



## Union of Concerned Scientists

Citizens and Scientists for Environmental Solutions

# Anti-Satellite (ASAT) Technology in Chinese Open-Source Publications

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## Introduction

Americans are justifiably concerned about China's military space programs, particularly China's efforts to develop anti-satellite (ASAT) weapons. Unfortunately, U.S. assessments of these programs lack credibility because they are based on limited information from a small set of poorly evaluated Chinese sources. U.S. government reports on Chinese ASAT programs are not well documented and in some cases contain information that is demonstrably wrong.<sup>1</sup> Non-governmental assessments, which tend to rely on the information contained in government reports, suffer from the same shortcomings.

Limited Chinese language proficiency contributes to this situation. Multiple assessments conducted by the U.S. Government Accountability Office (GAO) and the Department of Defense over the past several years indicate that many of the specialists working on China do not meet the language proficiency requirements of the positions they hold.<sup>2</sup> Many of the non-governmental analysts writing on Chinese ASAT technology cannot read or speak Chinese. Insufficient language skills restrict many American analysts to the small and unrepresentative sample of Chinese sources that have been translated into English.

Poor source selection is another reason American assessments of Chinese ASAT technology lack credibility. The Foreign Broadcast Information Service (FBIS), the open source research arm of the Central Intelligence Agency, provides many of the translations referenced in U.S. reports on Chinese military affairs. FBIS tends to focus on Chinese newspapers, magazines, and web-logs; the reliability of these sources is often questionable and they generally do not contain specific information on subjects as technical or complex as ASAT technology. FBIS also employs hundreds of independent contractors as translators who are not trained in aerospace engineering, Chinese military terminology, or many of the other specializations needed to properly evaluate Chinese open source publications that refer to ASAT technology. The quality of the translations is, not surprisingly, uneven and inconsistent. The translations often fail to convey nuances important to understanding and

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<sup>1</sup> Gregory Kulacki and David Wright, "A Military Intelligence Failure? The Case of the Parasite Satellite," August 16, 2004, [http://www.ucsusa.org/global\\_security/china/page.cfm?pageID-1479](http://www.ucsusa.org/global_security/china/page.cfm?pageID-1479), accessed November 8, 2008 and Gregory Kulacki and David Wright, "New Questions About U.S. Intelligence on China," September 15, 2005, [http://www.ucsusa.org/jump.jsp?path=/assets/documents/global\\_security/NASIC-analysis-final-9-15-05.pdf](http://www.ucsusa.org/jump.jsp?path=/assets/documents/global_security/NASIC-analysis-final-9-15-05.pdf), accessed November 8, 2008.

<sup>2</sup> Government Accountability Office (GAO), "Foreign Languages: Five Agencies Could Use Human Capital Strategy to Handle Staffing and Proficiency Shortfalls," GAO-02-237, January 31, 2002; GAO, "Foreign Languages: Staffing Shortfalls and Related Information for the National Security Agency and Federal Bureau of Investigation," GAO-C-02-258R, January 31, 2002; GAO, "Foreign Languages: Workforce Planning Could Help Address Staffing and Proficiency Shortfalls," GAO-02-514T, March 12, 2002.

interpreting the text that would be noticed by experts familiar with both the language as well as the subject matter.

A third problem is that analysts are often not careful enough in assessing the credibility of sources and the knowledge, authority, and motivations of authors. This has led to strongly worded opinion and advocacy pieces, and the writings of students or low-level military officers, being quoted and repeated in the United States as though they represent authoritative revelations about internal policy discussions within the Chinese leadership.

A key purpose of this paper is to demonstrate that there is a much larger universe of higher quality Chinese sources that can and should be consulted. China may not be as transparent as the United States, but it does publish technical and non-technical research on military space technology in open sources. It also makes this research very easy to access. China operates a national digital library called the China National Knowledge Infrastructure (CNKI). At present CNKI contains over 30 million unique Chinese-language publications dating back to 1915 and it adds an average of 10,000 new items every day.<sup>3</sup> The full Chinese-language text of these publications can be searched from any computer anywhere in the world that has access to the Internet.

