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The U.S. and China: What 'Common Ground' in Outer Space?

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As the International Space Station (ISS) struggles toward "assembly complete," and as the space shuttle program lurches towards retirement while its replacement wavers in configuration and schedule uncertainties, American space officials can be forgiven the impulse to look for miracle cures for growing U.S. space program challenges. The latest fad is to imagine all the wonderful things that might be made possible by bringing the burgeoning Chinese space program into partnership with the United States and other nations.

Chinese astronauts could visit the ISS, or transport cargo and foreign passengers on a commercial basis. Chinese scientists could build a laboratory module that would attach to a vacant docking port. Chinese engineers could develop components of future Earth spaceships bound for the Moon and beyond. Scientific instruments could be cross-hosted on each other's satellites and deep space probes.

We're being subjected to a swarm of enthusiastic public statements by the usual suspects and various newspaper editorial writers regarding these wonderful prospects. Think of all the time and money we would save from pooling efforts, they say. Think of all the mutual understanding and respect that would spill over into diplomatic amity, they say. Look at how well the Russian partnership has done for the space station—well, actually, few outside of NASA say that very much any more, and with good reason.

Bottom line, up front: There could well be sound reasons to expand U.S.-Chinese space cooperation, to exchange space hardware and space know-how, and even to link up manned spacecraft in orbit. There could be space cooperation projects that may deliver worthwhile benefits to the United States at acceptable costs and risks. But the rationale and tactics for such efforts must be based on reality, on cold-blooded assessments and on hard bargaining. Such an approach still seems a long, long way off.

Regarding the development of strategies for future dealings with China, U.S. government policy-makers are in desperate need of a few reality checks about potential benefits versus potential costs, and scant argumentation of benefit (indeed, much of harm) can be found in public forums in recent months. So here, perhaps, a sober and beyond-the-hype assessment of the development and prospects for a real-world example, the U.S.-Russian space partnership is a necessary, but not by itself sufficient, step.

The Chinese have clearly made a strategic decision to expand their space efforts across the board. Behind the high-publicity "flagship missions" of the Shenzhou human spacecraft and the Chang-Eh moon orbiter probe (planned for next year—more on this project shortly), there are satellite programs involving communications, weather, earth resources, navigation, and other applications as well as a series of science and technology demonstration satellites.

But their potential contributions to joint projects, while promising, must be assessed based on strictly feet-on-the-ground standards, not head-in-the-clouds hopes. U. S. experience with other international partnerships, particularly with the Russians, can provide helpful insight—if remembered and interpreted accurately.

Contemporary thinking on this theme

Realism is a more challenging task than first it seems. A good example of modern mythology is a newspaper essay[1] published last April 18 by Vincent Sabathier and G. Ryan Faith, space policy wonks at the Center for Strategic and International Studies in Washington, D.C.

Engaging in a new "moon race" with China, they wrote, "can cause more harm than good—and putting national competition at the center of a return to the moon can repeat the errors of Apollo—the errors that ultimately resulted in a 35-year-long retreat from the lunar surface."

Essentially the authors are rewriting space history to argue that had the Apollo program been a genuine U.S.-Soviet cooperative venture, human lunar exploration would have continued unbroken for decades. The gap, in this view, was only caused by the "space race" attitude.

But this is anti-historical, even fantastical. Apollo was funded at appropriate levels not because of Congressional curiosity about moon rocks, but out of a broad consensus that the superiority of U.S. advanced technology needed to be reasserted in the face of a Soviet challenge.[2] The payoffs of Apollo's success in doing exactly this goal (while revolutionizing planetary science on the side[3]) resonated to America's benefit for decades by giving credibility to American know-how across-the-board—scientific, commercial, AND military. Some have argued that it was this Apollo-sprung credibility that made Reagan's SDI the back-breaking, unavoidable challenge to the very existence of the Soviet state.[4]

The authors[5] argue a second "lesson of the post-Apollo era," to wit, "that international cooperation is essential to maintaining a space-exploration program." Experts may debate this point, but its relevance to a proposed partnership with China is obscure because, as is well known, the U.S. is already intimately involved in international partnerships with the space station. If China remains outside this team, it—not the rest of the current team members such as most of Europe including Russia, Japan, and Canada—would seem to be most vulnerable.

