China's Manned Space Program

What is that all about?

BY JOAN JOHNSON–FREESE

China is on a fast track into space. Indeed, a great deal has been written in the international press about China's wide-ranging space program, particularly concerning the impending launch of Chinese astronauts, called taikonauts. The Chinese are clearly not engaged in a Wizard of Oz, pay-no-attention-to-the-man-behind-the-curtain space program. The three launches since 1999 of the Shenzhou rocket intended to launch their taikonauts into orbit evidences substantial Chinese technical achievement, and the seriousness of their program. Consequently, those achievements, plus their pronouncements about timetables, space laboratories, shuttles, space stations, lunar bases and now Mars missions, naturally make one wonder just what the Chinese are up to. Is there a new, twenty-first century space race brewing, and if there is, who is racing and toward what goal? Analysis and commentary have spawned several alternate, and often one-dimensional, scenarios.

Policy and academic analyses of Chinese space activities have been limited, and stovepiped. With few exceptions, analyses has focused on either technical parameters, or been highly politicized as part of a threat assessment, usually in the context of US plans for missile defense. In the case of the former, even though much of the Chinese program remains cloaked in secrecy due to both the nature of the Chinese system and the military aspects of the topic, considerable agreement exists across technical analyses concerning Chinese capabilities, now and potentially in the future. Securing agreement regarding political "intent" remains more difficult. Some observers see China's race to space as a battle with its own demons. Prestige, in this scenario, becomes the Chinese brass ring. Conquering space represents an opportunity in what it refers to as mankind's "fourth frontier" to recapture its lost legacy of technological mastery and innovation. A Chinese quest for prestige is undeniable. Chinese scientists and policy-makers eagerly point out that when—not if—China launches taikonauts into space, it will be only the third country in the world to have that capability. No European countries can do so, or Japan either. It will be an exclusive club of the United States, Russia, and China. The domestic, regional and international implications of that exclusivity are considerable. But are they enough for a country that daily faces Herculean challenges keeping its population fed, employed and stable as prerequisites for continuation of essential domestic modernization efforts to spend an estimated US $2 billion annually on a space program?

If not, then maybe the reason the Chinese are pursuing a manned space program is to draw attention from its military space activities, which will clearly benefit from the dual-use nature of the technology being developed. Under a worst-case scenario, the Chinese manned efforts are just a Trojan horse. It has already been suggested, for example, that perhaps Chinese leaders see potential military value in Shenzhou as a reconnaissance platform. Chinese government officials have, after all, included national defense in the stated aims of their space program.

Both history and a logical policy analysis, however, reject Chinese reasoning as an either-or situation. Far more likely, Chinese motivations for eagerly, even aggressively, pursuing a space program, including manned space, are multifaceted. Unless they suffer a technical space disaster, which they are ardently working to avoid, space yields high returns on their investment in multiple policy areas. Indeed, in the

Joan Johnson-Freese *is Professor and Chair of the Department of National Security Studies at the Naval War College in Newport, Rhode Island*

United States as well space has always been a subfield of other policy areas: foreign, national security, economic, and science policy being the most prominent. Examining the Chinese space program under the same assumption, or set of premises, allows for a better understanding of what they are doing and why. Further, by extrapolating the current environment into the future, the context for a potential next space race subsequently becomes apparent, as well as why it is likely the United States and China will be the primary—though not the only—competitors.

Popular history tells us that the Apollo program exemplified the "can-do" attitude and visionary approach of the Kennedy Administration. If only, some space exploration advocates still wistfully muse, another US President would possess such imagination and vision, the glory days of the US vigorously pursuing space activity through NASA would return. Those reflections are both about half right. Popular history's view of the Apollo days rightly glorifies the "can-do" spirit, but greatly embellishes the vision aspect. On another level the knowledge and hardware created accrued additional multiple domestic benefits beyond the symbolic and military arenas.

