

A QUESTION OF BALANCE: FRENCH SPACE POLICY IN THE GLOBAL AGE

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As is the case in most space-faring countries, space policy in France appears to be facing a number of the emerging issues that make our world characterized by the so-called “global age” evolution and thinking.

Namely, the emergence of more and more widespread space-faring countries with ambitious space programs, corresponding with more and more diversified and/or flexible commercial or technical offers by private actors—all of which is connected to an unprecedented evolution in the information technologies domain (either at the data-collection level with the emergence of high resolution in the private sector, or in the telecommunication field with the advent of a number of private low Earth orbit (LEO) satcoms projects, even if difficulties have arisen here and there)—may have made this last decade more challenging for the traditional space powers than the previous 30 years.

These pioneering times were largely defined by national interest-driven policies built around Cold War issues or related to national sovereignty (as in the case of France) or to political identity-building processes (as in the case of Europe). With the vanishing Cold War context as a structuring factor that supported national space programs—and considering the emerging European political will to provide the European Union with a catalyst role beyond the traditional leading role of some member states, among which France is in the first place—time has come for France to review its national space program, in both the military and civilian areas. By doing so, and considering its means and objectives, France has to balance its approach very carefully along a narrow path, which must be kept with the following limits:

First Balancing Factor: The Franco-European Relationship in the Programmatic Domain

First and foremost, the French space policy is now living in a European context that will impose more and more its political substance and its specific strategic objectives to the national level of decisionmaking. Because the conviction exists in France that only a united European policy makes sense today—both in terms of the (ever

increasing) budgets required and in terms of industry and user community base—enlarging the national space effort to the entire European community is clearly viewed today as a prerequisite for starting any new big space program.

The time has passed since almost only national political wills were behind any great space undertaking such as Ariane, for example. Ariane today is widely recognized as a technological and industrial success throughout Europe, although it had to prove itself when it was debated some 30 years ago. Today, France—which has played a key role in promoting the idea of an autonomous European launcher and in translating it into facts—has to keep this initiative capability, this “idea-pushing” capability, not only by translating it at the European level but also by making it a positive driving force behind new, authentic European space undertakings such as Galileo and the Global Meteorological Environmental System (GMES).

Global in scope, these programs must draw sufficient European political interest to help promote a genuine European construction at a sufficient level, so that in reverse it can become a national objective for France.

The challenge then remains to make this objective sufficiently ambitious to foster interest at the national level without having it become a specifically national type of program unable to keep its European identity. As noted before, this balance constitutes a prerequisite nowadays for any successful national and European space endeavor. In other words, any new program must be balanced between national and European motivations; i.e., encompassing traditional national as well as global purposes.

Second Balancing Factor: The Military–Civilian Relationship

This same specific, and maybe even narrow, path explains the current trends in the military field in France as well as the evolving relationship between military and civilian space. The French space policy appears to be in the process of making a larger number of military space activities that rely on the civilian developments, in ways that are similar to what has been envisioned in the United States in the same domain.

The Pléiades program provides quite a significant example in this respect. Pléiades is designed by the French space agency CNES (Centre National d’Etudes Spatiales) as the future civilian French Earth observation program based on the use of two small platforms. The program is clearly seen today as an opportunity for the national security users even if Pléiades has as a prime objective to be the successor system of the SPOT series, with the traditional objectives and constraints attached to such systems. Even more than that, the Franco-Italian agreement signed in January 2001 about phasing of the French program Pléiades and the Italian high-resolution radar program Skymed-Cosmo has oriented this program toward a greater international cooperation phase. Despite these facts, which contradict the idea of the traditional independence attached to any military space program, Pléiades is commonly accepted as also presenting potential interest for military purposes, especially in the framework of a nascent European military force. From the military point of view, these kinds of

undertakings are now seen as complementary to the Helios program, which will remain the cornerstone of the French strategic observation capabilities.

This also takes into account the European context of building authentic, European “rapid reaction forces” able to deal with the so-called Petersberg missions (mainly for peacekeeping). In this respect, relying on civilian programs may be seen as a “cheap” way to provide consistency to the political and technical effort of building such a force from the part of a nation that has not decided to put space at the forefront of its military effort. In this particular respect, apart from the classical difficulties linked to limited budgets, this national position on military space also reflects French-specific approaches and evaluation in terms of doctrines or military organization and tools best suited to what the military authorities envision as the most probable conflict scenarios the country might encounter. In brief, space has regularly been put in perspective with realistic resources models for the future and specific military organization and needs derived from the evaluation of the threat. Developing space military capabilities beyond this line is not considered a priority, judging by the recent budgetary evolution, for example.

