintelligence capability “we stand to lose more than we would gain.”²⁵ Remarkably, however, the White House National Security Council had already contrarily directed U.S. intelligence agencies to lower the priority placed on intelligence collection for China.²⁶

Cooperation Entangled with Embattled Space Policy

Cooperation is desirable at least in order not to miss opportunities that can accrue from cooperation. This is well appreciated by an open society. Hence, it is awkward to appear opposed to cooperation with a nation with whom we have so many other ties. But China is not an ally and it is building a formidable military. Even so, some are inclined to find a way to nurture the possibility of cooperation with a country that hopefully might ultimately evolve in a more desirable direction. Hence, even under the previous administration there were efforts to explore cooperation with China. It was the surprise, unexplained Chinese anti-satellite test in early 2007 that discouraged serious follow-up.

Clearly, the Obama Administration is open to some form of cooperation with China in space. This follows from the meetings between the two presidents, Barack

²⁴ See recent book on subject...

²⁵ Michael Griffin and Michelle Van Cleave, “Cooperating in space: Time for a timeout,” *The Washington Times*, online, July 6, 2011.

²⁶ Bill Gertz, “China removed as top priority for spies,” *The Washington Times*, online, January 20, 2010.

Obama and Hu Jintao. It is seen even with regard to military space. Gregory L. Schulte, deputy assistant secretary of defense for space policy, believes that China's investments in counter space capabilities "makes it that much more important that we talk to them to make sure they understand our policy." The idea, it is said, is "to minimize the risk of misperception, mishap or miscalculation, particularly in a crisis."²⁷

Unfortunately, the subject of cooperation in space has become entangled in the general confusion in which the US space program now finds itself. There is a perplexing confusion of goals and direction, and it is exacerbated by the political and budgetary struggle between Congress and the White House. The impasse is partly partisan politics, but is also more complex. At the outset, following the cancellation of the Constellation Program, this was largely over whether or not to have a huge government rocket. Congress finally won this round in September 2011 when NASA suddenly and hastily revealed plans for the heavy rocket. It is suspected that this was done because the following week Apollo heroes Neil Armstrong and Eugene Cernan, both outspoken critics of the Administration's new space policy, were scheduled to testify at a congressional hearing. Thus the heavy NASA Space Launch System (SLS) rocket, which is the new designation for what basically appears to be a modification of the Ares rocket of the now cancelled Constellation Program, is in the plan going forward.

One consequence of this intense political struggle is that it has stimulated a fascinating informal public debate about space, giving rise to both thoughtful ideas as well as considerable acrimony. It is a debate that should have been initiated openly before the present administration announced its own surprising and inadequately articulated space policy. The division in the space community is palpable. One of our leading aerospace historians, Roger Launius, had already warned early on: "Nothing like the rancor of this debate, its longevity, its very public nature and its intensity has taken place in the history of human spaceflight."²⁸ Agreement to build the heavy government rocket has mollified critics somewhat, but the rancorous debate over space policy continues.

In these circumstances, this has not been a propitious time for the Administration to push for cooperation with the Chinese space program. Yet, despite warnings not to do so, John Holdren, the White House science advisor has met with Chinese, and Charles Bolden, the NASA administrator, visited China in late 2010. Bolden was hosted graciously and shown key Chinese space facilities. He was informed by his hosts that, frankly, while cooperation would be welcomed, neither nation depended upon the other in order to pursue their respective programs.²⁹ Otherwise, neither Holdren nor Bolden have been forthcoming with much more detail regarding cooperating with China.

²⁷ "Orbital Diplomacy," *Space News*, August 22, 2011, p. 22.

²⁸ Roger D. Launius was NASA's chief historian and currently is a senior curator in the Division of Space History at the Smithsonian Institution's National Air and Space Museum in Washington. See his "Guest Blog: Human Spaceflight on the Brink of Extinction? What Might We Learn from the 1967 Planetary Science Crisis," *Imaginova Community*, July 21, 2010.

²⁹ See Amy Svitak, "NASA Chief Gives Details of Recent China Trip," *space.com*, November 23, 2010.