There are several parallels that can be drawn between US decision-making in support of Apollo in the 1960s and in China today for a manned space program. Domestic, regional and international prestige are clearly factors in Chinese decision-making. Domestically, a positive public "rallying" factor complements national pride. Images of the Shenzhou vessel that basically make people feel good about themselves and their country are found on consumer goods from phone cards to water heaters. Also, domestic pride and international prestige also yield increased domestic governmental legitimacy, a strong consideration in Beijing. Internationally, regional politics and vying for the "top-spot" comes into play. Few areas of exclusive technical achievement remain from the 1960s as many countries have satellites and launch capabilities but globally there are still only two with manned space capabilities. Hence with prestige as a factor, accepting the exponentially higher costs associated with manned versus unmanned launches becomes obligatory.

Economically, the benefits of the space race generally and the Apollo Program specifically, were far-reaching, direct and indirect in the United States. Education and on-the-job experience for the Apollo scientists and engineers created a generation of highly-trained technical personnel. Engineering programs were specifically set up in colleges and universities to accommodate the need for new and specialized aerospace skills. The University of Science and Technology of China, Beijing University of Aeronautics and Astronautics, and Beijing Institute of Technology are all among the top universities in China, and all eagerly discuss and promote their involvement in the space program. Student interest in space is said to have exploded in China. If the Chi-

nese experience parallels anything close to what has happened in Japan already, universities and industries use even a remote possibility of being involved in space ventures as a lure for the best and the brightest into their programs.

While the US blazed through the heavens up the steepest of learning curves, other countries recognized a technology gap was developing, potentially detrimental to their future. In the late 1960s and into the 1970s, Europe aggressively pursued space activity, separately and then collectively, for economic reasons. In Canada, public and political justification for space activity to avoid being on the wrong side of the technology gap came through a space program designed to focus on one technology at a time, the technology carefully selected to directly benefit the Canadian people. Likewise, China keenly appreciates these earlier established relationships between space and technology and economics and domestic politics.

And finally, there is the military consideration. According to the Stockholm International Peace Research Institute, "no country can currently rival or contest US space dominance or the advantages that this provides to its terrestrial military operations." Wired magazine put it differently in April 2002. "Outer space is where a global cop patrols. America's eyes, ears and nerves are up there, all day, every day, circling the blue yonder. Space vehicles are the ultimate asymmetrical asset. They can't be reached with a hijacked jet. They laugh at anthrax." The Chinese are well aware of US space dominance and are cognizant of the potential military advantages that this brings.

The robustness and advocacy of US military space efforts under the Bush Administration—especially in contrast to the generally disapproving Clinton Administration attitude toward military space activities must also be considered in the context of US-China relations more generally. Until September 11th, when many international relationships got turned on their heads and several strange bedfellows resulted, some US analysts felt that justly or unjustly, China had been deemed the next enemy of the United States. Strained US-China relations precipitated the formation of a loose alliance united in their view that a rising China poses great risks to America's vital interests. They were determined and effective in encouraging a hard-line US government stance on anything Chinese. The effectiveness of their activities was fully recognized in China, and interpreted as signaling mainline acceptance of their views. That providing an opportunity for backlash from Chinese hard-liners, triggering a dangerous action-reaction cycle. Therefore, any activity having the potential to increase Chinese capabilities in an area of clear and expanding US dominance—like space—would easily garner support in Beijing.

Taken together, the political, economic, and military benefits to the Chinese in pursuing space activity, including manned space, validate their course of action as a rational policy decision. Although certainly not a full-blown Cold War, there are considerable parallels to the Apollo-era US rationales in terms of domestic benefits, surrogate struggles for regional influence, and both global political and military posturing. Indeed China itself is clear that it is pursuing space activity not just as an end in itself, but part of a larger strategy.

In November 2000, the Information Office of the State Council issued the first Chinese white paper on space, called "China's Space Activities." The technical milestones laid down were impressive, and the language insightful. It reminded readers that China invented gunpowder and that development was actually the "embryo of modern space rockets." In a field China sees itself as having initiated and once prevailed, and was then overtaken in, it now wants to regain a place of distinction.

The political, economic, and military benefits to the Chinese in pursuing space activity, including manned space, validate their course of action as a rational policy decision.