Yet their main thesis is a classic non sequitur (an assertion that does not follow from previous arguments): "If the United States is serious about leadership in space exploration, inviting the Chinese Shenzhou to dock at the international space station is an excellent first step on this journey."[6] But the U.S. has already made steps, many steps in fact, in this direction, as the historical record shows, with mixed results.

Other specialists bring up the perpetual promise of cost savings by sharing the load. John Logsdon, director of the Space Policy Institute of Washington University recently told newsmen that the "high cost of space exploration creates potential opportunities for cooperation among states."[7] But Logsdon, a genuine expert, knows better. The historical record shows that despite promises that mostly appeal to congressmen, major international joint programs almost invariably wind up costing more, taking longer, and delivering less than an alternative well-managed single-leader program.

When faced with the same argument as support for inviting the Russians into the U.S.-led 'Freedom' space station project in 1993, experienced observers at the time were skeptical. "I have yet to see a joint international program that saves any money," noted aerospace industry leader Norman Augustine.[8] By June 1994, the Government Accounting Office had written: "Most of the savings from Russian participation comes from an optimistic schedule that may not hold up. If the schedule slips, any savings will quickly evaporate."[9] As time

would tell, this outside advice was right on target, but at the time NASA and the Clinton White House refused to consider it—and now, a decade later, many want to rewrite history to show that such time and money savings actually occurred.[10]

Russian-provided hardware was years late in delivery, driving NASA's own costs sky high while integration redesigns wasted billions in earlier design work. To reach the northerly orbit required for Russian access, the Space Shuttle was both overstressed (subjected to a significantly higher aerodynamic load during launch) and off-loaded (a performance penalty of about one third was made up for through flying dozens more shuttle missions, each costing half a billion dollars). For 5% of the monetary contribution, Russia wound up being granted 40% of the station's facility services, while making billions of dollars in foreign sales of their space hardware and services.[11]

The Russian partnership did allow the ISS to remain manned during the years that the surviving shuttle fleet was grounded, but the actual benefit of this accomplishment, of keeping a skeleton crew (with few scientific tasks) on board a largely unfinished orbital outpost, is debatable. They mostly repaired equipment that their own presence was wearing out, while restocking supplies that their own presence was using up. Without the Russian partnership and the Soyuz transportation system, a shuttle disaster would have led NASA to evacuate the station (using an emergency capsule that was designed prior to the Russian arrival, but later cancelled), leaving it safely on autopilot until shuttle flights could have resumed.

Benefits beyond mere money

And how about non-monetary benefits of such partnerships? Contributing to the on-line space policy site *Space Review* on April 24, spaceflight observer Taylor Dinerman wrote: "There is a strong case for some kind of U.S.-Chinese space project, if only to establish the kind of personal links that will ensure minimal levels of trust and understanding in the future."[12] Dennis Wilder, identified as Acting Senior Director of Asian Affairs at the White House National Security Council, told newsmen April 20 that Bush's directive to NASA to go talk with Chinese space officials was "trying to deepen the relationship between our two societies and our two cultures."[13]

But John Logsdon put this concept in historical perspective in a report almost twenty years ago, when he wrote: "Those that advocate space cooperation as a means of making significant changes in superpower political and military relationships are fighting against most examples provided by history."[14]

Logsdon continued: "For most of the twentieth century, a school of international political thought called 'functionalism' has argued for 'peace by pieces'—creating a network of cooperative relationships in specific areas of human activity that would weave a web of interdependence to place constraints on conflicts so they did not erupt into armed hostility." Many international relations strategies in the years immediately after both World Wars were "motivated by this perspective," he wrote, but "most students of international politics are skeptical of the 'spillover' argument—that habits of cooperation developed in narrow areas of activity will have impacts in other areas of nation-state relationships."

This view—often extolled as a great benefit of U.S.-Russian space cooperation and hence a great promise for U.S.-Chinese space cooperation—is that such habits of cooperation create habits of international amity. They make people "feel good about each other" and change hearts and minds across borders.

Nothing could better illustrate this belief than the words of NASA astronaut Charles Precourt, after his third visit to the Mir space station, in mid-1998. Precourt is a highly intelligent and thoroughly decent human being, but his view that his exploits in space can force unwilling world leaders to make peace despite

themselves seems a bit overblown. Here's what he said:

> "So I just think that the fact that we're cooperating with so many countries, eventually perhaps on the new Space Station, it will provide the psychological impetus for politicians to force themselves to find an agreement to disputes that otherwise they wouldn't, because they'll look up there and say, 'Well, we have an investment in that, too—we have to keep this relationship going in a proper direction,' rather than doing something rash," he told an interviewer. In conclusion, "So I think it's the right way to do business."[15] Other astronauts, proud of what they see as their role in ending the Cold War by promoting peaceful exchanges, have made similar statements.