These evaluations have not led France to consider space applications as having a priority status over, say, transport capabilities or other armaments programs. But paradoxically, this recognition is certainly helping to devise some military use-of-force concepts that can include new space programs under way in the civilian sector with a military interest. Once again, the key notion here remains for France to be able to build a coherent approach at the European level that provides sufficient autonomy to any European military endeavor both without building unnecessary new military tools that may duplicate those existing through NATO, for example, but also without giving up completely the military type of capability that remains at the heart of the national sovereignty as seen from the French perspective.

As a consequence, new capabilities in remote sensing or in the telecommunications field appearing on the civilian “market” can clearly be conceived as positive factors that help enlarge the national security use opportunities without competing for core missions embodied in the national armed forces, which use dedicated systems by necessity. Again, from the French point of view, a balance between these two categories of systems, civilian and military, very different at first glance, can be achieved by abiding by the classical motto for France of “sufficient strategic capabilities,” this time applied to space and information technology:

- Below this level, and its appreciation is very much linked to how the needs are evaluated and then expressed (specific threat assessment, resources, doctrines, warfighting techniques, etc.), national dedicated military systems will remain the rule (this is the case for Helios II or Syracuse III, for example).
- Beyond this level, any new commercial or civilian, or dual-type, system can be seen as an opportunity to flesh out an ongoing European military structure, in complement to the more classical sharing of national military programs.

Third Balancing Factor: The National–Global Relationship

This raises the issue of interoperability which appears more and more as a crucial interface that must help manage the national–global levels relationship. This is where a country like France might have to find a balanced approach.

In this case also, space resources (especially remote sensing and telecommunications resources) must address the national needs according to this “sufficient strategic capability” criteria, while being at the same time able to interoperate with (at best) or be complementary to (at least) existing or planned systems, both in the civilian and the military field. In the civilian area, this may prove a good basis for the intended architecture in such programs as GMES, which require a world system to address truly global environmental issues, as already pointed out in a number of multilateral environmental agreements (MEAs)—e.g., Kyoto Protocol, Vienna Convention, etc.

As for the military, national systems designed both to become regional resources usable for some level of military action and to play a complementary role in a larger military architecture will appear more and more as a key element in programmatic decisions. For France, this logic naturally fits in the NATO–ESDP (European Security and Defense Policy) architecture issue as demonstrated by the Syracuse III–NATO satcom possible coevolution. It could also solve more concrete and relatively short-term problems experienced by coalition military operations by making existing national systems to fit with strategic or operational common needs. Again, at this level, French space policy must follow a very narrow path (as in the case of satcoms, for example, especially in terms of frequency use and management). And at the European level, France, with all the member states involved, will have to make sure that undertakings such as Galileo also fulfill these kind of needs.

Conclusion

The French space program today relies on several efforts very different in nature at first glance, namely,

- Ariane launchers, which has expressed from the beginning a quest for autonomy at the national and at the European levels;
- The SPOT and now Pléiades–Skymed Cosmo undertakings, which evolve toward a sharing of responsibilities and capacities between states with dual implications; and
- Galileo (and maybe later GMES), which can be considered one of the first authentic “European” programs (i.e., managed at the EC level, along with the European Space Agency [ESA] and Eurocontrol) in which France and other member states participate fully while taking the position of a future user of the program rather than the traditional position of a “space country” or space technology developer.

This represents for France a new role in space endeavors, which also helps explain the internal repositioning stated earlier.

But more paradoxically, France, which has often been considered *the* example of a country that was very eager to preserve its national ability to act independently in space, can be viewed today in a position to take benefit from this long-standing involvement in narrowly focused space endeavors. Being accustomed to carefully balance its somewhat limited resources and its political interests in the national framework around the “suffisance” principles mentioned above, France could use today this experience to play a catalyst role on a larger scale in some important areas (such as environment monitoring or land and resources management) where an increasing number of programs in the world remain characterized by their diversity (and sometimes by their diverging orientations and developments), and call for more international cooperation.