The paper also stated that China's ambitious goals for its space program will be achieved through adherence to "the principle of long-term, stable and sustainable development and making the development of space activities . . . serve the state's comprehensive development strategy. The Chinese government attaches great importance to the significant role of space activities in implementing the strategy of revitalizing the country with science and education and that of sustainable development, as well as in economic construction, national security, science and technology development and social progress. The development of space activities is encouraged and supported by the government as an integral part of the state's comprehensive development strategy." In that context international space cooperation was also promoted,

placing priority on cooperation within the Asia-Pacific region and supporting Chinese participation in international launch services.

China recognizes its current "catch-up" position as at least partly a situation of its own making. Space scientists and engineers did not escape the wrath of the Cultural Revolution. Facilities were destroyed and individuals starved and at times beaten, while being forced to continue work in austere and sometimes unimaginable conditions. One early launch account, for example, depicts rocket fuel being loaded using a bicycle pump. It was not that China did not have well trained individuals working on the space program. Many, including the program leader, Dr. Qian Xuesen, were trained in the West. Qian, along with approximately one-hundred other Chinese scientists, was expelled from the United States in 1955 during the McCarthy era, and not without long-standing and many say understandable ill-feelings toward the United States. From those roots, China proceeded tumultuously, though determinedly.

The Chinese must be commended for development of what was, until very recently, a virtually indigenous space program. Nevertheless, the Chinese always maximized their ability to learn from others. That their Xichang launch site is at approximately 28 degrees N latitude—and the Kennedy Space Center is at 28.5 degrees N latitude—is not coincidence. They picked a similar location to allow emulation of post-launch procedures and expectations published in open source literature. Even today, although the Shenzhou spacecraft bears similarities to the Russian Soyuz design, the Chinese avidly defend it as their own product, which technical comparisons seem to bear out. They view beginning with the Soyuz design and then initiate their own work as simply a smart business practice, rather than reinventing the wheel.

The Chinese government attaches great importance to the significant role of space activities in implementing the strategy of revitalizing the country with science and education.

The current manned space effort, known as Project 921, is China's second, if one does not count Wan Hu, a sixteenth century inventor who built a rocket propelled chair—upon testing, both the inventor and the chair met with unfortunate outcomes. Fourteen taikonauts have been selected, and much like the first US astronauts, they were drawn from the ranks of military fighter pilots. Although two taikonauts trained in Russia, most training is now conducted in a secret facility north of Beijing. Shrouded in secrecy, the Chinese are deliberately creating an aura of mystic and drama around the taikonauts.

China Aerospace Science and Technology Corporation (CASTC) was created in 1999 for development of national defense and aerospace endeavors, from the former China Aerospace Corporation (CAC). In an effort to become more competitive, the Chinese government reformed the top defense and technology corporations, including CAC, a large State Owned Enterprise (SOE) under direct supervision of the State Council. With nearly three-hundred thousand employees, CAC was divided into the China Aerospace Science and Technology Corporation (CASTC) and the China Aerospace Machinery and Electronics Corporation (CAMEC), presumably with about one-hundred and fifty thousand employees. The tricky part of reorganization and management reform in China is that cutting jobs is usually an integral part of becoming more efficient. Chinese launch site workers, for example, have personally shared that often three or four people are assigned to a task one person could handle, and likely handle better alone rather than having to parcel it out to several persons. Yet, as previously stated, creating jobs remains an important Beijing priority. So China has had to be creative, balance interests, and move slowly in its reform efforts. The aerospace industry has become somewhat of a test case for them. Among its responsibilities, CASTC has general authority for manned spaceflight, and the Long March series rockets. However, it should also be made clear that the Chinese military ultimate controls the Chinese space program.

The Chinese quickly made many significant autonomous technical achievements. Within a decade of their first launch, the Chinese could successfully recover large satellites from orbit. This is important today as a critical step in any manned program, since it requires the development of such technologies as heat shields, sophisticated tracking systems and automated controls, and so indicates Chinese progress.