Rocketry Realism

But a more cold-blooded assessment suggests that Precourt and others are just responding to the truism that "there is no up or down in space," and they actually are standing on their heads. Their views have treated space cooperation and international relations in a precisely inverse, 180 degrees off, alignment. They have confused cause and effect, and reversed their roles.

Handshakes in orbit do not lead to unclenched fists on Earth, neither in 1975 (with Apollo-Soyuz) nor in 1995 (with Shuttle-Mir), nor will they when and if a Chinese spaceship visits the international space station. The robin does not bring the spring, the cock does not bring the sunrise (although their bird brains may think so). And the astronauts, however skilled and courageous their performances, did not overthrow the old tensions of world diplomacy.

No, space cooperation is a consequence of improved ground-based relations. It is used by national governments as a display of trends already decided upon. The diplomatic improvement comes first, and space activities reflect it, never the other way around.

Yet that's not the viewpoint most widely expressed. Instead, we get assertions such as this from Sabathier and Faith's essay: "Much as Russian participation in the international space station was preceded by the famous Apollo-Soyuz mission during the Cold War, Chinese participation in the international space station can be a precursor for cooperation in decades to come."[16]

We need to say this again. The birds do not bring either the spring or the sunrise, no matter what THEY think. And hugging astronauts and cosmonauts, despite their equally misplaced confidence in their own significance and importance, do not bring peace and security, neither in the past nor in the future.

So then, WHY?

If U.S.-Chinese space cooperation won't save time or money, and won't bring peace on Earth, what other factors need to be considered before selecting among the proposed strategies?

Dr. Joan Johnson-Freese, an analyst at the Naval War College in Rhode Island, has written extensively and authoritatively about China's space program.[17] Wider cooperation, she believes, will lead to greater U.S. insight into China's space initiatives. At the same time she anticipates the chance to help steer Beijing onto the world stage and to give China's leaders higher stature among its people, according to a newspaper account.

While encouraged that official discussions have now been sanctioned, she told a Houston reporter recently that deeper cooperation had its opponents. "There are still a very large group of individuals who are very anti-China," she told the *Houston Chronicle*. "They are in the bureaucracies, the State Department, the Congress," she said.[18]

This injudicious wording, bordering on accusations of knee-jerk racism or ideological fanaticism, poorly reflects Johnson-Freese's nuanced and profound knowledge of China and

particularly its space program. But it touches on the most central aspects of a U.S.-Chinese space partnership: what objections are held by different branches of the U.S. federal government?

On the issue of technology transfer, the high level of government concern is arguably well founded. China, far more than the old Soviet Union and its fossilized industrial infrastructure, has proven adept at integrating foreign technical know-how into its own systems, and advancing beyond merely copying. And once one "wheel" has been invented, China's technology planners see to it that wasteful repetition is minimized.

The coming Chinese moon probe, Chang-eh, is a good example. Since its purpose is to orbit the moon to make scientific observations, its basic "bus" (the carrier spacecraft on which the science gear is installed) seems to have been adapted from the design of a Chinese 24-hour communications relay satellite, the DFH-3.

And how did China so quickly develop that project in the early 1990's? According to a credible section of the Cox Report on Chinese space technology acquisition efforts, China acquired know-how for key systems from a variety of Western sources.[19]

"The DFH-3 comsat had its development time cut in half by use of a large number of Western components," the report stated. It provided details (never disputed by Chinese officials): The central processor was built by Matra-Marconi; the solar panel substrates were provided by Messerschmitt-Boelkow-Blohm, which also performed final fabrication; the antenna assembly, consisting of a deployable dual gridded reflector, feed, and interconnecting structure, was built by Daimler Chrysler Aerospace Group; the infra-red Earth sensor (for attitude control) was built by Officine Galileo; the payload test equipment consisted of five racks with 80% U.S. equipment, and the racks themselves were provided by a German corporation.

So when it came time to use this same design for a more distant space mission, the firm foundation in Western technology allowed the project to proceed quickly and economically and reliably.

