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The Art of Military Discovery

Chinese Air and Space Power Implications for the USAF

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Now let any man soberly and diligently consider what the way is by which men have been accustomed to proceed in the investigation and discovery of things . . .

—Sir Francis Bacon, 1620

Among many things, the ancient warrior Sun Tzu admonished military strategists to "know your enemies." But exactly how does anyone come to know their enemies or even if they truly are enemies? Some would view this as merely the sum of fact gathering and analysis, but it is more. Knowledge and understanding of potential adversaries are imbedded in the art of military discovery. The art of discovery, as defined by Sir Francis Bacon, involves first seeking out and setting before you "all that has been said about it by others." This is accomplished in military circles, although not well, through the academic exercises of research, exchange of thoughts and ideas, and debate in areas of military analysis, political and cultural awareness, history, and personal experience. Following these, one is left to what Bacon calls "evoking the spirit to provide oracles,"[1] or in more modern language, seeking inspiration for original thought and insight into an issue. This article attempts to use Bacon's methods regarding the art of "military

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discovery" concerning Chinese air and space power and its implications for the US Air Force while simultaneously analyzing the current methods of military discovery employed by the Department of Defense (DoD) and the USAF community.

Since 2001, the US military has been facing great challenges in the long war against terrorism while continuing to prepare for potential conventional threats, including war with one or more near-peers. The rise of China, the most important change in the global economic and political balance of recent years, raises concerns about Chinese military modernization that might enable Beijing to dominate Asia or challenge US hegemony. Many military planners and defense thinkers are looking to China as the next potential large-scale threat to the United States, and the USAF is no exception, as the People's Liberation Army Air Force (PLAAF) rapidly evolves into an offensive air and space power. However, what methods of assessment and discovery are military planners using to derive future strategies? A general lack of indigenous USAF research and assessment capabilities regarding Chinese aerospace power development has caused the Air Force to place a heavy reliance on outsourced and narrowly focused open-source research. There have been few critical analyses of *how* the USAF has assessed China's progress in the air and space realm. With debates raging about the focus of the US military and the USAF's future in it, these analyses may have a substantial impact on acquisition requirements, systems, and strategies. It is imperative to take a critical look at the methodology associated with the USAF's military discovery process and to understand the implications this may have on contending with a near-peer competitor. As this article uses the art of military discovery to address key challenges to the USAF's assessment efforts, it will first examine some current studies on Chinese air and space power. Second, it will comment on contemporary assessments by the DoD and individual researchers. Third, it will offer an extensive assessment of actual Chinese progress and the problems of the PLAAF. Finally, it will review both the USAF's efforts and the associated challenges in maintaining air and space power superiority in the Asian-Pacific region.

There have been some notable efforts to study Chinese airpower since the end of the Cold War. Highly representative is a USAF-sponsored RAND study in 1995 on the history and capabilities of China's air force. This study opined that the PLAAF professed no coherent strategic doctrine, lacked funds for a comprehensive modernization program, flew outmoded equipment, had ill-trained pilots and ground personnel, possessed

no midair refueling capabilities, and could not rely on domestic Chinese manufacturers to develop and produce advanced airpower weapon systems. RAND concluded that China's air force would be unable to mount a credible offensive threat over the next decade due to challenges in five areas: leadership and strategy, manpower, technology and infrastructure, budgets, and competition from other service branches.[2] Today, although the decade has passed, the RAND study continues to be viewed as a benchmark in understanding China's air and space power and its development. For military discovery to have enduring usefulness, it is essential to understand the extent to which the RAND study remains true and to what extent China has progressed in overcoming the problems identified. Regardless, it is clear the RAND monograph was not immune to the challenges of predicting the future; its authors did not foresee the emergence of new security challenges during the second half of the 1990s which prompted the Chinese to accelerate their air force modernization endeavors.

Current Studies on Chinese Air and Space Power

The predominant role played by air and space power in the conflicts since the 1991 Gulf War has been well recognized in Chinese military writings and appears to have forced the PLAAF to reevaluate its strategy and procurement policies. Beijing's concern about a possible conflict in the Taiwan Strait has also intensified as the PLA debates its air force missions and modernization programs.[3] In a 1999 article, John Wilson Lewis and Xue Litai argue that China's failures in the past decades to create a modern air force led to uncertainty that its *future* efforts will succeed in building credible airpower to deter foreign threats and combat Taiwan's continuing course of separatism.[4] Their propositions found support in official analyses of China's air and space capabilities published since the late 1990s. For example, the 2000 annual report on Chinese military power by the DoD claimed that the shortage of air and command, control, communications, computers, and intelligence (C4I) technologies would continue to place the quality of China's air forces behind that of advanced Western nations and that China would not have "development and deployment of a comprehensive integrated air defense system" until around 2020.[5]

In her quest to characterize Chinese airpower, Jacqueline Newmyer attributes the PLAAF's weakness in offensive capabilities to Chinese culture and politics. These, she maintains, create a hostile environment for

the maturation of airpower development. She argues that Chinese Confucian and Daoist philosophies discourage scientific inquiry and discovery, and that communist authoritarian leadership is afraid of "the potential of technology to empower soldiers."[6] If true, China's culture should play a major role in influencing its air and space strategy toward a defensive emphasis. The author, however, by concentrating on cultural impediments, fails to consider how China's long-backward defense industry and limited resources left the PLAAF with relatively few alternatives for fleet modernization, often leading to unmet requirements. Newmyer's conclusion, which seems to hold true in many contexts, is that China's current success in economic reforms could foster a new attitude toward airpower.

Other intellectual studies regarding Chinese airpower found tacit acceptance inside the USAF. In 2003, the Air Force's *Air and Space Power Journal* published two studies on the PLAAF. Although they do not represent official USAF views, these articles are peer reviewed and represent intellectual efforts that Air Force thinkers find stimulating and representative of innovative thought on the subject. The first was an online article written by an Air Force public affairs officer examining the development of the PLAAF in four specific disciplines: conventional warfare, training, asymmetric or nontraditional warfare, and using asymmetric tactics within information warfare.[7] Without using Chinese sources and relying on outdated publications,[8] Lt Morgan O'Brien argued that despite China's surge toward global power in the twenty-first century, the PLAAF still faced serious challenges, including failures to "develop incremental short-term plans to accomplish a variety of goals over a long period of time" and a shortage of personnel who are well educated in science and engineering. He concluded that "the PLAAF will continue to depend on traditional and cyber-espionage" to compete with the USAF.[9]

The second study was published in the same journal by Lt Col Thomas R. McCabe, an Air Force reservist and intelligence analyst. His analysis focused on the PLAAF's air and space power doctrine and its abilities to execute that doctrine.[10] While recognizing that the Chinese military was preparing to fight a local war under high-technology conditions, the author found no evidence to suggest that the PLAAF was transforming toward a USAF-like organization with an emphasis on all-weather offensive, precision strike, and sophisticated command and control (C2) or intelligence, surveillance, and reconnaissance (ISR) capabilities. He contended that modernization of the PLAAF was challenged by three restraints: PLA

tradition that regards the ground army as the "preeminent service," economic limitations that make the replacement of the PLAAF's antiquated equipment costly, and technological limitations that necessitate the PLAAF invest years or decades in the development of high-technology weapons.[11] The study concludes the PLAAF would not be able to compete with the USAF in the "foreseeable future."