Among CASTC's most important current achievements are the more than twenty consecutive successful launches achieved since 1996. Although each of those successful launches is important independently, together they build a record of reliability

important to commercial launch insurance companies. After a series of launch accidents in the 1990s, and the subsequent Cox Commission report issued in the United States, the lucrative Chinese launch market quickly dried up. Other than launching thirteen satellites for the failed Iridium communication venture, the commercial launch market, which had generated hard currency for China, has been at a virtual standstill. The Chinese probably hope that positive spill-over from a successful manned launch, in terms of perceived technical capability, will benefit their commercial launch program. Nevertheless, an improved perception of Chinese technical capability will neither bring down higher launch costs (between US $60-70 million per launch) compared with others on the international market, or change restrictive US export laws.

In a field China sees itself as having initiated and once prevailed, and was then overtaken in, it now wants to regain a place of distinction.

Besides launch vehicles, China has numerous satellite programs. Dong Fang Hong (DFH) communications satellites have gone through multiple iterations. DFH-1, also known as Mao 1, was launched in 1970. It is most famous for broadcasting the song "East is Red." The latest DFH iteration is being cooperatively developed with Germany. The Fanhui Shi Weixing (FSW) recoverable satellites were originally developed for photo-reconnaissance, but now are also used for remote sensing. The third type of application satellite is the Fen Yun (FY) series, used for meteorology and remote sensing. The Chinese have also launched a series of Shi Jian satellites, carrying science payloads. Between 2001-2006, the Chinese have said they intend to launch thirty satellites as part of an expanding program, culminating with human spaceflight.

The first Shenzhou flight occurred in November 1999. Statements first made in 1996 gave 1999 as the year planned for the first manned launch, to commemorate the fiftieth launch of the founding of the Communist state. Depressed finances and technical issues, however, made it impossible to keep to the original timetable. There simply was not enough time for unmanned proving missions to assure that they would not meet with disaster. Shenzhou I completed fourteen orbits and returned to Earth after just twenty-one hours, but achieved a significant step forward for the Chinese.

The second flight was in January 2001 and both more complex, and more mysterious. Numerous maneuvers were conducted before the descent module returned to Earth seven days and one-hundred and eight orbits later. Chinese ability to maneuver the Shenzhou II independent orbital module surprised Western observers. Additionally, international press reports varied, with some stating that the flight carried cell and tissue samples of eight-seven animals, plants and microorganisms, while other stated that animals (rats) were on board. Clearly, life support systems were being tested at some level. The Chinese were ambiguous as to exactly how, and China's state-run Xinhua Agency made no reference to animals in its reports. Dr. Liu Yongding, Life Sciences Payload Manager for the mission refused to comment when specifically asked if a monkey, dog, rabbit and small snails were among the live specimens on board. Guidance and reentry technology was also tested. No pictures of the returned capsule were released though, indeed there was a virtual press blackout, leading to Western speculation that there had been landing problems, likely either with the parachutes or the retro-rockets. The Chinese denied such allegations.

Shenzhou III was launched on 24 March 2002, and returned to the grasslands of Inner Mongolia on 1 April 2002. In each of the three seats dummy humans were wired to medical monitors, all to test life support systems, most of which were purchased from the Russians.

The Shenzhou forward orbital module is used to hold experiments and to act as a docking crew transfer module for future Chinese space missions. These could include docking with another Shenzhou vehicle to form an interim "space laboratory" such as Beijing has talked about. The spacecraft has a rear service propulsion system with a manned capsule in between. Shenzhou III left the forward module in orbit, likely for future docking tests. It also appears to be carrying a relatively sophisticated remote-sensing payload (medium-resolution imaging spectroradiometer, MRIS), transmitting high-quality data to Chinese ground stations. The infrared technologies being validated by the instrument potentially have both civil and military applications (for military satellites), again illustrating the inherently "gray" nature of most space technologies and hence any the complexity of analyzing "intent" behind any space program.