Reliability of Chinese rockets is another controversial issue, and U.S. aerospace firms have been fined for providing technical advice during China's accident investigations that involved rockets carrying U.S. commercial clients. The sensitivity rests largely on the unusual Chinese rocket industry, where military missiles and space boosters are both variations of basic hardware developed by the same factory. Anything that improves the performance of Chinese space boosters is a potential improvement for Chinese military missiles (and vice versa).

For these reasons, and for the efficiency with which China seeks, acquires, and exploits foreign technology, levels of caution higher than in any other international space relationship are called for.

An outer space insight

What, then, really are the main barriers to a closer integration of Chinese and U.S. space efforts? NASA Administrator Mike Griffin dropped a clue, perhaps unconsciously, when he testified before the U.S. Senate Subcommittee on Science and Space on that very question on April 25. "Twenty years ago few people would have said that Russia will be our best partner in the Space Station," he noted.[20]

The point glossed over by Griffin, and by every other commentator who uses the current Russian partnership (and its Apollo-Soyuz ancestry) as an analogy for a future Chinese partnership, is almost too obvious to require stating—but it does. Twenty years ago, there was no "Russia" to be partners with. The country we are NOW partnered with, whose capital is Moscow, did not EXIST twenty years ago.

Thirty years ago, the United States confronted the Soviet Union, whose ruling regime dedicated massive resources towards a military machine that threatened the U.S. with

nuclear devastation while fueling a series of proxy wars against the U.S., that was placing strike weapons aboard space vehicles in orbit (and lying about it), that ruled its population through totalitarian fiat, backed up by secret police and both prisons and mental hospitals for the disobedient, while strangling political, artistic, and religious freedoms, that propped up puppet states and local dictators along its borders, that engaged in full-spectrum espionage to obtain Western technologies in order to further enhance its weaponry, and which propagandized fear and hatred into the hearts and minds of its own citizens and anybody else beyond its borders foolish enough to be mentally misled.

With such a regime, other nations could cooperate scientifically in non-military fields, and could meet at conferences, at research bases in Antarctica and on the high seas, and even—once, in 1975—in space, while surrounding the American space workers with curtains of camouflage and disinformation.[21] But there was and could be no 'partnership', there were no joint projects.

Following Apollo-Soyuz, in the late 1970's, it was the Carter Administration (that once had discounted 'an inordinate fear of communism') that cancelled follow-on space cooperation. The Reagan White House in the early-1980's several times attempted to restart joint manned space missions with Moscow, such as a Shuttle-Salyut docking, but every time things got promising, the Soviets would shoot down a lost passenger airliner or murder too many of their own (or on occasion, our own) citizens to tolerate, not to mention the ultimately confirmed Andropov plan to murder the Pope. Twenty years later, or a hundred years later, there was never going to be any prospect of a mutually trusting and beneficial partnership with such a regime. As long as the Soviet Union endured and was true to its traditions, there would be NO progress towards serious cooperation.

The partnership of the post-Soviet Moscow state, Russia, in the International Space Station was made possible by, and many observers argue was actually made necessary by, the welcome collapse of this former regime. But while the regime had persisted, all attempts to expand space cooperation were stymied, as they should have been.

What does China want?

So what about China? Is it today and in the foreseeable future more "Soviet-like" or more "Russia-like"? And what does real, as opposed to fanciful and self-delusional, experience with partnering similar states tell us as guidance for the future?

In assessing the same sorts of criteria that characterized a Soviet-style regime, we can examine internal political and religious repression, levels of world-wide messianic ideas, threats against neighboring states, aggressiveness of technology acquisition both legally and illegally, support for regimes more directly hostile to the U.S. (such as North Korea), ethnic oppressions of annexed non-Han regions (e.g., Tibet, but Russia's current tactics in Chechnya win them no points either), and similar criteria all too reminiscent of the USSR.

On the other side of the balance sheet are strong commercial ties, despite unrelenting copyright and patent violations, as part of a burgeoning semi-free commercial sector. While there is a much wider flow of internal information, including about its space program, official efforts to silence independent bloggers and to quarantine segments of the Internet that contain undesirable news and opinions are intense, as is a campaign (arguably with at least semi-official backing) to conduct low-level cyber-war against Western internet targets. And ultimately, if the digestion of Hong Kong continues gently and accommodation is reached over Taiwan, there do not seem to be flashpoints of military conflict awaiting a spark.