For the analysis in this paper, we conducted a full-text search of the Chinese academic and professional journals contained in the CNKI national digital library to find articles that discuss ASAT weapons and technology. The search returned 1,486 articles published between 1971 and 2007 that contain the character string *fanweixing*, which represents the Chinese term for “anti-satellite” (the search was conducted prior to China’s January 2007 destruction of its FengYun-1C satellite). These articles were written by 957 different lead authors from 328 different work units and were published in 292 different Chinese journals. By comparison, one relatively recent American analysis of China’s ASAT programs produced for the U.S.-China Economic and Security Review Commission was based on 20 Chinese articles from 14 publications, as well as three Chinese books, published between 1992 and 2006. The author claimed this list was “exhaustive” because it “drew from all Chinese language material including Chinese professional military or aerospace technical journals and texts available through open source.”<sup>4</sup>

Analysis based on open sources has its limitations, but it can provide useful information when used appropriately. Some individual papers by authoritative authors can provide useful, specific information. Moreover, referencing a larger cross-section of Chinese-language sources exposes trends and provides insights that can be missed by analysts who base their conclusions on a handful of Chinese articles. Consulting a wider variety of authors and publications can help analysts better assess the quality, credibility and purpose of the information they contain. It makes it less likely that an analyst might place undue emphasis on the writings of a particular author, mistake Chinese summaries of American writing as original Chinese analysis, or portray statements by marginal figures in the People’s Liberation Army (PLA) as official Chinese military doctrine. Similarly, placing individual articles in a broader context is necessary to give readers confidence that the article conveys accurate and meaningful information about Chinese doctrine or policy.

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<sup>3</sup> China National Knowledge Infrastructure, <http://www.global.cnki.net> , accessed May 11, 2009.

<sup>4</sup> Commissioned Research Study for the U.S.-China Economic and Security Review Commission, “An Assessment of China’s Anti-Satellite and Space Warfare Programs, Policies and Doctrines” prepared by Michael P. Pillsbury, January 17, 2007, [http://www.uscc.gov/researchpapers/2007/FINAL\\_REPORT\\_1-19-2007\\_REVISIED\\_BY\\_MPP.pdf](http://www.uscc.gov/researchpapers/2007/FINAL_REPORT_1-19-2007_REVISIED_BY_MPP.pdf), accessed July 7, 2008. The author excluded the vast majority of Chinese open sources because he did not consider them to be “mainstream” or because they did not “explicitly recommend that China should pursue one or more specific options or programs.”

Finally, articles by Chinese authors can show how Chinese analysts are viewing U.S. actions and programs, and what they see as most important or threatening.

The articles returned by our search obviously do not include “classified” papers. There are classified Chinese sources in the CNKI library, and several were returned in our search for articles referring to ASAT technology, but not surprisingly the full text of those articles could not be downloaded.<sup>5</sup>

The scale of the digital library project and the volume of the publications it contains should remind American researchers that the Chinese government no longer exercises the kind of editorial control over the content of Chinese publications that it did in the early days of the People’s Republic. China’s leaders currently manage the content of publications by requiring licenses to publish, and through the regular dissemination of guidelines that determine which topics cannot be discussed in print. Chinese editors call the guidelines “red lines.” Chinese authors censor themselves in order to avoid crossing these lines, but otherwise have considerable latitude in what they can write. As a result, the existence of these macro-level controls does not mean everything that is published in China reflects the perspective, opinions or preferences of the Party leadership—contrary to what is frequently assumed in the west. There is quite a bit of room between China’s “red lines” that allows for significant disagreement. And all of this is taking place in an increasingly competitive commercial environment where many publications are expected to turn a profit and therefore need to publish content that attracts readers.

Our study provides a guide to how the question of ASAT technology has been discussed over a period of several decades in a large and comprehensive set of Chinese publications. It does not attempt to detail or even summarize China’s ASAT policy or assess ASAT technology; those tasks are beyond the scope of this paper. Instead it summarizes the types of articles available on this topic, details the history of China’s internal discourse about anti-satellite technology, identifies some of the individuals and organizations involved in that discourse, and assesses the content and quality of what they publish. The goal is to make U.S. analysts more aware of the broad and diverse set of Chinese sources on ASAT technology and to help analysts better assess the purpose and credibility of these sources before they use the information those sources contain to make judgments about Chinese capabilities and intentions.