There is really no need for the Chinese to rush (to potential failure), especially since small incremental steps creates considerable (and positive) journalistic attention in the West anyway. Per the Beijing Morning Post, they have a three step plan: a taikonaut in space, establishment of a space laboratory, and eventually setting up a space station. Wang Zhuangyin, a leading space program engineer, says manned spaceflight will occur by 2005. The official China Daily stated that China would put a man into orbit by 2005, and on the moon by 2010. Ouyang Ziyuan, chief scientist of China's moon exploration program, stated "China is expected to complete its first exploration of the moon in 2010 and will establish a base on the moon as we did in the South Pole and the North Pole." They are adamant about building a sustained program rather than planting a flag or returning a Moon rock, referencing the US abandonment of its manned lunar program and failure to use it as a step further into space. In a truly rational, well-laid out (and well-funded) plan, many analysts feel that any establishment of a Moon base (by any country) should ultimately lead to exploitation of lunar mineral resources. Establishment of a Chinese base on Mars by 2040 has also been proclaimed as a goal. In any event, with the kind of statements being made, going far beyond the earlier white paper, the often-reticent Chinese are going out on a limb in terms of actually placing dates with ambitions. Experience to date, however, has shown them that they don't actually have to meet the dates to keep the rest of the world speculative and interested, but just keep working toward them. In the case of the first manned launch though, it is likely that they will not wait for 2005. With a successful Shenzhou IV precursor launch, the Chinese will likely go for a first manned launch in 2003.

With a successful Shenzhou IV precursor launch, the Chinese will likely go for a first manned launch in 2003.

That the Chinese have not been included in space projects known as much for their political, cooperative aspects as for their technical utility or capability—such as the International Space Station (ISS)—has been a source of frustration for them. People's Daily on 27 December 2000 stated that the Chinese government would seek acceptance into the ISS program. In all fairness, ISS partners have been expected to contribute either technology, or money, (or both) and until recently China has not had either. More recently, however, Brazil, a country with far less space experience than China, has become an ISS partner, making it more difficult to dismiss the premise that China's exclusion has included a strong political component. The United States has historically viewed international space cooperation as both a political "carrot" and a technical way to "guide" other countries' space activities. Both Europe and Canada, and later Japan (including in the previously forbidden area of launch technology), enjoyed the benefits of working with the United States in space program development. That the United States has taken a different path with China has likely, though inadvertently, contributed to China's determination now to become a space power. It is also interesting to note that since September 11th and many international relationships being subsequently redefined, NASA is suddenly much more open to closer ties to Beijing. Space science traditionally serves as a safe first-area of space cooperation, being the least threatening from a military perspective. Progress toward ISS participation, even incremental, is a domestic and regional triumph for Beijing.

China has signed cooperative space agreements with a number of countries, including Canada, Germany, Italy, France, Britain, Russia, Pakistan, India and Brazil. The scope of cooperation ranges from development of the Dong Fang Hong 3 communications satellite with Germany, to a broad Russia-China cooperative agreement, to narrow scientific co-ventures. One future area of international cooperation that will be especially interesting to watch is launch services, since participation in international launch services was included as a white paper goal. The Chinese understand that launch consortia have become increasing prevalent, and so they may well be looking down the road toward finding partners for the Long March series.

Space weaponry (beyond the handguns that have been carried into space by astronauts and cosmonauts), including both weapons placed in space and ground-based for use on space-based assets, has until recently been a carefully avoided option by all space-faring nations. For many years too there was the argument that space weapons were banned in the 1967 Outer Space Treaty. What Article 4 of that treaty actually says, however, is: "States Parties to the Treaty undertake not to place in orbit around the earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction, install such weapons on celestial bodies, or station such weapons in outer space in any other manner. The moon and other

celestial bodies shall be used by all States Parties to the Treaty exclusively for peaceful purposes. The establishment of military bases, installations and fortifications, the testing of any type of weapons and the conduct of military maneuvers on celestial bodies shall be forbidden." The argument against weapons was hung on the "peaceful purposes" phrase, though the United States has long contended that "peaceful" included defensive purposes. The "peaceful purposes" rational against weapons has been eroding because the parties making that argument often defined "peaceful" as meaning non-military. Increasingly, however, they found themselves in a conundrum since in the age of communications, navigation and reconnaissance satellites, all dual-use, that definition became increasingly problematic for any military wanting to use space hardware.