Meanwhile, the Chinese are playing the "space game" in this new arena for many reasons, but status is clearly a leading one of them. And the status of being accepted as a

partner of the rest of the world is something Beijing highly desires, both for international prestige (which has measurable military, diplomatic, scientific, and commercial value) and for internal prestige (the "mandate of heaven" in the minds of the Chinese masses). The degree of their anxiety to obtain such recognition makes it possible for the U.S. to drive a hard bargain.

Furthermore, a realistic assessment of the space capabilities that China will be developing in the next decade or two can also go a long way to squelching unrealistic hopes. Above all, widespread claims that China is racing the U.S. to put men on the Moon seem fuelled not by sound deductions but by political maneuvering to ignite a new "moon race" and consequent open congressional purse strings.

The pace of China's manned space program, Shenzhou, has in the last year or two astonished most outside observers in its slowness, not its boldness. After a two-year gap between the first manned flight in 2003, a weeklong 2-man mission was performed last year. But Beijing officials make no secret that their next manned flight, involving a 3-man crew and a spacewalk, won't occur until late 2008. Subsequent flights involving tests of rendezvous and docking procedures and hardware won't occur until the next decade, leading eventually to a small Salyut-class space laboratory.

But even that toddler-step in space (taken by the U.S. and the USSR in the early 1970's) awaits the development of a key component, a space booster powerful enough to carry the spacecraft. Dubbed the Long-March-5, the rocket will be able to carry 20 tons into orbit, putting it on par with the Russian Proton, the European Ariane-V, and several U.S. boosters.

Despite expectations in the past that the rocket could become operational in the very near future, more recent reports from Beijing indicate that Chinese rocket scientists are only now completing test firings of the main engine in ground test stands. The rocket itself, arguably justified by its commercial value to launch communications satellites, still awaits formal government approval and funding. No indications have been found, either in the Chinese press, in private conversations, or in the all-seeing commercial "space eyes" now in orbit, that even preliminary construction has started on the massive launch pads the rocket will someday need.

It is thus growing more and more clear that the candidate space capabilities that China might be able to bring to the table as bargaining chips for joint projects in the next decade have been grossly overestimated.

A short list of genuine potential benefits

Experience aboard the International Space Station shows that space capabilities and safety are enhanced through redundancy, through alternative options for transportation and flight operations. Jointly-built single space vehicles have led to nothing but delays, soaring costs, and tensions, but parallel, stand-alone hardware that can swap-in and swap-out as needed has provided flexibility and emergency alternatives. Just where China can contribute here—such as human transport to and from the station—is a potentially fruitful topic for investigation.

China's eagerness to acquire foreign space technology is matched by a reluctance to fully acknowledge the degree to which their program does depend on such acquisitions. In the manned program, officials have given credit to Russian sources, and it is unfair to call the Shenzhou a copy, by any means, of a Russian Soyuz design. Still, the availability of Western technology, both whether donated, rented, bought, or stolen, has saved China much time and money.

And here is a lesson that the West—particularly NASA—could well benefit from learning. How can one nation efficiently exploit the space experience and the space capabilities of other nations? China has made this into a fine art, to its benefit. NASA needs to steal this concept

and use it itself as it faces the challenges of transitioning from the Space Shuttle to the Ares/Orion replacement spacecraft. Lessons from others, and lessons from NASA's own past, may be the key to succeeding in this, and a relationship with China, even at a superficial level, can serve as a reminder to NASA of how the process is done right. It can drive home the lesson that U.S. space workers too often forget: there are other ways besides today's NASA's of doing space business, and some of them might even be better.

Access to the insides of the Chinese space program will also allow the U.S. to better see both the results of China's technology acquisition programs (when they show up as hardware) and the targets of future acquisition efforts (when existing shortcomings are detected and described). And as for losses, partners in an integrated activity most of all lose their misconceptions and illusions about the capabilities and intentions of each other—a very beneficial loss.

Genuine reciprocity and sufficient disclosure must be central principles of such negotiations. If China wishes to make Shenzhou dockings to the International Space Station, and this is likely to be a relatively clean-interfaced mission in the post-2010 period, they must agree to allow a new-generation NASA Orion Crew Exploration Vehicle make a test flight to visit whatever sort of orbital laboratory they set up in the next decade; to do this, preliminary design specifications need to be shared soon. Radio communications and spacesuit hose attachments can be standardized from the start, based on the evolved U.S.-Russian practices.