Thus, the continuation of a balanced evolution for the national French space program appears to be a workable programmatic and organizational interface with other space developments abroad, and may define for this reason a new national strategic orientation for France as a first-rank cooperative partner in the global era.

REQUIREMENTS FOR INDIGENOUS MILITARY CAPABILITIES: THE CASE OF CHINA¹

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The blessing or the curse of space technology, depending upon perspective, is its inherently dual-use nature. Visionaries wax glorious about space travel in rockets that soar above the Earth. Military analysts offer threat assessments of possible scenarios for the development of hostile missiles. Most space technologies are inherently dual-use technologies, with civil space activities sometimes having direct military analogues. A communications satellite (comsat) can be used for either military or commercial uses, though some configurations are clearly better for one use than the other. Similarly, given sufficient capabilities, a remote sensing satellite has direct military application since its images identify objects and activities on the Earth's surface similar to a military reconnaissance satellite. The basic technologies required for commercial rockets and military missiles also share commonalities.² One is designed to put a payload into orbit or into space; the other is designed to reenter the Earth's atmosphere and precisely place a payload on a target. This makes threat assessments difficult and assumptions based purely on technology development, discounting or excluding considerations of a country's *intent*, tenuous at best.³

The problem with discussions on dual-use technology, however, is that they can go on ad infinitum. Technically, it is difficult to determine where the line should be drawn regarding potentially relevant military technology. By some definitions, a Sony Playstation includes potentially useful military technology. Nontechnically, complications are even more difficult. Food, if distributed to troops, can be considered "dual use." Subsequently, much of the technology deemed essential for indigenous military aerospace capabilities includes technology also deemed essential for national economic development, and vice versa. So, if a country has a technical space capability, then it will inherently have a military space capability—though intent is an issue to be dealt with separately.

¹The views expressed in this article are the author's alone and do not represent the official position of the Department of Defense or the U.S. government.

²Whether this is a recognized technical reality effectively dealt with through technology transfer regulations or a technical ambiguity deliberately hidden and often nefariously exploited depends on perspective. See Edward Timberlake and William C. Triplett II, *Year of the Rat: How Bill Clinton Compromised U.S. Security for Chinese Cash* (Washington, D.C.: Regnery Publishing, 1998), pp. 159–185; Aerospace Industries Association of America (AIA), *Commercial Satellites and China: Background Papers*, "Safeguards in the launch process: How the U.S. government guarantees the security of U.S. technology when a satellite is launched by the Chinese," June 8, 1998.

³Formerly, threat assessments in the United States were based on "probable" scenarios. The change to including consideration of "possible" scenarios came primarily after the Rumsfeld Commission report. The difficulty lies in coming to agreement in terms of how much to rely on probabilities versus possibilities for *planning* purposes. See Joseph Cirincione, "Assessing the Assessment: The 1999 National Intelligence Estimate of the Ballistic Missile Threat," *The Nonproliferation Review*, Spring 2000 (Vol. 7, No. 1); <http://cns.miis.edu/pubs/npr/circ71.htm>; Dean Wilkening, *Ballistic Missile Defense and Strategic Stability*, Adelphi Paper No. 334, May 2000, 0 19 929004 0.

This paper will look at the Chinese experience developing an indigenous space capability. Specifically, it will examine the requirements, the key players, and the enabling technologies that have been focused upon. Further, it will look at areas of key focus now, and the impact of the availability of foreign technology on Chinese activities.

Requirements for an Indigenous Space Program

In retrospect, it is clear that the primary requirements for the Chinese development of an indigenous space capability have been the same as those in the United States and the former Soviet Union (FSU): political will, economic support, and development of requisite areas of expertise in not only technology but science. The differentiating factor between China and the United States and the FSU has been money. The United States in particular had the funds to allow a crash space development course in the 1960s. China's dismal economic situation in the 1960s, however, and the Cultural Revolution and extended time subsequently necessary to transform the Chinese economy, has impacted political will and prolonged the establishment of the expertise necessary for building a successful program.

Development of a wide range of Chinese space capabilities has for the most part been a slow, incremental process. There have been three periods, however, of accelerated activity. The first was between 1958 and 1964, when development of a nuclear weapon and delivery capability was a national strategic priority; after 1983 in conjunction with the U.S. Strategic Defense Initiative; and lately, for multiple reasons.