Despite the conclusions asserting China's air and space power development was nonthreatening, the 1995–96 Taiwan Strait crises[12] and alleged Chinese espionage at the US Department of Energy's Los Alamos laboratory[13] generated intense apprehension among US policy makers and leadership regarding the long-term intentions of China toward both its neighbors and the United States. Congressional legislation was passed to regulate activities and matters pertaining to China's military. This continued through the 1990s, and the 2000 National Defense Authorization Act (NDAA) specifically required that the secretary of defense prepare an annual report to Congress on the PLA's current and future strategies, to include military and technological developments.[14] To comply with this legislative requirement, the Pentagon has since produced the report annually—except in 2001—to inform US lawmakers about China's national goals and strategic posture. The report offers what is generally viewed as the best available public information on the Chinese military, and it presents the Defense Department's analysis of long-term trends in China's military development—including nuclear capacity; land-, air-, and sea-based access denial capabilities; space and cyberspace capabilities; and precision-strike weapons—that potentially pose credible threats to a modern military operating in the region.

Contemporary Assessments by the DoD and Individuals

DoD analysts use a "net assessment" approach, taking into account China's strategic goals, doctrines, operational concepts, and fundamental military capabilities. This encompasses a comparative analysis of military, technological, political, economic, and other factors governing relative military capabilities designed to yield an understanding of China's motivations for its evolving military modernization programs. Since 2005, the congressionally directed report has been published in a relatively standardized format that begins with an appraisal of Chinese grand strategy, including how China perceives national power, and incorporates ideas on

how China is pursuing its security strategies with prominent emphasis on Taiwan and the Asian-Pacific region.[15] The report focuses on new developments in Chinese military doctrine for modern warfare that address reforms at its military institutions and personnel systems, improved exercises and training standards, and the acquisition of advanced weapon systems. Other areas of emphasis include China's preparations to fight and win short-duration, high-intensity conflicts along its periphery. The 2005 report characterized China's "active defense" as "distinctively offensive" and asserts that deception has a major role within its military strategy.[16] The increasing concern about China's lack of transparency and its missing clarity of intent has prompted DoD analysts to doubt many of China's stated strategic intentions.[17]

In his evaluation of the 2007 report on Chinese military power, Dennis Blasko, a former Army officer and current military analyst on China, criticized the DoD report as failing to "provide a thorough analysis of PLA modernization" because of its excessively broad attempt to discuss "all elements of the (congressional) tasking." As a result, according to Blasko, the report leaves "many components of Chinese military strategy and organization" underaddressed.[18] For example, the DoD report focuses mainly on the PLAAF's acquisition of third- and fourth-generation aircraft[19] and long-range and precision capabilities as well as China's efforts to develop antisatellite (ASAT) weapons and computer network operations (CNO). However, the assessment of these developments illustrates that the PLA is shifting from a strategy of providing point defense of key military, industrial, and political targets to a new joint antiair/antiaccess strategy based on a modern, integrated air defense system capable of offensive and defensive counterair operations.[20] Because this was not a complete assessment, it reflects only a fraction of emerging PLA capabilities. In addition, China's successful test of a direct-ascent ASAT missile against its own weather satellite in early 2007 convinced DoD analysts that "the PLA's interest in counterspace systems is more than theoretical" and that capability could potentially negate the United States' current asymmetrical advantage in space. The 2008 report postulated that China's military capabilities are expanding beyond the dimensions of the traditional battlefield into the space and cyberspace domains.[21]

Though the DoD report contains much beneficial information about Chinese air and space power, some aspects are faulty and misleading, while other key elements are not presented. For those concerned about

how Chinese military modernization may pose a threat to Taiwan and America's interests in the region, criticism of the 2007 report is justified. Indeed, the report fails to address or assess the antiballistic missile implications of the January 2007 ASAT test, which could lead to an erosion of US advantages in ballistic missile technology. Further, it fails to mention the threat to Taiwan posed by China's fast-growing precision missile/munitions inventory and the emergent long-range air defense capability of the PLA,[22] a change which may have serious implications for US airpower in the region. In addition to these sins of omission, factual inaccuracies raise doubts about the quality of the assessment. For example, the 2005 report lists the FB-7 and FBC-1 as two different aircraft being developed in China, but these are in fact the same aircraft, coded by the Chinese as JH-7/7A.[23] Another significant factual error was seen in the 2007 reporting of China's acquisition of Su-27 (J-11/11A) fighters. These aircraft had been a focal point of PLAAF modernization for many years,[24] and in actuality, China had *stopped* production of J-11 fighters under a licensed coproduction agreement with Russia by the end of 2006, when it began to produce an indigenous version of the multirole J-11B fighters which entered service with the PLAAF 1st Division in late 2007.[25] Unfortunately, and perhaps indicative of a lapse in attention, the 2008 report does not give any indication of this development.

As if omissions and inaccuracies were not enough, no assessment has ever been included in this report about the fundamental structure of the PLAAF, which is transforming from its overland, limited territorial focus to a more flexible and agile force that is also able to operate offshore in both offensive and defensive roles. It is unclear if this transformation is considered out of scope for the assessment, whether this fact has not been recognized or acknowledged, or whether it is not considered significant. Other details lacking in the report include a failure to address pilot training, proficiency, tactics, and maintenance for China's advanced aircraft, all of which would seem to be important to the DoD assessment. If this report were limited to an attempt to justify regional policies, it might be more understandable; however, since its primary focus is on elements of PLA modernization that are believed to be potentially threatening to US interests, these issues should be better explained. As a document produced by the DoD that claims to represent a factual assessment, it appears to fall well short of an honest and comprehensive appraisal. Thus, the art of

military discovery calls into question whether the appropriate measure of thinking is being applied to DoD reports provided to Congress.

Since 2006, US policy has been to encourage China to make the right strategic choices while hedging against the possibility Beijing might choose a confrontational strategy. It is possible this hedging strategy drove the authors of the DoD report toward equating PLA "modernization" with "expansion" and therefore dismissed the "possibility of alternate analysis of the same information that might result in different policy options."[26] Under the influence of this policy, there have been an increasing number of monographs and literature on China's military and its possible immediate, intermediate, and long-term impact on the United States and the international community. Unfortunately, many of these assessments have themselves used the DoD reports as primary sources and found their analysis encapsulated within potentially politicized analyses. For example, the *Air and Space Power Journal* Fall 2007 issue carries a study by an Air Force author who explores the PLAAF's air warfare capabilities and elucidates the nature of offensive Chinese airpower.[27] While arguing the PLAAF does not possess any long-range bombers for projecting airpower beyond the Pacific, the author maintains that the development of an offensive airpower doctrine by the Chinese should nonetheless be alarming for American forces in the region. While the PLAAF's heavy emphasis on the use of tactical aircraft to attack traditional targets such as command and control, industrial, and leadership infrastructure is a strategy common to most air forces with regional enemies, the author recommends the US government take action to curb PLAAF's ability to wage longer-range offensive air operations by further limiting the transfer of military technology to China, continuing a deterrence and embargo policy, constraining engagement with the Chinese military, and implementing forward deployment of USAF assets to Guam.[28]

US Air Force officers have consistently expressed interest in studying Chinese air and space power. Much of this study is done during their professional military education (PME) schooling at Air University, Maxwell AFB, Alabama. Here, an increasing number of unpublished research reports address Chinese efforts to modernize PLAAF capabilities, which include deployment of fourth-generation fighters and AWACS and refueling aircraft.[29] These research reports attribute most PLAAF weaknesses to inexperience in combat and, correspondingly, to a lack of critical air competencies, which would be significantly disadvantageous for China in an armed conflict

against experienced enemy forces.[30] Col Jon T. Thomas' 2006 study points out that even in a relatively "close-fought" war scenario against Taiwan, the PLAAF would have problems addressing the challenges of survivability, availability, and sustainability of airpower assets against enemy air defenses due to limited logistic capabilities and the absence of air refueling, C2, and ISR assets.[31] Amplifying the author's doubts about the PLAAF's combat capabilities is the fact that Chinese military tradition and doctrine has long been dominated by PLA ground elements. To what extent the Chinese military has thoroughly considered "how it would conduct an independent air campaign" is unclear.[32] It appears that the implications of independent studies by USAF officers focused on PLAAF culture, strategy, and tactics differ significantly from those of research in the advanced weapons that the PLAAF has recently procured.[33] The focus on how these weapon systems will be employed by Chinese soldiers in the context of military doctrine and institutional tradition lapses into inconsistencies in logic and belies the fact that the US military has no internal coherent, comprehensive, or substantiated agreement concerning the PLA and its intentions. The process of military discovery finds that the inconsistencies produced by these differing approaches highlight gaps in US military understanding.