While not in itself causing the world to become more peaceful, these activities do seem to have the capability of encouraging long-range attitudinal impacts on younger generations. If these changes can be more deliberately engineered, and more realistically based, measurable benefits can also be expected.

Nor should we overlook the cynical value of "international obligation" as an argument for domestic funding debates regarding each nation's specific contributions. Local political tides may threaten any single nation's space budgets, but if much of the budget is tied to expenditures by other partners, then such funding may be cushioned by diplomatic pressure not to renege on treaties and other promises.

These benefits are nowhere on the scale of grandiose promises once made for the "Russian space partnership," and sometimes still claimed, falsely or in ignorance, to actually have been achieved, or the fanciful hope-driven hand-waving of current advocates of a grand new U.S.-Chinese space partnership. But they could have the advantage of being real, and of quite possibly coming true, if properly negotiated.

They, and other ideas bound to be born in the future, may well be worth the space candle, if space-minded U.S. officials, politicians, and opinion-makers with their eyes on the stars can ALSO keep their feet on the ground.

Notes

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2. For the political strategy behind Apollo decision, see Walter A. McDougall, "…the Heavens and the Earth—A Political History of the Space Age", (Basic Books, New York, 1985); and John M. Logsdon, "The Decision to Go to the Moon: The Apollo Project and the National Interest" (Cambridge Mass.: MIT Press, 1970)
3. The scientific value of Apollo missions was described inter alia in Bevan M. French's "The Moon Book," (Penguin, New York, 1977)
4. The Apollo/SDI relation to the collapse of the USSR is developed in an unpublished paper by Paul Spudis that is described in detail in my book "Star-Crossed Orbits – Inside the U.S./Russian Space Alliance",

McGraw-Hill, 2003, pp. 13-14.

5. Sabathier and Faith, 2006, *op. cit.*
6. *Ibid.*
7. Quoted in "China, U.S. to join hands in lunar probing?", People's daily Online, ***http://english.peopledaily.com.cn/20060 5/01/eng20060501_262542.html.***
8. Quoted in "NASA's Russian Payload", by James Oberg, *The American Spectator,* August 1998, pp. 39-45.
9. *Ibid.*
10. The same empty promise appears in the editorial "Partners in space", *Florida Today*, April 25, 2006.
11. Negatives in the Russian space deal are catalogued in chapter 5, "Origins of the Partnership", in Star-Crossed Orbits (McGraw-Hill, 2002), pp. 83-96, by James Oberg.
12. Taylor Dinerman, "Cooperation with China: still dancing on eggs," 'The Space Review', April 24, 2006.
13. Dennis Wilder was quoted inter alia in Todd Halvorson, "U.S., China to talk lunar exploration," *Florida Today*, April 21, 2006.
14. Logsdon, John; "U.S. Soviet Space Relationships in the 1990s: A Perspective on Policy Alternatives", 39th International Astronautical Federation convention, Bangalore, India, October 1988, paper IAA-88-624.
15. Rebecca Wright et al., NASA Oral History Project, interview with Charles Precourt, July 12, 1998, ***http://spaceflight.nasa.gov/history/shuttle-mir/people/oral-histories/precourt.pdf***, p. 21.
16. Sabathier and Faith, *op. cit.*
17. A fine overview of Johnson-Freese's assessment is in "The Chinese Space Program: A Mystery Within a Maze" (Orbit: a Foundation Series, 1998).
18. Mark Carreau, "Only time will tell for the U.S.-China space union", *Houston Chronicle*, May 7, 2006. She presents a more nuanced assessment in comments published in Leonard David, "U.S.-China Space Ties Weighed," ***www.space.com***, April 20, 2006.
19. The full title of the "Cox Report" (1999) is "U.S. National Security and Military/ Commercial Concerns with the People's Republic of China", and it can be found at ***http://www.house.gov/coxreport/.***
20. Griffin's comment came during congressional testimony and was quoted inter alia in Kelly Young, "NASA and China may 'boldly go' together", *New Scientist*, April 26, 2006.
21. ASTP disinformation is detailed in Vladimir Syromyatnikov's memoir, "100 Stories About Docking" (Universitetskaya Kniga, Moscow, 2005, in English).

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