Political Will and Economic Support

As in the United States and the FSU, the Chinese space program was founded not in the hopes of exploring the heavens or even for the more mundane and pragmatic goal of economic profit, but rather as part of their Cold War strategic defense policy. The benefit of being designated part of a strategic program is that government funding requisite to meet programmatic requirements usually follows. In China that has been the case, further strengthened because the technology being developed is dual use and folds into the overarching Chinese goal of economic development. Further, People's Liberation Army (PLA) involvement in space industries has encouraged their support for dual-use space programs.

Whereas, though, the United States deliberately separated its civilian and military space programs, China and the FSU did not.⁴ The Chinese word for "space"—*hangtian*—refers to both space systems and ballistic, cruise, and surface-to-air missiles. Indeed, the Chinese themselves say, "Especially the development of the ballistic surface-to-surface missiles laid a foundation for the development of space launch vehicles."⁵ The technological aspects of defense policy in the post-World War II years

⁴Since the end of the Cold War, the United States has in many areas of space activity been engaged in "convergence" efforts, to maximize efficiency. Clearly, both the U.S. model and the FSU/Chinese model have had benefits and disadvantages.

⁵Zhang Xinzhai, "The Achievements and the Future of the Development of China's Space Technology," *Aerospace China*, Summer 1996, p. 22.

focused on both nuclear weapons development and delivery systems for the FSU and for China. In China, their weapons research and missile research was in many ways juxtaposed and singular: a strategic program. The priority of the overall strategic program, during some particularly difficult years in China, was such that it was “a magnitude equal to America’s Manhattan Project and postwar missile program combined.”⁶

In 1956, Soviet advisors in Beijing strongly recommended the inclusion of missile technology in the 12-year plan for scientific and technical development then under development to cover 1956–67.⁷ About the same time, Qian Xuesen (H.S. Tsien), a Chinese rocket specialist with a doctorate from the California Institute of Technology, was deported to China after accusations of Communism were levied against him during the McCarthy era. Tsien had participated in an American military survey of the German missile industry after World War II and indeed worked on the early research and development (R&D) of U.S. missiles. Upon his return to China, he quickly became one of the most powerful scientists in China and, not surprisingly, harbored considerable mistrust toward the United States as the country that had turned against him.⁸ Tsien wrote a proactive article on missile development that became a proposal to the Chinese leadership. Until the break in 1960, cooperation existed between China and the Soviet Union on missile development, primarily consisting of the transfer of two Soviet R-2 missiles, with accompanying technical drawings. After 1960, development of Chinese space technology was almost purely indigenous, led by Tsien.

Although Beijing achieved its objective of becoming a nuclear weapons state with retaliatory strike capability, the negative impact of the Cultural Revolution on space development extended beyond the so-called “ten wasted years” and was widespread. Science and technology education virtually ceased in some areas, and the economy was in ruins. Recovery was slow.

One factor in Beijing’s favor during slow-growth periods was that by maintaining one space program rather than two, as the United States had, aerospace R&D was combined. Economists and technology development analysts have recognized that splitting R&D efforts to develop a technology for both military procurement and the commercial sector can lead to failure through “schizophrenic” efforts.⁹ Higher funding requirements for two-track efforts also inherently follow. Full utilization of both knowledge and experience to develop generic, dual-use space technology, and a parallel defense-industrial complex, has benefited China.

In 1983, Beijing was both able to and desiring to once again accelerate Chinese activity in space, this time in response to the U.S. announcement of the U.S. Strategic De-

⁶John W. Lewis and Xue Litai, *China Builds the Bomb* (Stanford, Calif.: Stanford University Press, 1988), p. 52.

⁷For a comprehensive history of missile/rocket development in China, see John W. Lewis and Hua Di, “China’s Ballistic Missile Programs,” *International Security*, Fall 1992 (Vol. 17, No. 2), pp. 5–40.

⁸See Iris Chang, *Thread of the Silkworm* (New York: Basic Books, 1996).