In addition to airpower issues, some US analysts express growing trepidation over potential exploitation of US security dependencies and vulnerabilities on space systems. China's space accomplishments in recent years have spurred USAF officers to examine its military space doctrine, civilian and military space organizations, and military space capabilities. In many cases, their studies acknowledge that any efforts to analyze China's space programs are hampered by the lack of transparency.[34] Lt Col Carol Welsch, in her award-winning Air War College research paper "Protecting the Heavens: Implications of China's ASAT Programs," urges caution when referencing existing English translations of Chinese publications for analysis. She points out these analyses are always subject to the selectivity of the passages translated, the manner of translation, and the unknown authoritativeness of many Chinese writings.[35] Unlike many studies that argue the Chinese are preparing to fight in space, research reports by USAF officers at the Air War College find minimal evidence to suggest that China has the capability to execute a space warfare doctrine or is developing organizational and management structures to perform such space operations.[36] What is articulated in Chinese military writings, according to Colonel Welsch, is "only a *desired* capability" (emphasis in original).[37] Lt Col

Steven Smith expands on the potential advantages of these desired capabilities by pointing out that *if* China developed and deployed an electronic intelligence (ELINT) satellite system, it *could* enable its long-range antiship missile systems to pose a much more effective threat to US Navy ships in the region.[38] Recognizing China's long-term desire for space warfare capabilities is different from attributing an ability to fight space wars. As such, China's posture regarding space may mirror that of the United States—*a desire* to fully exploit the domain for enhanced war fighting as opposed to executing space warfare itself. Despite these illuminating observations, a preponderance of thinking acknowledges that the nation cannot afford to lower its guard regarding Chinese space programs due to increased US dependencies and vulnerabilities in the space domain.

How should the United States respond to Chinese air and space modernization? Research by individual Air Force officers does not paint a common picture. Unfortunately, many of the inconsistencies stem from source documents themselves. Not only is access to Chinese sources limited, but much US analysis is also incomplete and speculative. Regardless, it seems plausible the PLAAF will become a near-peer competitor in air and space by 2020. One recommendation suggests the United States should respond with less countering and more engaging to support China's development as a responsible regional military power while still carefully watching for any sign its conventional airpower capabilities could grow far beyond its borders.[39] Another consents to this approach, noting the United States must also pursue an engagement policy to deal with China while maintaining a predominant military capable of defending America's interests as well as its allies around the world.[40]

Regarding space, one study argues that because the United States is unable to prevent China from developing its own space capabilities, Washington should adopt a policy to engage Beijing in civilian space programs while concurrently preparing for military operations in a degraded space environment.[41] Still another does not believe civilian engagement with China will by itself serve US security interests in space and recommends the adoption of a robust deterrence policy that includes defensive and offensive counterspace measures to dissuade China's space ambition.[42] What seems truly problematic is not the lack of a common position nor the conclusions derived by these officers, for which natural variance is expected, but the method of discovery that determines how they arrive at their assessments of Chinese air and space power development.

Assessment of Chinese Air and Space Research Issues

The lack of transparency has historically been a major impediment to the assessment of Chinese military power. This transparency has improved markedly in written media over the last decade, and more Chinese information on the PLA is available through official and unofficial channels than could have been imagined a decade ago. However, handicapped by language capability, few individual assessments by USAF officers, published or unpublished, are actually made on the basis of these Chinese sources. Studies by individual officers have relied on secondary sources and reinterpretations of existing analyses. One of the major sources for individual research on Chinese air and space has been the Pentagon's annual report on Chinese military power, which, as already noted, may be inadvertently influenced by political judgments, evaluations, and intentions and may not be supported by a complete and comprehensive basis in fact. As China continues to emerge in the global arena, it will likely choose to significantly improve its military capabilities. In light of this, should the DoD revisit the methods of military discovery which led to the creation of flawed—or at least questionable—analysis? The DoD's propensity to pursue additional defense capabilities has been facilitated by China's lack of transparency. Rather than using primary, open-source analysis, the favored defense methodology has been to project Chinese motivations and intentions for their military modernization based on an examination of only a fraction of the information available. Defaulting to a preconception of China as a potential or even likely adversary from the viewpoint of the worst case scenario, the DoD's assessments should certainly give both the researcher and analyst pause. This methodology creates analysis that appears less objective and probably does not provide the necessary information to make honest and accurate appraisals. Trustworthy appraisals lead to the last stage of military discovery, which generates insights to the true nature of things and original thinking about the issues at hand.

Even when using original Chinese sources in analyses, the unique writing style of the Chinese monograph can create misunderstandings. For example, Chinese monographs generally do not cite sources, nor do they include footnotes to provide distinctions between the author's own opinions and the contributions of others to the ideas being presented. Within the past few years there has been an increase in the availability of Chinese writings on air and space power by PLAAF authors. The most notable

among these is former deputy chief of PLAAF Maj Gen Cai Fengzhen's *Kongtian zhanchang yu Zhongguo kongjun* [*The Aerospace Battlefield and China's Air Force*] (2004), and *Kongtian yiti zuozhan xue* [*Study of Integrated Aerospace Operations*] (2006).[43] Perhaps what is most alarming about these publications is not the content, per se, but rather the cyclic nature of the research process as it relates to Chinese doctrine and capabilities. For example, these documents directly borrow most of their terminology and concepts from US air and space doctrine, while giving little credit to the American thinkers who developed the original concepts. Iterative US analysis of these books and Chinese air and space capabilities in general ends up being a cyclic, US self-critique of its own doctrine and China's ability to imitate and rearticulate this doctrine as its own. General Cai uses US air and space capabilities, as demonstrated in conflicts since the 1991 Gulf War, to build and elucidate air and space strategy and concepts of operations. He then argues for the PLAAF's development and implementation of similar air and space capabilities. According to Cai and his colleagues, the Chinese air force looks forward to a long path of modernization due to four challenges: outdated concepts, backwards weapon systems, deficient force structures, and shortages of educated personnel in science and technology.[44] Former PLAAF commander Qiao Qingchen wrote prefaces for both of Cai's books, noting that the first book represents a forward-looking effort to explore the theory of air and space warfare, while the second has laid the theoretical foundations for a future study of air and space operations.[45] Using these two books—which are based on US air and space doctrine—along with other Chinese publications, Larry Wortzel, a well-known and highly respected Washington Chinese military analyst, declares that what makes General Cai's analysis impressive is "how rapidly the PLA has developed advanced capabilities to engage in warfare in space."[46] While it is perhaps true that China has shown great interest in transforming the PLAAF into a capable air and space force, examination of the sources indicates that China continues to borrow heavily from the language and rhetoric in US concepts while continuing to struggle in the development of its own theories and strategies for space warfare and counterspace operations, lagging even further behind in its ability to implement them.