The Chinese clearly see 1998 as a turning point: a time when some in the US began moving from militarizing space—which has a long and accepted history—to weaponizing space. The US Space Commission Report stated it as inevitable that space will become a battleground, and so the United States would be remiss not to prepare. Many analysts feel that the first "space assault" will likely be a ground-based electronic attack on a satellite. Indeed evidence exists suggesting that such assaults have already occurred, resulting in satellites being temporarily "blinded." China is purportedly aggressively working on such ground-based laser technology. The easiest way to attack and destroy a satellite, however, is with weapons launched from the ground. A small missile could deposit a cloud of sand, ball bearings, or other hard objects in a satellites path. The target's own velocity provides the impact needed for destruction. A dozen or so countries have the capability to build such a system, though there is no evidence any have done so. China claims to have developed "parasite satellites." These are orbiting bombs that attach themselves to enemy spacecrafts for detonation when deemed necessary. Verification is difficult since none have ever been launched. An argument can be made both that it behooves China to have the United States think it has these capabilities, so that the United States will not think China's strength "inadequate"—and that claims such as these prod the United States to be even more aggressive in its military space development. In either case, there is clearly an action-reaction cycle building from which there seems no obvious escape.

A space race of some sort currently seems inevitable.

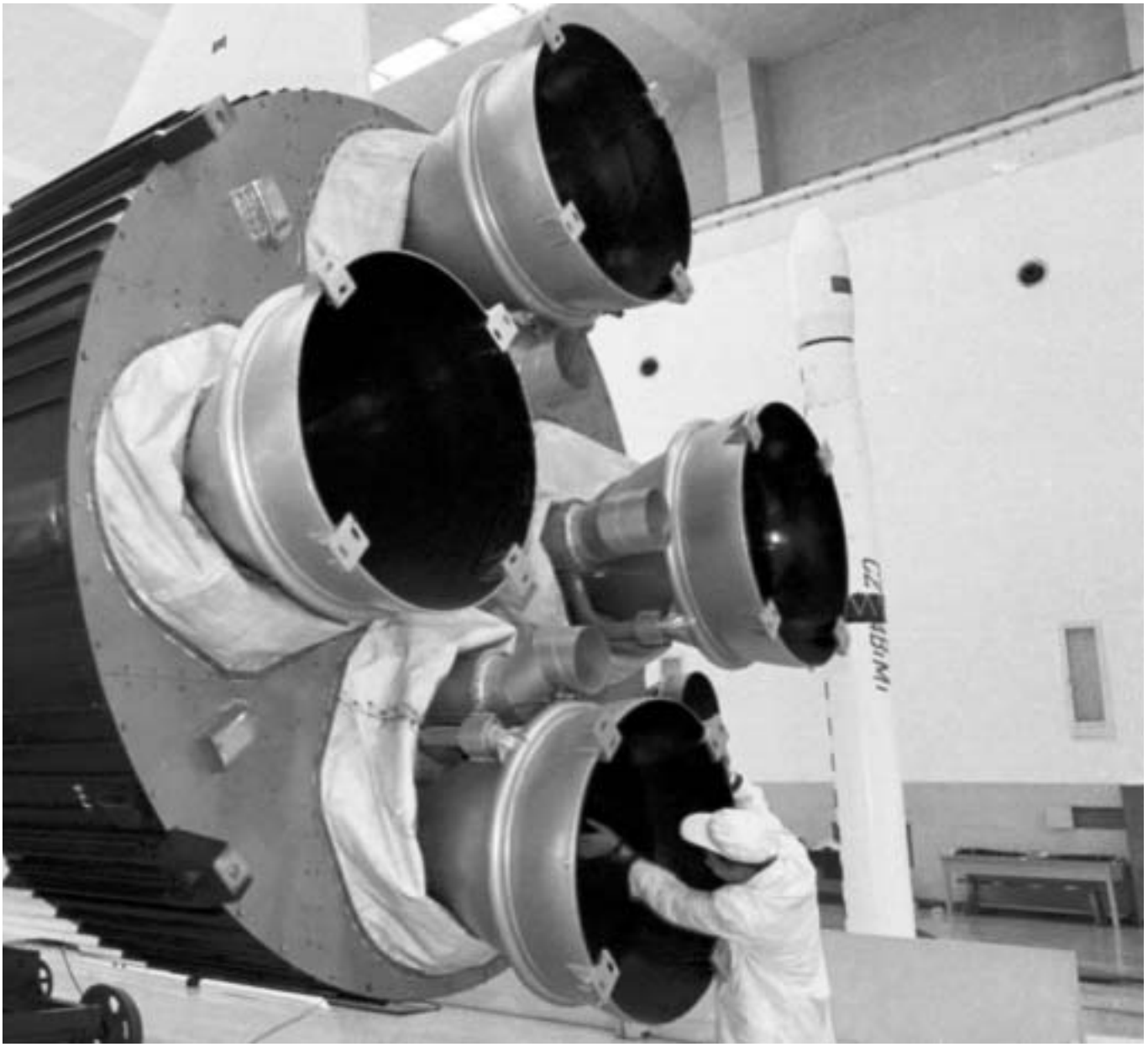
Early in 2002, NASA discovered potentially vast resources of water close to the Martian surface. Subsequently, there was considerable speculation that NASA was "on the verge" of announcing plans to send a man to Mars. At a revised estimated cost of US $50 billion and several other countries (Japan, Europe, China) gaining space ground, the question was raised as to whether there would be a new race to space? Likely there will be, but not because of water on Mars.