⁹See John Zysman and L. Tyson, *American Industry in International Competition: Government Policies and Corporate Strategies* (Ithaca, N.Y.: Cornell University Press, 1983).

fense Initiative (SDI). They feared losing their retaliatory strike capability, and hence began to evaluate potential responses.¹⁰ One result of these evaluations was the institution of the 863 Program. It (still) provides the framework for technology development for the 21st century. Managed by the Commission on Science, Technology, and Industry for National Defense (COSTIND) and the Ministry of Science and Technology (MST), projects under the 863 Program maintain budgets separate from the PLA, COSTIND, and the State Science and Technology Commission (SSTC) budgets. COSTIND has oversight on projects concerning lasers and space; MST covers the areas of automation, biotechnology, information systems, energy, and new materials.¹¹

More recently, the Chinese, like others, have emphasized the link between the space and information fields. Chinese recognition of the importance of information for strategic dominance dates back to Sun Tzu's *The Art of War*, written in the second century B.C.E. The Chinese have had centuries to master the arts and sciences of collecting, controlling, and manipulating information. Information warfare is not a new concept to the Chinese: Technology is merely a new means to a long accepted end.

Clearly, the Chinese military is engaged in a military modernization plan, which includes information dominance. In a highly insightful 1999 study for the Strategic Studies Institute,¹² nine factors are offered as driving China's strategic modernization.

Doctrine. "The most important element driving China's military modernization is an emerging doctrine which emphasizes strategic attack against the most critical enemy targets."¹³

U.S. and Russian Missile Defense Programs. "Since the late 1970s, another key driver for China's strategic modernization has been U.S. and Russian efforts to develop missile defense systems."¹⁴

China's Gulf War Syndrome. "The 1991 Gulf War was a rude awakening for the CMC and the military industrial complex."¹⁵

China's Revolution in Military Affairs (RMA). "Lessons drawn from the U.S. experience in the Gulf War are being augmented by subsequent literature on the potential RMA."¹⁶

¹⁰Dating back to Anti Ballistic Missile Treaty negotiations, compromising 20 percent of a country's nuclear force has been deemed as "threatening" their strategic capability.

¹¹The 863 Program is the Chinese counterpart to the European Eureka Program, initiated at generally the same time for the same reason.

¹²Major Mark Stokes, "China's Strategic Modernization: Implications for the United States," September 1999 (see <http://carlisle-www.army.mil/usassi/ssipubs/pubs99/chinamod/chinamod.htm>).

¹³*Ibid.*, p. 7.

¹⁴*Ibid.*, p. 10.

¹⁵*Ibid.*, p. 12.

¹⁶*Ibid.*, p. 12.

Quest for Great Power Status. “From the Chinese perspective, there are certain technologies and weapons which a great power is simply expected to possess.”¹⁷

Territorial Defense. “Assessments are made as to what the threats are that China will face in the near, medium, and long term, and how China can assure the capability to defend against those threats.”¹⁸

Support for the National Economy. “Strategic modernization requirements must compete, or at least support, China’s overall economic development. China’s overarching objective is economic development, and fostering of an environment conducive to their economic security.”¹⁹

Organizational and Bureaucratic Politics Within the Defense Industrial Complex. “There is no doubt that various PLA branches and services compete for finite budgets and resources, probably with the Second Artillery, Navy, and Air Force coming out on top.”²⁰

Technological Advances. “Strategic programs put on hold in the 1970s and 1980s due to technical difficulties have been resurrected due to increased access to foreign technology and expertise.”²¹

While agreeing which each of the individual factors, my own research and citing some others would support more emphasis being placed on the overlapping nature of the factors rather than viewing them as discrete elements. Chinese analyst You Ji, for example, in a 1999 article²² focusing on RMA, linked several factors. He argued that lessons learned from the Gulf War propelled Chinese thinking on RMA and doctrine, reacting to both U.S. capabilities and the potential for ballistic missile defense (BMD) to provide the United States the ability to act with even further impunity than already demonstrated. Plans for an asymmetrical approach then become viewed as part of territorial defense. One might then ask if doctrine is being developed by push or pull, relevant to considerations of intent.

In my own research, I have also stressed the importance of internal politics and economic development.²³ Economic development is, indisputably, the guiding governing principle for the Chinese. Some of the most globally sought technologies by economically developing nations include telecom and remote sensing—both also critical for indigenous military space capabilities. A November 2000 white paper entitled “China’s Space Activities” stated that China intended to industrialize and commercialize space to advance “comprehensive national strength” in the areas of

¹⁷Ibid., p. 13.