Another challenge to contemporary assessment of China's air and space power is the burgeoning Chinese publication of magazines and periodicals from a variety of institutions and sources. This has created a progressively

more complex and confusing situation for Western analysts. Some are popular specialized magazines such as *Hangkong zhishi* [*Aerospace Knowledge*], *Jiangchuan zhishi* [*Naval & Merchant Ships*] *Xiandai bingqi* [*Modern Weaponry*], *Xiandai junshi* [*Modern Military Affairs*], *Jianzai wuqi* [*Shipborne Weapons*], and others. The sponsorship of these publications comes from either state-owned defense enterprises or Chinese defense industry associations. The challenge becomes to what extent these magazines illuminate the PLA's development of its military capabilities. The articles found in these magazines are often sensational and written by non-authoritative writers using eye-catching illustrations or photography to better attract continued investment by advertisers and popular readership. Therefore, their usage requires researchers to be careful about the nature of the sources to the extent that they are authentic and reliable.

Even so, the principal dilemma for American analysts is how to address and evaluate specialized Chinese science and technology journals on air and space.[47] Their contributors are civilian and military faculty members, researchers and graduate students affiliated with PLA academic institutions, and research institutes. These journals report on theoretical, basic, and applied research into the areas of air and space weapons and electronic warfare. The difficulty is determining whether the writings represent only the authors' personal views—as much of US research does—whether it reflects the official views of the PLA, or whether this research should be considered as part of ongoing, officially endorsed Chinese government programs within particular areas of interest, such as space warfare. Using common DoD analytical methods, which are often heavily based on worst case assumptions rather than available primary information, conclusions generally default to the latter, where speculations and inaccurate references can inadvertently and easily be made. For example, in his recent article on the PLA's space warfare programs, Wortzel cited a number of Chinese studies in which authorship was attributed to PLA officers, implying official direction.[48] On further examination, not all of the authors were affiliated with the PLA, and only one of the four was associated with the PLA's Second Artillery Command College, an organization with authority on the subject. As with many individual USAF publications, the purpose of these specialized periodicals is to disseminate research results, showcase theories, and stir academic debate. Instead, these studies tend to be collectively treated as evidence of the PLA's ongoing space warfare efforts and effectively contribute to confusion regarding actual Chinese military programs.[49] One

can readily see how when cyclic references, iterative academic exchanges, and a predisposition to address worst case scenarios converge, they produce misleading and, at times, fallacious conclusions which may lead analyses away from the discovery of China's true directions.

Assessment of Actual Progress and Problems of the PLAAF

One thing that is clear is that Chinese air and space power is being transformed. According to China's 2008 defense white paper, Beijing is adopting a three-step development strategy with the goal of modernizing the PLA into "mechanized and informationalized" forces by the mid twenty-first century with different milestones to be achieved in 2010 and 2020.[50] This development effort is focusing on troop training reform (to include conducting training in complex electromagnetic environments), integration of logistics support systems, building three-dimensional weaponry platforms with integrated sea-air-space capabilities, improving military information systems, and strengthening officer training with an emphasis on joint operations. These efforts also include enhanced ideological and political training and "perfecting" the military legal system.[51] The white paper specifically maintains that the PLAAF has begun transforming itself from a territorial air defense force to one with both offensive and defensive capabilities, including "certain capabilities to execute long-range precision strikes and strategic projection operations."[52] Several key issues deserve attention to understand China's own claims about the development of the PLAAF and air and space power for the present and the near future and as it concerns the USAF. These issues include strategy, force structure, the officer corps and enlisted force, unit training, and logistics and maintenance.

During 2004, the PLAAF introduced a new strategic vision calling for the development of a strategic air force with long-range capabilities and the active involvement of integrated air and space [*kongtian yiti*] operations with information and firepower systems [*xinxi huoli yiti*].[53] Despite being modeled on US practices, this strategic vision differs from USAF doctrine on counterspace operations for the purpose of space superiority.[54] In the midst of its discussion about how to integrate air and space power from a broad perspective, the PLAAF continues to face constraints that make it a challenge to operate at a near-peer level against the USAF.[55] The most critical constraint perhaps is the fact that the PLAAF does

not possess any of its own space assets or strategic missiles. Instead, these systems remain under the control of the General Armament Department and the Second Artillery Force, respectively. Not only has this been the case in the past, but apparently the PLAAF has continued to lose recent debates as to whether these capabilities should be placed under its control.[56] Nonetheless, the PLAAF's study of warfare in the United States and Russia has caused Chinese air force theorists to conclude that space systems will continue to play a support role in operations for at least 40 years. Given their limited ownership and control of space assets, Chinese military theorists have recommended that the PLAAF concentrate on building facilities and institutions to receive satellite services for communication, weather, navigation, and global positioning. This will allow the PLAAF to transition from a traditional air force to one enabled by space-based information (communications, positioning, navigation, timing, and ISR) capabilities.[57]

Since 2003, China has made efforts to streamline and optimize the PLAAF's force structure. These efforts include the retirement of earlier generations of aircraft, a reduction in the number of troops, and the deployment of third-generation combat aircraft and ground-to-air missiles.[58] Although the PLAAF has become modernized and its force size significantly reduced, it still faces substantial replacement problems. While the older J-7 and J-8 fighters remain in service, the initially purchased Su-27s and later Chinese-assembled J-11s appear to be incapable of fully supporting the mission requirements of the PLAAF, which now places an increased emphasis on offensive vice defensive roles.[59] Currently, the PLAAF has three and one-half regiments of Su-30s, one regiment of J-11Bs, five and one-half regiments of J-10s, and three regiments of JH-7As.[60] The size of the Chinese air force and its offensive capabilities will continue to be limited until a significant number of J-10s and J-11Bs enter service in the next five years.[61] Even so, the PLAAF will continue to rely on upgrading second generation aircraft to maintain a sizeable air force. Based on these projections and known aircraft performance, there appears to be no way the PLAAF will match the capabilities of the USAF, particularly with the combination of speed and stealth seen in the fifth-generation US fighter, the F-22 Raptor.

In 2005, the PLAAF established an additional transport division and a special aircraft division to enhance its long-range airlift and airborne early warning capabilities. Russia's failure to deliver 30 IL-76MDs as scheduled

in 2007–08 will keep this newly created transport division underequipped for years to come,[62] with a limited number of Y-7s and Y-8s constituting the majority of airframes in the interim.[63] There is also slow progress in the integration of support systems such as airborne early warning/airborne warning and control systems (AEW/AWACS), aerial refueling tankers, intelligence collection platforms, and signal jamming aircraft, which are all necessary to increase the effectiveness of combat aircraft and augment war-fighting capability.[64] The 2008 defense white paper describes the PLAAF as remaining a mixed force of aviation, ground air defense, airborne, signal, radar, electronic countermeasures (ECM), technical reconnaissance, and chemical defense.[65] This mixed-force structure will continue to complicate China's air and space decisions, particularly with regard to training, allocating roles and missions among services and branches, and influencing resource allocations for Chinese air force modernization.[66]