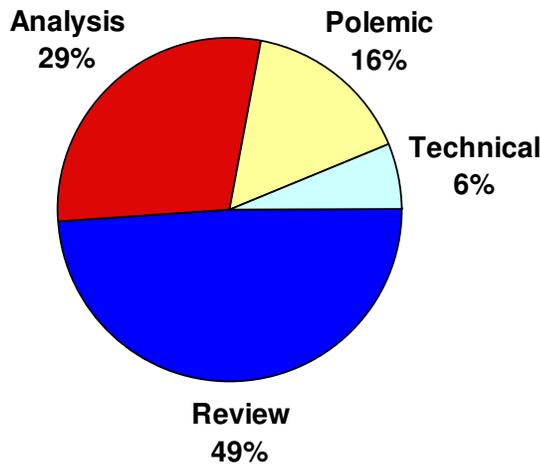
### **A Typology of Chinese Sources on ASAT Technology**

The nearly 1,500 ASAT articles returned in our search fall into four broad categories: (1) reviews of relevant articles, events, or activities—both domestic and foreign; (2) analyses of the articles, events, or activities; (3) polemic and propaganda articles; and (4) technical studies of relevant hardware or applications. The articles were divided among these categories as shown in Figure 1. We discuss each of these categories below.

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<sup>5</sup> There are also some “internal” publications in the database, such as *Keji Dangan*, the publication of an official body called the Special Committee for Scientific and Technical Accomplishments Archive. Internal publications are not necessarily secret or classified. They are privately distributed to designated subscribers, usually confined to the institutions or organizations that publish them. Universities, for example, have scores of small-distribution internal publications, as do factories and enterprises. The fact that they are not generally available does not imply that they are more authoritative than other sources. Many of these internal Chinese publications are not part of the CNKI digital library, however, and some may contain references to ASAT technology.

**Figure 1: Types of Chinese Articles Referring to ASATs (1971-2007)**



**(1) Review Articles:** Nearly half of the Chinese articles returned in our search are secondary sources that contain reviews of information, opinion, and analysis from other sources. Most of the information contained in articles in this category, including information about Chinese technologies or policies, comes from foreign publications and not from original Chinese sources. Authors of review articles summarize and present salient information and analysis without adding original commentary or interpretation.

One of the most troubling shortcomings of U.S. inquiries into Chinese ASAT programs is a failure by U.S. analysts to distinguish Chinese reviews of foreign writings from articles containing original Chinese research or discussions of Chinese views or policy. A most telling example involves an essay written by a junior Chinese military officer named Wang Hucheng that was translated into English by FBIS.<sup>6</sup> Many well-respected American analysts cite Wang's essay, "The Soft Ribs and Strategic Weaknesses of the American Military," as evidence of Chinese views on American military vulnerabilities in space.<sup>7</sup> Yet all of the specific information about U.S. weaknesses contained in

<sup>6</sup> Wang Hucheng, "Meiguo de Junshi 'Ruan Lei' yu Zhanlüe Ruodian" ("The Soft Ribs and Strategic Weaknesses of the American Military"), *Liaowang*, Vol. 27, July 3, 2000, pp. 32–34. (The FBIS translation reference number is FBIS, CPP20000705000081.)

<sup>7</sup> This article has been cited in more than a dozen articles by American analysts, and is used to suggest that Wang's views reflect how the Chinese leadership approaches space issues. The earliest article is Al Santoli, ed., "Beijing Describes How to Defeat U.S. in High-tech War," *China Reform Monitor*, No. 331, September 12, 2000. Later citations include: Phillip Saunders, Jing-dong Yuan, Stephanie Lieggi, and Angela Deters, "China's Space Capabilities and the Strategic Logic of Anti-Satellite Weapons," July 22, 2002, <http://cns.miis.edu/pubs/week/020722.htm>, accessed November 8, 2008; Maj. Richard J. Adams and Col. Martin E. France (Air Force Space Command), "The Chinese Threat to U.S. Space Superiority," *High Frontier: The Journal for Space & Missile Professionals*, 1:3, Winter 2005, p. 18; Kevin Pollpeter, "The Chinese Vision Of Space Military Operations" in *China's Revolution in Doctrinal Affairs: Emerging Trends in the Operational Art of the Chinese People's Liberation Army*, ed. by James Mulvenon and David Finkelstein (Arlington, VA: Rand Corporation and the Center for Naval Analysis, 2006), p. 360; Col. J. Kevin McLaughlin and Col. Chris D. Crawford, "A Roadmap for Air Force Space (Part I)," *High Frontier: The Journal for Space & Missile Professionals*, 3:4, August 2007, p. 23; Richard Fisher, Jr., "China's Direct Ascent ASAT," January 20, 2007, <http://www.strategycenter.net/research/detail.asp>, accessed November 8, 2008. The most recent and one of the most