¹⁸Ibid., p. 13.

¹⁹Ibid., p. 14.

²⁰Ibid., p. 14.

²¹Ibid., p. 15.

²²“The Revolution in Military Affairs and the Evolution of China’s Strategic Thinking,” *Contemporary Southeast Asia*, Singapore; December 1999, pp. 344–364.

²³Joan Johnson-Freese, *The Chinese Space Program: A Mystery Within a Maze* (Malabar, Fla.: Krieger Publishing, 1998).

economics, state security, and technology. I would further suggest that prestige is an important benefit of space activity to be considered. This is most evident in the Chinese manned space program efforts. The yields from a manned space program are primarily political rather than technical, and at a substantial cost. Nevertheless, the Chinese are pursuing that road much as the United States and FSU did earlier.

Key Players

In any discussion about China, mass is a consideration. With a population of more than 1.2 billion, employment is a perpetual issue. Whether considering the government bureaucracy, the military, or industries, large-scale and labor-intense methods are almost assuredly a factor. Although large operations can result in efficient production through economies of scale, that is not always the case. In China, large-scale operations are most often associated with cumbersome, complex, slow-moving decisionmaking and action. Indeed: Regarding space, multiple, often stovepiped, dinosaur-like organizations compete for funds and power.

In parallel, at the top level there is the Central Military Commission (CMC) and the State Council. The CMC is roughly equivalent to the U.S. National Command Authority. The State Council handles economic planning. Beneath each are multiple functional organizations. The Chinese have a propensity for frequently renaming their organizations, primarily in external identifications, subsequently resulting in considerable (and intentional?) confusion.

Reforms were undertaken in 1998 in some cases going beyond new names for old institutions. Under the State Council, the former State Science and Technology Commission (SSTC) became the Ministry of Science and Technology (MST). It is responsible for China's overall science and technology development plan, last outlined in a 1998 white paper. Until 1998, the PLA controlled the parallel Commission on Science, Technology, and Industry for National Defense (COSTIND), with responsibility for China's defense industries. Reforms there were aimed at separating the military and civilian components of COSTIND, driven by both internal and external concerns. Internally, before restructuring COSTIND represented both the defense manufacturers and the armed forces—producers and consumers—which led to infighting over competing interests. Externally, commercial interests were often reluctant, or forbidden, to deal with a PLA-owned entity. Since restructuring, COSTIND's responsibilities are R&D; weapons production; defense conversion; and management of the arms trade. China Poly Group, which is the General Staff Department's (GSD) primary arms trading and business conglomerate, was also transferred to COSTIND.²⁴ Key industrial entities include China Aerospace Corporation, with its multiple research academies, the Ministry of Electronics Industry (MEI) and the newly formed Ministry for Information Industry (MII).²⁵ Additionally, a government mandate for the PLA to divest itself of many of its business holdings, and the breakup of many of

²⁴"Industry Embraces Market," *Jane's Defence Weekly*, December 16, 1998, p. 1.

²⁵Joan Johnson-Freese, "China's New Ministry of Information Industries (MII): A Chance for Real Change," *Pacific Telecommunications Review* (Vol. 20, No. 1), 2nd Quarter 1999.

the State-Owned Enterprises (SOEs), affects internal dynamics. Clearly, a powerful defense–industrial complex exists in China. Just as clearly, its structure and clout is undergoing change.

Militarily, the 2nd Artillery, headquartered outside Beijing, is responsible for China's strategic nuclear force. The 2nd Artillery Corps is under the operational control of the GSD, but is directly controlled by the CMC, and has been an independent arm of the Chinese armed forces since 1974. In addition to its combat formations, the signal unit of the 2nd Artillery Corps operates communications systems to provide communications support capabilities for launch operations. The headquarters complex maintains contact with subordinate units through its own communications regiment.²⁶

Enabling Technologies

Until 1985, when China initiated commercial launches, Chinese space activities were closed to the outside, and the outside for the most part refrained from working with China on space activities. Now, that has changed. Countries and companies are posturing for position, eager to reap the potential benefits of the Chinese market of more than 1.2 billion people. That has meant that China is no longer forced to work alone. In many cases, China is pursuing a course of joint ventures in the near term to develop indigenous capabilities in the longer term.