The PLAAF regards the implementation of its 1999 "Strategic Project for Talented People" as a key to transforming the Chinese air force into a force able to fight high-tech wars under informationalized conditions. This project emphasizes recruiting, educating, training, and retaining qualified and capable personnel.[67] Unlike the USAF, whose officers all have college degrees with over half holding advanced degrees,[68] only one-third of Chinese air force officers are college or university graduates, and only 5 percent possess master's degrees.[69] To aid in the Chinese transformation, the PLAAF reorganized the officer corps of the units receiving new-generation aircraft and equipment to include more highly educated personnel. These personnel were transferred from air force headquarters, research institutes, and universities and filled up to 80 percent of leadership and technical positions in these units.[70] In addition to improving the quality of next-generation flying units, the introduction of the 1999 National Defense Student Program enabled the PLAAF, for the first time, to recruit 60 percent of all new officers from civilian colleges and universities.[71] Unfortunately for the PLAAF, although these measures will improve the quality of the force, the PLA still does not have an effective assignment system to periodically rotate officers both across and within their specialties. Chinese officer promotions are still implemented at the unit level, where fraternization and departmentalism influence individual initiative and organizational success. Major challenges remain for the PLAAF in retaining highly educated personnel, encouraging capable officers to serve longer, finding

those with the special expertise necessary to fulfill key technical positions, and recruiting young talent to join the service.[72]

Chinese aviation units are transitioning from older generational aircraft to new aircraft with significantly improved capabilities. The PLAAF is also enhancing its training, featuring new systems and methods which increase the importance associated with technical and tactical training in complex environments, combined arms and aircraft type training, and joint training under mission-oriented and confrontational conditions.[73] In April 2002, the PLAAF chose a new Outline of Military Training and Evaluation to modernize flight training, and one year later, it created its own "Red Flag" training base modeled after the program at Nellis AFB.[74] Despite these changes, Chinese fighter pilots only fly an average of 130 hours per year versus their US counterparts, who average 250–300 hours per year.[75] Still other discrepancies are shown in training requirements, where USAF fighter pilots will fly around 50 hours of air refueling, AWAC command and control, dissimilar air combat training, and night training before being declared combat ready. Although Chinese flight training requirements are not clearly understood, current flight training manuals seem to require several times those 50 US hours for a pilot to receive only air refueling training.[76] This suggests that even though the PLAAF has adopted a new guide for pilot training, their equipment, overall requirements, procedures, and methods are still not comparable to US standards and quality of training.

The PLAAF has reportedly begun reorganizing its air logistics and maintenance systems to support deployed units for the conduct of mobile offensive operations, but many areas are still weak. At a field station work conference in December 2008, the Chinese air force logistics department acknowledged that most PLAAF field stations were not built to support the multiple types of aircraft deploying into their airfields. A plan has been adopted to modernize airfields *in batches* with new equipment that can more efficiently move supplies from depots to the field and with integrating computers that can track spare parts and logistics and maintenance support for individual weapons systems and units as a whole. In addition, PLAAF airfields are moving toward microwave landing systems, automated meteorological observation and sounding systems, and secondary radar systems to increase their capabilities to support a variety of aircraft types under all weather conditions.[77] One major PLAAF challenge is a shortage of qualified logistics and maintenance personnel with the knowledge and skills to

serve in a variety of positions. While the PLAAF has also begun to convert some junior officer maintenance billets to NCO billets, it is not yet clear whether this has helped or hindered its overall maintenance capabilities.[78] A second major logistics and maintenance challenge is that reform is still at the initial stages of experimentation and at local levels. This means new systems do not yet appear to be standardized across the force.[79] The final challenge in logistics support is that limited resources will primarily be focused on development units and new units receiving new equipment. Currently, the PLAAF enjoys the benefits of a favorable military spending policy, but budget challenges are likely. As long as the General Logistics Department continues to control military finance, a funding shortfall for the air force is inevitable for the years to come.[80]

China has adopted a three-step strategy to transform its air force. These steps include developing advanced aircraft and integrating them with effective support systems, conducting offensive and defensive operations against ground and sea-based targets, and relying heavily on informationalized systems to employ air and space power effectively. The speed of Chinese air and space modernization has caused concern in the West but is likely to be constrained by the current technological limitations in the Chinese defense industry and by the resources needed to support modernization. Perhaps even more true is that the Chinese air and space transformation will continue to be tempered by inherent differences in the institutional cultures of the PLA ground forces and the PLAAF. While the PLA as a whole is transforming with the introduction of new advanced weapons, the real struggle it faces is against traditional concepts, older ways of doing things, outdated organizational structures, and limited funding. In the PLA's own assessment, there has been repeated concern about limitations for the force. These have been identified in official publications as the "three incompatibles," which specifically refer to commanding officers' capabilities, troops' knowledge in science and technology, and training and education, which together are not viewed as sufficiently synchronized to win modern informationalized wars.[81]

China recognizes many of these weaknesses and has made addressing them a high priority, so a more-rapid-than-anticipated transformation may still be possible. The remaining challenge to the US Air Force is what Chinese air force modernization means to its mission in the Asian-Pacific region.

USAF Efforts and Issues in Maintaining Air and Space Power Superiority in the Pacific

This article has focused on issues related to the process of discovery with regard to current Chinese air and space power. It has identified some of the challenges associated with making useful assessments and presented actual problems and progress within the PLAAF. Finally, it contemplates current issues for the USAF in maintaining air and space power for regional superiority—issues that are informed and impacted by the analysis of Chinese air and space power, which as shown, are perhaps imperfectly connected. As discussed earlier, decisions for the USAF are complicated by a lack of indigenous research capabilities dedicated to Chinese air and space power development and by the lack of a unified DoD position on China in addressing air and space matters.

In truth, the US posture in the Pacific is influenced, but not driven, by the methods of assessment of Chinese military development and what details are included or excluded from the assessment. The United States has long been a Pacific nation as well as an air, space, and more recently, a cyberspace nation. These national characteristics naturally cause the USAF to perceive an inexorable linkage between its role in protecting US interests in the Asia-Pacific region and its air, space, and cyberspace capabilities.[82] This linkage exists in the region regardless how Chinese capabilities unfold. During the earlier days of the USAF, Gen Carl A. "Tooey" Spaatz, the first Air Force chief of staff, who had commanded strategic air forces in the Pacific, stated,"The argument has been advanced that the Air Force should be concerned with land objectives, and the Navy with objectives on and over the water. That distinction is to deny the peculiar quality of the air medium, the third dimension. The air is indivisible; it covers land and sea."[83] It is clear that General Spaatz recognized the need for airpower to complement existing land and sea power capabilities. While pursuing airpower dominance, the USAF also developed a strong offensive culture with the emphasis of air superiority and strategic striking.[84] Bringing Spaatz's ideas as well as the air force strategic culture forward, the USAF finds it imperative to apply them to the domains of space and cyberspace in today's security environment. The Asian-Pacific region with its existing threats and emerging near-peer competitors has the potential to present a true challenge for the USAF's air, space, and cyberspace capabilities.

Despite the military's current irregular warfare involvement in Iraq and Afghanistan, the USAF cannot lower its guard in deterring potential

conventional/advanced warfare adversaries, extending global freedoms, and maintaining regional peace and prosperity. From an Air Force Asian-Pacific perspective, challenges in these areas come from North Korea's nuclear proliferation and the high-end military competition that involves both China and Russia. Among these, the most troublesome for the USAF are (1) the emerging threat of modern integrated air defenses to the Air Force's ability to maintain the dominance in modern air warfare; (2) competition for access, use, and preeminence in space; and (3) security vulnerabilities resulting from America's dependence on cyberspace.[85] While not unique to the Asian-Pacific regional challenge, all of these issues are clearly associated with a potential confrontation between the United States and China over Taiwan. US-Taiwan military cooperation under the guidance of the Taiwan Relations Act continues to serve as a source of tension between China and the United States.