Indeed, in April last year Congress enacted legislation that specifically prohibits cooperation with China's space program. This was initially in the continuing resolution as part of the budget compromise at that time and was then included in the 2012 spending bill. This provision stated that no NASA or Office of Science and Technical Policy (OSTP) funds can be used "to develop, design, plan, promulgate, implement or execute a bilateral policy, program, order, or contract of any kind to participate, collaborate, or coordinate bilaterally in any way with China or any Chinese-owned company."³⁰ Representative Frank Wolf (R-Virginia) separately published the rationale for such a prohibition, arguing that it is based not only on the presumed threat to national security but on the many critical ways that Chinese policies and practices are at cross-purposes with those of the U.S.³¹ Science Adviser Holdren objected to such restrictions and at a House hearing on July 7, 2011 indicated that the prohibition should not be read as prohibiting interactions that are part of the president's authority to conduct negotiations. The matter would be looked at on a case-by-case basis. In response, Congress slashed the OSTP 2012 budget.

Conclusion

It is to be hoped that after the presidential election next month, when so many urgent decisions must be made during what is a serious national financial crisis, some time and energy can be found to shape up American space policy. There have been worthwhile suggestions toward this objective. Last year, e.g., the Aerospace Industries of America (AIA) had called on President Obama to take specific steps to address threats to American space leadership. These steps included the establishment of a long-term, comprehensive national space strategy, stable and robust budgets, policies that maintain a healthy and vibrant space industrial base, and the modernization of export control policies.³² Space historian Roger Launius has suggested a leadership initiative to bring parties together. This would not be easy, but hopefully it would lead to what he says might be a new "consensus to avoid decisions that might (otherwise) take courses unacceptable to the space community as a whole."³³ To this end, the establishment of a coordinating national space council is surely a worthwhile idea.³⁴

As for prospects ahead, it is worth remembering that in 2008 then candidate Barack Obama promised to re-establish the national Aeronautics and Space Council, something that seems to have been forgotten. Of course, he had also endorsed the goal of sending human missions to the Moon by 2020, only to arbitrarily cancel NASA's Moon program soon after becoming president, dismissively saying that we had already been there. This seemingly cavalier attitude toward the Moon invited Republican vice-

³⁰ Stephen Levy, "Wolf: Technology shared too freely with China," *The Washington Times*, July 20, 2011, see <http://www.washingtontimes.com/news/2011/jul/19/wolf-technology....>

³¹ Frank Wolf, "Why the U.S. Shouldn't Help China in Space," *Space News*, May 30, 2011, pp. 19-21.

³² AIA *Daily Lead*, August 15, 2010.

³³ Roger D. Launius, "Guest Blog: Human Spaceflight on the Brink of Extinction? What Might We Learn from the 1967 Planetary Science Crisis," Imaginova Community, July 21, 2010.

³⁴ As argued, for example, by Dr. Joan Johnson-Freese, "Guest Blog: Military Space & A National Space Council: An Unwanted Answer to Persistent Problem?" *Space News*, August 4, 2010.

presidential candidate Paul Ryan's recent caustic rejoinder that "China may someday be looking down on us from the Moon," to which he added: "That's unacceptable!"³⁵

This isn't to suggest that there is a space race underway or that one is being considered. But there is an awakening consciousness about the implications of what the Chinese are achieving. In testifying to Congress a year ago September, Michael Griffin termed China a "near-peer competitor," adding: "When the Chinese can reach the Moon and we cannot, I do not see why any other nation would regard us as a world leader."³⁶

John Logsdon has made the worthwhile suggestion: "Before the United States gets totally committed to skipping the Moon on its planned journeys away from Earth, might a new attempt to create a truly global exploration effort, with interdependence among key partners and with the Moon rather than a NEO [near earth object]...be worth considering?"³⁷ Indeed, why not? And, in the future, any manned space expeditions to distant planets, i.e., to major destinations beyond the Earth's moon, would do well to prudently embrace optimum international cooperation. Otherwise, such exorbitantly expensive and exceedingly dangerous expeditions, ostensibly on behalf of mankind as a whole, do not make a lot of sense. In fact, the present and former NASA administrators are basically in accord with this reasoning. On the other hand, Michael Griffin explicitly does not believe that this presumption is shared by China, which he believes may well choose to go to the Moon on its own, and later to Mars on this basis as well.³⁸

For now, a new House bill, pointedly entitled "Space Leadership Preservation Act" (HR 6491), has been introduced that seeks to restructure NASA's management and funding, with the idea of making the agency more professional and less political. Thus the administrator would be appointed to a ten-year term, allowing for more continuity in the planning and execution of NASA's various missions. It would also make the agency less subject to the changes of administrations and give Congress more of a say.³⁹