The technology used in the Chinese Long March family of launchers is basically derived from China's earlier work on long-range missiles (their Dong Fang series). The Long March family of vehicles provides China access to space.²⁷ Plagued by a series of accidents in the 1990s, the Chinese have been constantly striving to improve its accuracy and reliability to gain and hold a portion of the commercial launch market. There is no evidence, however, that it is developing the capability to conduct launch-on-demand operations (ability to launch within 24 hours of a decision to do so), which would have significant military implications. A major aspect of the 1997 Cox Committee hearings in the United States, and multiple related hearings, focused on whether launching commercial satellites on Chinese vehicles inherently improved Chinese missile capabilities, if only through paid practice.²⁸ Strong Chinese capabilities in the areas of ballistic missiles, as well as ground-based radars and information denial, are well accepted. In other areas, however, their competencies are far more lacking.

The focus of Beijing's attention in terms of technology development is microelectronics. Since 1991, China has considered the development of an indigenous microelectronics industry as a strategic priority. The dual-use nature of both microelectronics and telecommunications equipment particularly make support for these

²⁶See <http://www.fas.org/nuke/guide/china/agency/2-corps.htm>.

²⁷For more information, see Brian Harvey, *The Chinese Space Program* (Chichester, UK: Praxis, 1998).

²⁸Henry Sokolski, executive director of the Nonproliferation Policy Education Center in Washington, D.C., has been the primary proponent of this line of reasoning. See *Space Technology Transfers and Missile Proliferation*, Testimony Before the Commission on the Ballistic Missile Threat, April 10, 1998.

industries possible, for both economic development and military modernization purposes. Information technology has been the fastest-growing segment of China's economy, increasing at an annual rate of 30 percent.²⁹ China has been able to cut its dependence on foreign sources (including the United States, Japan, and Korea) for integrated circuits (IC) from 80 percent in 1993 to less than 50 percent in 1995.

China's national teledensity remains low at 17.7 percent; urban 38 percent and mobile teledensity 5.1 percent. In September 2000, China's MII announced that Chinese telephone subscribers had topped 200 million—from 2 million in 1979.³⁰ Beijing has made connecting the population, especially rural and urban, a national priority. With companies from Europe, Japan, and Israel competing to sell telecommunications technology, hardware, and software, in China, the PLA has primarily ridden the coattails of this commercial push.³¹ This will likely continue, although foreign investment is still inhibited by a lack of rules and regulations in China deemed necessary to protect the investments.³² U.S. satellite companies have to a large extent been preempted from competing in China by explicit and implicit U.S. export control regulations.³³

The PLA certainly recognizes the need for development of an integrated national information infrastructure. They are working with the Ministry of Post and Telecommunication (MPT) in that regard. Indeed, since the commencement of the 863 Program, Chinese investment into the dual-use telecommunications sector has totaled more than \$200 billion, compared with, for example, the Chinese defense budget of \$17.195 billion announced in March 2001.³⁴

Imagery is another area of space systems that is part of a broader network of capabilities being developed, some of it through the 863 Program (specifically, the 863-308 Project). The National Remote Sensing Center provides oversight for China's remote sensing community. Under its coordination, the electronic and space industries are developing an array of ground-based, airborne, and space-based sensors, for example, as part of bolstering their information dominance capabilities—civil or

²⁹Stokes, p. 30.

³⁰"China's telephone subscribers top 200 million," *BBC Monitoring*, September 25, 2000, from Xinhua News Agency, Beijing, in English 1152 September 25, 2000.

³¹C4I modernization and updating has been a priority since at least 1979. With the exception of the 2nd Artillery, which is better equipped than others, most installations rely on microwave communications equipment. Teleconferencing and what was described as a "military information superhighway" are recent innovations. Generally speaking, "China still lags far behind Western standards for controlling complex joint operations and lacks the robust C4I architecture required to meet the demands of the modern battlefield" (Report to Congress, Pursuant to FY2000 National Defense Authorization Act). See <http://www.defenselink.mil/news/June2000/china0622000.htm>.

³²Lynnette Luna, "Risky business," *Telephony*, Chicago; January 1, 2001, p. 20.