The development and maintenance of capabilities for global reach, global power, and global vigilance are keys for the Air Force to confront challenges. So far, it has made efforts to optimize command and control and enhance ISR capabilities in the Pacific, redeploy C-17s and KC-135s to Alaska and Hawaii, place three of its seven programmed F-22 squadrons to the Pacific, and rotate the presence of B-1, B-2, and B-52 aircraft at Guam while advocating the need to develop the next generation, long-range bombers by 2018.[86] However, with the global economic recession, there are likely to be large reductions in the US defense budget as Defense Secretary Robert Gates recently recommended.[87] If true, the USAF must prepare to make adjustments to include low-cost alternatives to meet the challenges in the Asian-Pacific region. An objective assessment of the regional military situation will be vital for the USAF to respond accordingly.

It is clear that the ongoing Chinese innovation and transformation will affect the USAF's regional posture. Despite the imperfect coverage in the DoD report to Congress on Chinese military development, the rapidly growing precision missile/munitions inventory and the long-range air defense capabilities of the PLA will be expected to pose significant challenges to both the Air Force and the Navy and will have implications for operations and force structure. As stated in Joint Forces Command's 2008 publication, *The Joint Operating Environment* (*JOE*), "In the long term, the primary purpose of the military forces of the United States must be deterrence."[88] The forging of Air-Sea Battle doctrine through the Pacific Vision 2008 exercised by the Pacific Air Force and the Navy was an important

step in building more appropriate deterrence capabilities needed to deal with a transformed and potentially hostile China. The Air-Sea Battle also recognizes the essential nature of synchronized air-sea operations against a potential near-peer competitor.[89] Much has been written with regard to potential USAF strategies to safeguard international transit through the Malacca Straits and whether Chinese economically centered strategies should be of concern to future USAF operations. While this article does not address those issues in detail, it bears repeating that addressing basing and airfield access issues with allied and friendly nations for forward deployment is essential to maximize USAF effectiveness and progress toward a sustainable USAF and DoD deterrent capability.

As discussed previously, Air Force research shows that China has little true capability to conduct space warfare and that its publications likely reflect a "desired capability." However, divisions created between the domains of space and cyberspace are superficial at best. While all cyber operations are not space operations, the converse may be said to be true. Nearly 100 percent of product from satellites is information, and information is processed through a variety of networks, computers, and communications—the cyber domain—a domain in which the Chinese are already capable peer competitors.[90] The USAF has made a profound acknowledgement of this understanding by placing the cyber mission as a numbered air force subordinate to Air Force Space Command (AFSPC)[91] and contemplating the creation of a separate combatant command or a subunified command for cyber under US Strategic Command.[92] These actions recognize the critical connection between the space and cyber domains and will continue to be essential in providing the USAF an initial ability to protect global access and project American military power if needed.

While this reorganization is a positive step, it may not move quickly enough to adjust to the new paradigms of military operations with a capable peer competitor. The USAF has a relatively brief window of opportunity to rethink its present culture and abilities, which still reflect "an industrial age, mobilization-based . . . paradigm" and to adjust to ways that are "consistent with the intellectual requirements of the future joint force."[93] Space and cyber operations are critical to the Air Force, but they are inherently joint and connected to interagency and civilian interests. How capabilities are developed to operate effectively in these domains will be important to USAF and DoD operations in the Asian-Pacific region

as well as against potential competitors worldwide, including a resurgent Russia, terrorists, and even criminals.

Conclusion

While no intelligence sources were used in the preparation of this study, open-source military discovery indicates that fears of a conventional war with China may be overstated. While the USAF must make adjustments to create a more effective deterrent and protect US interests in the Asian-Pacific region and around the world, DoD assessments of Chinese military power, particularly air and space power, appear inadequately addressed and may not justify established US policy as stated in the 2006 *Quadrennial Defense Review Report* that "China has the greatest potential to compete militarily with the United States and field disruptive military technologies that could, over time, offset traditional US military advantages."[94] If China is to be viewed as a potential adversary, the USAF and the DoD must pursue effective open-source (as well as the intelligence community) discovery of its strategies and capabilities that lead to reports which, in turn, inform Congress. Congressional trust, in turn, will lead to the development of more effective avenues and capabilities for cooperation or confrontation, as appropriate.

Creating indigenous USAF research and discovery capabilities, to include undergraduate and graduate-level Chinese study programs, is necessary for improved military discovery and decision making. In particular, an enhanced understanding of Chinese air and space power development will enable the Air Force to more accurately assess, proactively prepare for, and as appropriate, respond to China's progress in the air and space realm. Because current analyses are relatively ad hoc and limited in their temporal scope, they tend to be less than impartial and reflect incomplete interpretations based on selected and nonauthoritative sources. These limitations call into question the objectivity and thoroughness of the general body of current DoD analysis and may not provide accurate representations. As stated in the *JOE*, "The defining element in military effectiveness in war lies in the ability to recognize when prewar visions and understanding of war are wrong and must change."[95]

Although conventional arms and strategies have created an effective US deterrence capability, it appears that China's conventional air and space capabilities have not yet reached the level that some allege and still face

significant challenges. Their capabilities in other areas, such as cyberspace, are only beginning to be explored and understood. Effective and complete military discovery, as it pertains to China or anything else, is an art that is accomplished not by meekly repackaging questionable information but through deep study, contemplation, and professional discussion. SSQ

Notes

1. Sir Francis Bacon, *The New Organon or True Directions Concerning the Interpretations of Nature* (1620), Book 1, section LXXXII, http://www.constitution.org/bacon/nov_org.htm. Bacon formulates methods of discovery and postulates that logical invention cannot reveal the way things truly are, but that there is an art of discovery which is found in meditation, agitation, and working of the wit.

2. Kenneth W. Allen, Glenn Krumel, and Jonathan D. Pollack, *China's Air Force Enters the 21st Century* (Santa Monica, CA: RAND, 1995), 181–88.

3. Dong Wenxian, a PLAAF headquarters researcher, published several articles in *Kongjun junshi xueshu* [*Air Force Military Journal*] and *Jiefangjun bao* [*PLA Daily*] regarding such debates. These articles are available in his book, *Xiandai kongjun lun* (xubian) [*Modern Theory on Air Force* (sequel edition)] (Beijing: Blue Sky Press, 2005).

4. John Wilson Lewis and Xue Litai, "China's Search for a Modern Air Force," *International Security* 24, no. 1 (Summer 1999): 94.

5. Department of Defense (DoD), *Annual Report on the Military Power of the People's Republic of China* (Washington, DC: DoD, 2000), http://www.defenselink.mil/news/Jun2000/china06222000.htm.

6. Jacqueline A. Newmyer, "China's Air-power Puzzle," *Policy Review* 119 (June/July 2003): 71–85.

7. Morgan J. O'Brien III, "Rising Airpower: The People's Liberation Army Air Force in the Early 21st Century," *Air & Space Power Journal—Chronicles Online Journal*, 2003, http://www.airpower.maxwell.af.mil/airchronicles/cc/ obrien.html.

8. The author relies principally upon two 1996 writings: June T. Dreyer, "The New Officer Corps: Implications for the Future," *China Quarterly* 146 (1996); and David Shambaugh, "China's Military in Transition: Politics, Professionalism, Procurement and Power Projection," *China Quarterly* 146 (1996).

9. O'Brien, "Rising Airpower."

10. Thomas R. McCabe, "The Chinese Air Force and Air and Space Power," *Air & Space Power Journal* 17, no. 3 (Fall 2003): 73–83.