Wang's essay is taken directly from U.S. sources, including the Quadrennial Defense Reviews of 1997 and 2001, statements by former National Security Agency Director John McConnell and former Chief of Naval Operations Adm. Jay Johnson, an unnamed 1998 U.S. Air Force report, and the 1998 *U.S. Space Command Long-Term Plan*. While the author includes a few rhetorical questions and original statements to organize his essay, Wang was not offering his analysis on the subjects he addresses, or the views of other Chinese analysts or policy-makers, but was merely summarizing information and ideas he extracted from American sources.

Because American analysts failed to understand what they were reading, Wang's article is commonly portrayed as an indication that the Chinese military has aggressive intentions in space, a portrayal that alarmed U.S. policy makers because it suggests that Chinese analysts have identified exactly those vulnerabilities U.S. military planners are most concerned about. The article does indicate a general Chinese interest in these vulnerabilities, but it does not by itself say anything about Chinese intentions or military policy.

One American expert has suggested review articles can be ignored.<sup>8</sup> But by illustrating what attracts the attention of Chinese authors, review articles offer an important window into understanding their interests and concerns. Review articles can also help American analysts identify and understand the sources of some of the information that influences the Chinese debate. However, because so many of the references to ASAT technology that appear in review articles are from foreign secondary sources, American analysts need to distinguish between Chinese restatements of the content of foreign sources and original Chinese commentary or analysis. This usually requires a careful reading of the entire original Chinese document. Too often American analyses rely on a couple of sentences plucked from a translation—especially translations of the abstracts of Chinese articles. This practice, which is unfortunately common, can be very misleading.

**(2) Analytic Articles:** Nearly a third of the Chinese sources that refer to ASAT technology are articles that include original Chinese analysis of domestic, foreign, or international events, including diplomatic initiatives, wars, elections, new technologies, or changes in foreign policy. Like review articles, publications in this category tend to be based on foreign secondary sources, but they also offer some insight into how the author understands and employs the information or ideas he or she presents.

A good example is “Space Warfare & Laser Weapons: Trends in the Development of Missile Defense” published in March 1979.<sup>9</sup> Four years before the United States announced its Strategic Defense Initiative, and more than a decade before the Gulf War, which many U.S. analysts characterize as a turning point in China's approach to military space technology, the authors of “Space Warfare & Laser Weapons” explore trends in the development of military applications of

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direct assertions that Wang's views represent original Chinese thinking is Ashley J. Tellis, “Punching the U.S. Military's ‘Soft Ribs’: China's Antisatellite Weapon Test in Strategic Perspective,” *Carnegie Endowment Policy Brief*, No. 51, June 2007. See also, Ashley J. Tellis, “China's Military Space Strategy,” *Survival* 49:3, September 2007, pp. 41-72 and Ashley J. Tellis, “China's Space Weapons,” *Wall Street Journal*, July 23, 2007.

<sup>8</sup> Michael P. Pillsbury, “An Assessment of China's Anti-Satellite and Space Warfare Programs, Policies and Doctrines,” Commissioned Research Study for the U.S.-China Economic and Security Review Commission, January 17, 2007, [http://www.uscc.gov/researchpapers/2007/FINAL\\_REPORT\\_1-19-2007\\_REVISIED\\_BY\\_MPP.pdf](http://www.uscc.gov/researchpapers/2007/FINAL_REPORT_1-19-2007_REVISIED_BY_MPP.pdf), accessed July 7, 2008.