Lining up competitors in any potential space race today is relatively easy, though there are some wild cards. Although Russia starts from a presumed position of strength, the country's cash-strapped situation has left it an emaciated version of former self. Russia's President, Vladimir Putin, has said that the country now has nothing to be proud of in space. European efforts, traditionally through the European Space Agency, have long been restricted—by having to get its fifteen members states to agree on goals, and then funding, and then follow-through. This will become further complicated by the new and as yet undefined role of the European Commission in space activity, and because Japan, the country once touted as the most consistently progressing toward a fully matured program, has found its space activities plagued with problems. India has an aggressive and impressive space program, but as a democracy Indian decision-makers are acutely aware of what politicians in the United States have long known—space is positively viewed by the public, but considered expendable relative to other public concerns. So, while India develops specific space technology for civil and military purposes, and has generated a considerable regional technological reputation, there is little chance that the amount of public expenditure required for a manned program could be tolerated domestically. But China doesn't have voters to worry about. Subsequently, although China has yet to produce a Nobel prizewinner who did his work on Chinese soil and remains constrained by economics, they have the scientific and engineering potential and could have the political will, through domestic and action-reaction considerations with the United States, to stay the course in space development. Overall a country's relative position on the spaceflight learning curve can provide a barometer of a nation's fortunes, and its unforgiving nature can dramatically illustrate a country's failings just as graphically.

The Chinese are reaching for the stars—quite literally

The wild card may well be South Korea. It is scheduled to launch its first three-stage rocket in November 2002, with indigenous plans for launching satellites, including military satellites, by 2005. That action—because of both prestige and military implications—could spur Japan to reinvigorate its own efforts, challenging China, with implications for India. Indeed there has even been speculation that a successful Chinese manned launch would push Japan toward an autonomous manned program, a bet that the risk-averse Japanese government has been hedging for many years. Certainly regional action-reaction considerations will come into play, with the pertinent question being how quickly will it expand beyond the US and China.

Though China does not have to be an enemy of the United States, it is certainly destined to be a competitor if anything beyond the status quo in Asia is the benchmark by which competition is measured by the United States. Subsequently, as long as the US continues to develop and exploit the obvious militarily advantages of space and China feels compelled



to respond, a space race of some sort currently seems inevitable. It is inevitable because both countries recognize that space can provide one country advantages, or at least avoid disadvantages, compared to the other.

Assessing whether China intends to take a tortoise or hare approach today's space race is relative. China invented the game of *wei qi*, the Asian equivalent of chess (commonly called "Go" in the West) which has two-hundred and fifty-six pieces with which to strategize, versus just sixteen in chess. That type of a planning perspective, in the context of a country with a five-thousand year continuous history, exemplifies the dramatic difference between China's idea of long-term planning as opposed to that typical in the United States. Nevertheless, the Chinese clearly have committed to the goal of space development and at whatever rate funding permits, it will be factored into the precarious balancing act the Chinese regularly practice. China's manned space program is about China's determination to regain what it considers as its deserved place in regional and global politics.