11. Ibid., 76–77.

12. See Andrew Scobell, *China's Use of Military Force: Beyond the Great Wall and the Long March* (Cambridge, UK: Cambridge University Press, 2003), 171–91, for a detailed analysis of this confrontation.

13. For the most authoritative examinations of Chinese espionage and the Energy Department internal security deficiencies, see US Congress, *House Committee on Military/Commercial Concerns with the People's Republic of China Report*, House Report 105-851 (Washington, DC: GPO, 1999); and the President's Foreign Intelligence Advisory Board, *Science at its Best; Security at its Worst: A Report on the Security Problems at the U.S. Department of Energy* (Washington, DC: President's Foreign Intelligence Advisory Board, 1999).

14. National Defense Authorization Act for Fiscal Year 2000, Public Law 106-65, 269–72, http://www.dod.mil/dodgc/olc/docs/2000NDAA.pdf.

15. The concern of Chinese military modernization beyond Taiwan has been revealed for the first time explicitly in the 2005 annual report on Chinese military power. DoD, *Annual Report on the Military Power of the People's Republic of China* (Washington, DC: DoD, 2005), 12, http://www.defenselink.mil/news/Jul2005/d20050719china.pdf.

16. Ibid., 15.

17. DoD, *Annual Report on the Military Power of the People's Republic of China* (Washington, DC: DoD, 2006), 1, 12, 14, http://www.dod.mil/pubs/pdfs/China%20Report%202006.pdf.

18. Dennis J. Blasko, "The 2007 Report on the Chinese Military: The Top 10 List of Missing Topics," *Joint Force Quarterly* 47 (Fall 2007): 48.

19. The United States and China do not use the same terminology when discussing generations of aircraft: the US criteria is that aircraft produced from 1970 to 1990 are the fourth generation, while China refers them to be third generation.

20. DoD, *Annual Report* (2005), 31.

21. DoD, *Annual Report on the Military Power of the People's Republic of China* (Washington, DC: DoD, 2008), 1, 19–20, http://www.defenselink.mil/pubs/pdfs/China-_Military_Report_08.pdf.

22. Richard Fisher Jr., "Two Cheers for the 2007 PLA Report," International Assessment and Strategy Center, 20 June 2007, http://www.strategycenter.net/printVersion/print_pub.asp?pubID=162.

23. Chinese military aviation Web page, http://cnair.top81.cn/J-10_J-11_FC-1.htm.

24. DoD, *Annual Report on the Military Power of the People's Republic of China* (Washington, DC: DoD, 2007), 4, http://www.defenselink.mil/pubs/pdfs/070523-China-Military-Power-final.pdf.

25. Chinese military aviation Web page.

26. Dennis J. Blasko, "Rumsfeld's Take on the Chinese Military: A Dissenting View," *Current History* 105, no. 692 (September 2006): 264.

27. Eric Lin-Greenberg, "Offensive Airpower with Chinese Characteristics: Development, Capabilities, and Intentions," *Air & Space Power Journal* 21, no. 3 (Fall 2007): 67–77.

28. Despite its focus on how China develops offensive airpower with Chinese characteristics, almost half of the article considers the implications that Chinese airpower has for the United States and the means by which the latter can counter its development to maintain regional stability in Asia. Ibid., 72–75.

29. The best one is Jon T. Thomas, "The Wings of the Dragon—PLA Air Force Rapid Conventional Force Projection: Beyond Taiwan?" (Research report, Air University [AU], 2006).

30. Jerome T. Traughber, "Near Peer Competitors: The Growth of Chinese Military Capabilities," (Research report, AU, 2008), 14; and Clayton B. Perce, "Challenge and Response: Developing a USAF Agenda for Cooperative Action with China," (Research report, AU, 2007), 13–14, https://research.maxwell.af.mil/papers/ay2007/awc/Perce.pdf.

31. This analysis does not consider Beijing's strategy to use the Second Artillery Force to take out much of Taiwan's air assets in advance to place substantially lesser demands on the PLAAF performance. For this argument, see William S. Murray, "Revisiting Taiwan's Defense Strategy," *Naval War College Review* 61, no. 3 (Summer 2008): 20–25.

32. Thomas, "Wings of the Dragon," 43–48.

33. For examples, see Carlo Kopp, "The Flanker Fleet—The PLA's 'Big Stick'," International Assessment and Strategy Center (IASC), 3 May 2006, http://www.strategycenter.net/research/pubID.106/pub_detail.asp; Richard Fisher Jr., "China's New Bomber," IASC, 7 February 2007,

http://www.strategycenter.net/printVersion/print_pub.asp?pubID=146; and "PLA Transport: Building for Power Projection," IASC, 25 June 2006, http://www.strategycenter.net/printVersion/print_pub.asp?pubID=113.

34. Kim Ramos, "China's Space Doctrine," (Research report, AU, 2006); Steven A. Smith, "Chinese Space Superiority? China's Military Space Capabilities and the Impact of their Use in a Taiwan Conflict," (Research report, AU, 2006), 1; Carol P. Welsch, "Protecting the Heavens: Implications of China's Antisatellite Programs," (Research report, AU, 2008), 5—Recipient of AFSPC Best AWC Space Paper Award, AY-08; Ralph Sandfry, "China's Military Modernization: A Look Toward 2030," (Research report, AU, 2008) 2; and Stanley Stafira Jr., "Dragon in Orbit: China's Pragmatic Approach to Space Strategy," (Research report, AU, 2008), 1.

35. Welsch, "Protecting the Heavens," ii.

36. Ramos, "Chinese Space Superiority?" 32; and Welsch, "Protecting the Heavens," 20.

37. Welsch, "Protecting the Heavens," ii.

38. Smith, "China's Military Space Capabilities," 27.

39. Thomas, "Wings of the Dragon," 3–4.

40. Brian Killough, "Engaging the Dragon: Potentials for War and Peace," (Research report, AU, 2007), 55.

41. Ramos, "Chinese Space Superiority?" 35.

42. Welsch, "Protecting the Heavens," 36–37.

43. Cai Fengzhen, Tian Anping, et al., *Kongtian zhanchang yu Zhongguo kongjun* [*The Aerospace Battlefield and China's Air Force*] (Beijing: PLA Press, 2004); and *Kongtian yiti zuozhan xue* [*Study of Integrated Aerospace Operations*] (Beijing: PLA Press, 2006).

44. Cai et al., *Kongtian zhanchang*, 259–83.

45. Ibid., 1–3; and Cai, *Kongtian yiti zuozhan xue*, 1–3.

46. Larry Wortzel, "The Chinese People's Liberation Army and Space Warfare," *Astropolitics* 6, no. 2 (May 2008): 114.

47. For example, these include *Dimian fangkong wuqi* [*Ground Air Defense Weapons*], *Hangtian dianzi duikang* [*Aerospace Electronic Countermeasures*], *Feihang daodang* [*Winged Missile Journal*], *Zhuanbei zhihui jishu xueyuan xuebao* [*Journal of the Academy of Equipment Command & Technology*], *Hangkong bingqi* [*Aero Weapons*], etc.

48. Wortzel, "Chinese People's Liberation Army," 123–25, 135–36.

49. Some of the authors are faculty and researchers of Chengdu University of Electronic Science and Technology, Haerbin Institute of Technology, and the Second Research Institute of China Aerospace Science and Industry Group.

50. Information Office of State Council of People's Republic of China, *China's National Defense in 2008* (Beijing: Foreign Languages Press, 2009), 8–9.

51. Ibid., 13–26.

52. Ibid., 5–36.

53. Dai Xu, "Goodbye, Old J-6 Fighters: A Complete Examination of the Service History of the Last Meritorious Fighter in the Chinese Air Force with Combat Victory Record," *Guoji zhanwang* [*World Outlook*], no. 19 (2005): 21.