In any case, beyond improvements to NASA what is needed is a coherent, comprehensive space policy. Having such a policy would in turn facilitate the setting out of the specific political and commercial goals that should be kept in mind as we seek cooperation with the Chinese space program, and perhaps in aerospace as a whole. Without such goals, as China space specialist Dean Cheng advises, "it is not possible to negotiate successfully with Beijing."⁴⁰

³⁵ Jonathan Terbush, Paul Ryan accuses Obama of 'dismantling' NASA, letting China win space race, *The Raw Story*, September 23, 2012.

³⁶ Kerry Sheridan, *AFP*, September 22, 2011.

³⁷ Logsdon is the founder of George Washington University's Space Policy Institute. "Opening the Door for International Cooperation," *Space News*, September 27, 2010, pp. 19-20.

³⁸ Dan Vergano, "NASA chief: U.S. won't go it alone on manned Mars mission," *USAToday.com*, August 2, 2012.

³⁹ Eric Berger, "Congress mulls over space agency reboot," *Houston, chron.com*, August 12, 2012. The bill was introduced in mid-September 2012.

⁴⁰ Dean Cheng, "China and the New National Space Policy," *Space News*, July 12, 2010, p. 21.

Even so and in the meantime, the U.S. might well consider welcoming opportunities to cooperate with China in space ventures that are purely scientific. The AMS-2 on the ISS should be no anomaly at all. It should be seen as a fortuitous opportunity, however unintentionally and passively, to cooperate scientifically. This is in keeping with the preferred stance of a free and open society. The result is beneficial to both the U.S. and China, and to humanity as a whole. Similarly, efforts to get a handle on the dangerously increasing space debris problem should welcome China's active participation. Moreover, it would be desirable to learn more fully what China is doing in certain areas, e.g., as in their space based solar energy program.⁴¹

In fact, there are many calls for cooperation and some measures to that end already underway. For example, the International Lunar Observatory Association (ILOA) of Kamuela, Hawaii has signed a memorandum of understanding with the Beijing-based National Astronomical Observatories (NAOC) of the Chinese Academy of Sciences to use China's Chang'e-3 moon lander for astronomical imaging.⁴²

Even with current limitations there should be friendly exchanges among astronauts of all nations. They are, after all, every one of them, courageous members of a very special fraternity/sorority, dedicated to inspirational exploration...and to the rigors of protracted elemental survival in a very hostile environment. Rex Walheim, an American astronaut aboard the final flight of the space shuttle Atlantis, said that "China being in space I think is a great thing. The more nations that get into space, the better cooperation we'll have with each...Space is one of the biggest international brotherhoods we have."⁴³ American astronaut Elroy Chiao flat out suggests that China should be a partner in space.⁴⁴ Astronaut Chiao had been the first person of Chinese descent to walk in space and to command a space mission. He visited space facilities in China in 2007.

For the time being, however, cooperation in manned space programs must remain limited for political and security reasons, until it can be determined that American interests are safeguarded. This can better be achieved with a national space policy that is well thought out, supported by a coordinating space council, and appropriately funded. It is likely that the Chinese, too, could use an authoritative high level coordinating body that effectively represented and explained their ongoing space programs. In any case, greater openness in the Chinese space program would encourage a positive American response.

⁴¹ See Christopher Stone, "National Space Strategy: proactive or reactive?" *The Space Review: essays and commentary about the final frontier*, online, October 3, 2011.

⁴² Steve Durst, ILOA founding director, said that the exchange in kind calls for China's NAOC to receive observing time on the ILO-X and ILO-1 mission instruments - science gear that's part of the International Lunar Observatory Association's work with Moon Express, a Google Lunar X Prize enterprise based at NASA Research Park. The ILO-X instrument is a precursor to the ILO-1 telescope under a program to land a multifunctional 2-meter dish at the Moon's south pole. See Leonard David's column in *Space*, online, September 19, 2012 and article in *Space News*, September 24, 2012, p. 14.

⁴³ Irene Klotz, "UPDATE 1-Astronaut welcomes China to space brotherhood," Houston, *Reuters*, online, July 15, 2011.

⁴⁴ Leroy Chiao, "Make China our new partner in space," CNN Opinion, online, September 2, 2011.