<sup>9</sup> Ji Shipan, Li Minghu, “Kongjian Zhanzheng yu Jiguang Wuqi: Dandao Daodan Fangyu de Fazhan Qushi (Space Warfare & Laser Weapons: Trends in the Development of Missile Defense),” *Xiandai Fangyu Jishu (Modern Defense Technology)*, No. 3, 1979. pp. 1-31.

space for imaging, electronic intelligence, early warning, ocean observation, navigation, and communication satellites. They also call attention to Pentagon concerns about American dependence on these space systems and their vulnerability to attack. “It’s a natural law,” the authors write, “that where there is a sword there must be a shield, where there are satellites, satellite interceptors.” The authors argue that “technological breakthroughs...in infrared sensing, adaptive optics, lasers, precision guidance, micro computing, aerospace, particle beam and other weapons will lead to a fundamental change in strategic defenses.” They also argue that these changes would eventually undermine arms control efforts between the United States and Soviet Union that restrict the development of missile defense and ASAT systems.

This article is interesting because it shows that Chinese analysts were observing and thinking about these issues much earlier than many western observers assume. This is not surprising, of course, given the missile defense and ASAT activities of the United States and Soviet Union during this period.

One of the challenges for American analysts working with translated Chinese sources is distinguishing analysis from polemics. Reading the original Chinese offers important clues in tone, style and phrasing that can make this distinction clearer. Nuances of the original Chinese language are often lost in translations and their absence can obscure or distort the author’s views. This is especially true for translations produced by contractors like those commonly used by FBIS, who are generally not familiar with the subject of the articles they translate.

Even when an article is properly identified as primarily analysis it is still important to assess its quality and credibility. This requires determining something about the background, knowledge, and authority of the author. In many cases authors identified as being at military institutes, with the implication they are credible on military issues, do not have research backgrounds in the subjects they discuss, or they use language that calls into question the integrity of their analyses. Many of the PLA authors cited frequently by American analysts in regard to Chinese ASAT technology do not have a career history that indicates expertise in space technology, access to Chinese policy-makers, or participation in Chinese military planning.

**(3) Polemic Articles:** Nationalist rhetoric, institutional indoctrination, and political propaganda account for most of the articles that fall into this third category of Chinese articles, which constitutes one-sixth of the total returned by our search. It also includes Chinese articles that present arguments based on assumptions about the motivations of individuals or governments, the premises of political theories, or the dictates of ideology. These articles present opinions rather than analysis.

A typical example is the article “Space Power and National Security,” which was published in the journal of an academic institute run by the General Armaments Department (GAD) of the People’s Liberation Army. The author, Major General Chang Xianqi, advocates for Chinese development of their national “space power” by repeatedly raising suspicions about American intentions:

*“From the very beginning of his term of office, Bush Jr. renewed determination to deploy a national missile defense system and clearly strengthened alliances and military cooperation between America, Japan and South Korea. On January 22, 2001, only his second day in*

*office, the American Air Force, from their base in Colorado, carried out their first 5-day simulated space war exercise.”*<sup>10</sup>

The author attempts to persuade with rhetoric rather than logic. The text is littered with clichés, such as “space is not only the ultimate military high ground; it is the high frontier of national security.” Chang also believes there are historical laws of technological development and its relationship to warfare that allow him to predict the future. In his article he claims that “as the militarization of space and the ‘spaceification’ of the military continue to accelerate, war in space will be unavoidable.”

While Chang’s military rank may make him sound credible, he is an academic administrator who spent most of his career at one institution, the Academy of Equipment Command & Technology, a PLA institute that publishes the journal where his article appears.<sup>11</sup> Although he eventually rose to become President of the Academy, and holds what would appear to American observers as a high military rank, Chang’s vita defines him as a marginal figure in the Chinese military. The rank of Major General in the PLA does not confer the same breath of experience and accomplishment as it does in the U.S. Army. The Academy of Equipment Command and Technology is essentially a vocational college that trains the managers and technicians who work in China’s satellite launch facilities and weapons proving grounds. The primary focus is on teaching, not research, and students select from a small number of specializations such as computer networking, image processing, signals processing and satellite tracking. The fact that Chang’s career was confined to this one mid-level educational institution, and that he remained there as a professor even after his presidency, is a strong indication that Chang does not play a significant role in the formation of Chinese military doctrine or the implementation of Chinese military policy. He also does not hold a significant position in the Chinese Communist Party, having not been elected, even as an alternate, to the Central Committee.