54. Air Force Doctrine Document (AFDD) 2-2.1, *Counterspace Operations*, 2 August 2004, iii.

55. The PLAAF regards these constraints as a backward concept for developing and deploying airpower and the lack of progress in science and technology. Min Zengfu, chief ed., *Kongjun junshi sixiang gailun* [*An Introduction to the Military Thinking of Air Force*] (Beijing: PLA Press, 2006), 308.

56. Dong, *Xiandai kongjun lun*, 327–28, 373, 389.

57. Cai et al., *Kongtian yiti zuozhan xue*, 287–301; and Shan Jinsuo and Li Niguang, "Creative Development of the Party's Guiding Theory of Air Force Building," *Zhongguo junshi kexue* [*Chinese Military Science*] 20, no. 5 (2007): 45.

58. Phillip C. Saunders and Erik Quam, "Future Force Structure of the Chinese Air Force," in *Right Sizing The People's Liberation Army: Exploring the Contours of China's Military*, eds. Roy Kamphausen and Andrew Scobell (Carlisle, PA: Strategic Studies Institute, Army War College, 2007), 391–92.

59. Chinese airpower advocates internally argue that any efforts to continue emphasis on the air force defensive role may cause the PLAAF to lose another opportunity to become an independent striking force. See Liu Yazhou, "Changing Our Air Force Strategy," *Lingdao wencui* [*Best Articles of Leadership*], no. 8 (2005): 95–101; and Dai, "Goodbye, Old J-6 Fighters," 19–21.

60. A new regiment in the Shenyang Military Region has been converted to a JH-7A unit. See http://pic.chinamil.com.cn/news/2009-02/01/content_1635720.htm.

61. China does not make the PLAAF aviation order of battle publicly available. China -Defense.com forum provides some order of battle information. It appears that since 2007, one regiment will make the transformation to fly the JH-7A, J-10, and J-11B. In addition to these J-10 and Su-30 units, the PLAAF has six H-6 regiments to play an offensive role and 7.5 Su-27 and J-11 regiments to play limited offensive roles. See http://www.china-defense .com/forum/index.php?showforum=5.

62. According to a recent report, the production line at the Ulyanovsk Mechanical Plant will not be ready for production before December 2010. Jon Grevatt, "China's Ilyushin orders face further delays," *Jane's Defence Weekly* Web site, 18 December 2008.

63. Martin Sieff, "Airlift the Key to True Superpower Capability Part One," *SpaceWar .com*, 12 December 2008, http://www.spacewar.com/report/Airlift_The_To_True_Superpower _Capability_Part_999.html; and Vladimir Isachenkov, "Russia Faces an Aging Defense Industry," *Los Angeles Times*, 20 July 2008, http://article.latimes.com/2008/jul/20/world/fg-russia20plr.

64. The PLAAF special operation aircraft units entered service in 2005, but so far there is little evidence to suggest that they are fully operational. According to a *People's Liberation Army Daily* report on 31 March 2008, for the first time during a regular training day of an unidentified air division, a regiment commander conducted his command and control role in an AWACS aircraft. See "The Change of Command Mode by One Air Force Division Increases Its Combat Capability: Command Post Flies from the Ground into the Sky," *PLA Daily*, 31 March 2008, 2. Another *PLA Daily* report indicates that Chinese AWACS aircraft flew command and control missions for the 2008 Olympic Games. See Xu Qiliang, "The Dream Flies in Reform and Opening Up," *PLA Daily*, 4 November 2008, 7.

65. Information Office, *China's National Defense in 2008*, 26.

66. For the best discussion about trade-offs concerning the PLAAF's modernization, see Saunders and Quam, "Future Force Structure of the Chinese Air Force," 401–17.

67. Deng Changyou, "To Build a Personnel Team with Continuously Recruiting Talents," *Jiefangjun bao* [*PLA Daily*], 8 January 2009, 11.

68. USAF active duty demographics from Air Force Personnel Center, current as of 31 December 2008, http://www.afpc.randolph.af.mil/library/airforcepersonnelstatistics.asp.

69. Min, *Kongjun junshi*, 312.

70. Deng, "To Build a Personnel Team."

71. China News Agency, 24 August 2006, http://news3.xinhuanet.com/mil/2006-08/24/ content_5003469.htm.

72. Deng, "To Build a Personnel Team."

73. Information Office, China's National Defense in 2008, 36.

74. "PRC: Article Features Chinese Air Force Testing, Training Base," 1 December 2008, CPP20081201004007, Open Sources Center.

75. Senior PLAAF officers, interviews by authors.

76. Wang Jun and Zhang Zhirong, "Air Regiment Commander Fang Bing—A Leading Wild Goose Flying in the Sky," *PLA Daily*, 29 August 2008, 3.

77. Wang Shanhe, "The Air Force Vigorously Promotes the Improvement of Aviation Field Station Supply System," *PLA Daily*, 8 December 2008, 1.

78. "Making the Transition to Train the Single Skilled Personnel with Multi Skills," *PLA Daily*, 18 December 2004, 2.

79. Ding Yi, "Establishing the Complete Maintenance Standard for the New Type Fighters," *PLA Daily*, 9 December 2008, 1.

80. Ren Lijun, Wang Deshun, and Wang Yehong, "Identify the Major Strategic Direction, Strengthen Air Force Finance Development," *Junshi jinji yanjiu* [Military Economic Study], no. 7 (2008): 52–53.

81. Huang Hong and Liu Xiwu, "The Evolution of Our Military Historical Mission and Its Implications," *PLA Daily*, 8 June 2006, 6.

82. Gen Carrol H. "Howie" Chandler, USAF, "An Airman's Perspective: Air, Space, and Cyberspace Strategy for the Pacific," *Strategic Studies Quarterly* 2, no. 2 (Summer 2008): 9.

83. AFDD 2-1.4, *Countersea Operations*, June 1999, 5, http://www.fas.org/man/dod-101/usaf/docs/afdd/afdd2-1-4.pdf.

84. For the development of the USAF's institutional identity, see Tami Davis Biddle, *Rhetoric and Reality in Air Warfare: The Evolution of British and American Ideas about Strategic Bombing, 1914–1945* (Princeton, NJ: Princeton University Press, 2002), 289–301.

85. Chandler, "An Airman's Perspective," 11–13.

86. Ibid., 14–19.

87. Greg Jaffe and Shailagh Murray, "Gates Seeks Sharp Turn in Spending," *Washington Post*, 7 April 2009, 1.

88. US Joint Forces Command (USJFCOM), *The Joint Operating Environment*, 2008, 43, http://www.jfcom.mil/newslink/storyarchive/2008/JOE2008.pdf.

89. Richard Halloran, "PACAF's Vision Thing," *Air Force Magazine*, January 2009, 54–56.

90. 2008 *Report to Congress of the U.S.-China Economic and Security Review Commission* (Washington, DC: GPO, 2008).

91. AFSPC announced on 24 October 2008 that the Twenty-fourth Air Force would be stood up to accomplish the USAF cyberspace mission underneath AFSPC.

92. Colin Clark, "New Cyber COCOM Likely," *DODBuzz.com*, 6 March 2009.

93. USJFCOM, *Joint Operating Environment*, 50.

94. DoD, *Quadrennial Defense Review Report*, 6 February 2006, 29, http://www.defenselink.mil/qdr/report/Report 20060203.pdf.

95. USJFCOM, *Joint Operating Environment*, 51.