³³Joan Johnson-Freese, "Alice in Licenseland: U.S. Satellite Export Controls Since 1990," *Space Policy*, August 2000; Joan Johnson-Freese, "Becoming Chinese: Or, How U.S. Satellite Export Policy Threatens National Security," *Space Times*, January/February 2001.

³⁴John Pomfret, "China Plans Major Boost in Spending for Military," *Washington Post*, March 6, 2001, p. 1. That was a 17.7 percent increase from 2000. The 2000 defense budget was an increase of 12.7 percent from 1999. It should be noted that it does not include either weapons procurement or military R&D, and some analysts estimate the defense budget to actually be up to three times the official figure. Matt Forney, "China Heralds Budget That Trims Deficit—Plan Veers from Practice of Using State Spending to Juice Up Economy," *Wall Street Journal*, March 7, 2000, p. A21.

military. China has used both indigenously developed space reconnaissance platforms and imagery from foreign sources.³⁵ Generally, work is being consistently supported and conducted (sometimes jointly with other countries) in the areas of electronic reconnaissance satellites, electro-optical satellites, synthetic aperture radar satellites, and weather satellites. Again, however, the dual-use nature of the technology makes strictly categorizing some efforts as military or civilian difficult.³⁶

Indigenous Chinese reconnaissance satellite technology is outdated by Western standards. That is not to say, however, that they are not working to improve it, both indigenously and through joint ventures. China has worked with Canada, for example, on various RADARSAT and synthetic aperture radar (SAR) programs since 1993. China has announced plans to deploy four optical satellites and two radar satellites. The orbiters will belong to a class known as Small Multi-Mission Satellites, because of their versatility. So it is not surprising that the satellites are referenced both as being able to provide round-the-clock environmental and disaster management monitoring and as militarily significant for their surveillance capabilities.³⁷

China, like other countries, has access to the U.S. Global Positioning System (GPS) and the Russian Global Navigation Satellite System (GLONASS). It has developed a 12-channel GPS/GLONASS receiver. There are indications that GPS is being incorporated into all of China's new fighters. It is also believed that GPS is being integrated with commercially available satellite imagery to develop digital terrain maps for targeting, missile guidance, and planning. This raises the entire issue of dual-use global utilities, such as GPS, and the capabilities they will inherently provide.

China's R&D strategy, dating back to the 1960s, has three general phases: preliminary research, model R&D, and production. There is strong emphasis put on the first, with two alternative approaches; they reason that an up-front investment can save time and money later. One approach is to work on technology applications for specific systems, such as propulsion for a specific missile. The other is generic research for application to multiple systems, such as GPS exploitation. Therefore, it can be expected that China will be fully maximize GPS utility.

Besides those areas already mentioned, there is clear indication that China has put priority on development of missile early warning satellites, navigational satellites, space surveillance, SIGINT, and ELINT. Again, because of the dual-use nature of many of the technologies concerned, they are even working with other countries on component aspects. Clearly, however, China continues to adhere to its two-decade-old policy of giving priority to economic rather than military development needs. Hence, few of these programs are fast-tracked in the same way as telecom.

³⁵China has received data from, for example, the U.S. Landsat platform, Russian remote sensing platforms, and the French SPOT satellite.

³⁶The same is true in other countries as well. See Joan Johnson-Freese and Roger Handberg, "Changing Parameters of Japanese Security Policy: The Advent of Military Space in the Post-Cold War Environment," currently under review for publication with *East Asian Review*. Condensed version, as Commentary, in *Space News*, February 12, 2001.

³⁷"China to launch optical satellite network," Reuters (Beijing), November 19, 1998; Richard D. Fisher, Jr., "China Rockets into Military Space," *Asian Wall Street Journal*, December 1998, p. 6.

Conclusions

China's development of a comprehensive, indigenous space capability has been a slow, incremental process. That process can be accelerated, as shown retrospectively, accordingly to internal and external factors. Internally, political will (influenced by internal and external factors) and subsequent funding, as well as a science and technology base, are key determinants. Externally, the availability of commercial technology allows gaps to be supplemented while focusing efforts elsewhere or while indigenous capabilities are being pursued. With so much commercial space technology available from multiple suppliers around the globe, other countries that commit to a space-sector development now can begin further up the learning curve. The dual-use nature of space technology makes civil–military hardware differentiations sometimes difficult. Hence, consideration of probable intentions must be maintained toward making meaningful assessments of potential technology use.