As a result, Chang does not appear to be an authoritative source on this subject. One American analyst argues that Chinese military “doctrine” is “developed by military researchers and academics” like Chang.<sup>12</sup> Perhaps, but given the lackluster biographies of many of the PLA authors on military space issues it is incumbent on U.S. analysts who make this argument to provide some evidence that these academics are as consequential as they claim. One cannot simply assume that anyone from the PLA who writes on these issues is reflecting an established Chinese consensus on ASAT technology.

It is reasonable to assume that PLA polemics on space warfare provide perspective on how ASAT technology is discussed within Chinese military circles. However, a difficult but essential task confronting American analysts is interpreting what role, if any, these polemics play in the formation of Chinese military doctrine and the conduct of Chinese military planning. While polemic articles may in some cases reflect strongly held views that underlie Chinese concerns, they are most often

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<sup>10</sup> Chang Xianqi “Kongjian Liliang yu Guojia Anquan (Space Power and National Security),” *Zhuangbei Zhihui Jishu Xueyuan Xuebao (Journal of the Academy of Equipment Command and Control Technology)*, Vol. 6, 2002, p.4.

<sup>11</sup> Formally affiliated with the Commission on Science and Technology for National Defense (COSTIND), the Academy trains the technicians that work at China’s launch sites, tracking stations, satellite control centers and related work units. Zhongguo Junxiao Wang (China Military School Network), <http://www.cn-sina.cn/junxiao/ShowArticle.asp?ArticleID=1193>, accessed July 8, 2008.

<sup>12</sup> Kevin Pollpeter, "The Chinese Vision Of Space Military Operations" in *China’s Revolution in Doctrinal Affairs: Emerging Trends in the Operational Art of the Chinese People’s Liberation Army*, ed. by James Mulvenon and David Finkelstein (Arlington, VA: Rand Corporation and the Center for Naval Analysis, 2006), p. 330.

used to advocate positions that *contradict* official policy. Indeed, the strident language used by Chang and others in support of an increased Chinese emphasis on space warfare suggests resistance to their ideas, and in many of their articles these authors call on Chinese political authorities to do more to prepare for the conflict in space they believe to be inevitable. In this case, such articles may actually indicate exactly the opposite of what they are commonly believed to show, that is, that the positions they are espousing are not currently official policies.

There is a similar group of authors in the United States who also believe their government is not doing enough to prepare for a military conflict in space. What is interesting about the Chinese literature is that many of the arguments and much of the language used by PLA authors on military space issues is borrowed from their U.S. counterparts. Chang's paper is constructed using American terminology such as "high frontier," "space control," "space dominance," and "space deterrence," which appear in his article in quotation marks. An important question for American analysts is whether the PLA academics who write these articles are articulating original Chinese military theory, or whether they are parroting the views of the American authors they have encountered in the course of their research.

**(4) Technical Articles:** The final and the smallest category of Chinese articles returned in our search consists of detailed discussions of specific weapons systems, technology, software, or methodologies for solving logistical or operational problems. While making up only six percent of the total, this nevertheless corresponds to nearly 100 articles. More so than the others, articles in this category provide meaningful information about China's current and future capabilities. This includes assessments of foreign technology, which sometimes contain useful information about Chinese technical capabilities.

A good example of the sources in this category is an October 2004 article published by the same PLA journal that published the polemic example above. The author of this piece works for the Shanghai Institute of Satellite Engineering. His article attempts to determine the best way for China to deploy, maintain and progressively improve an ocean surveillance system that can identify, track and target the warships of foreign states.<sup>13</sup> After assessing the suitability of U.S. and Russian approaches to ocean surveillance, and comparing them to China's current capabilities, he recommends that China initially deploy an experimental three-satellite ocean-surveillance system that could provide limited regional coverage. He also suggests that China could add some electronic intelligence packages on this initial constellation that would provide some immediate military utility while testing the technology China needs for a fully-functioning ocean surveillance capability.

While this article does not represent official policy on this issue, it provides information about Chinese systems that is not available from other sources, and shows how those familiar with the technology view the current situation and possible future directions.

### **Applying the Typology**

Many of the articles returned in our search contain sentences or segments that might be said to fit into another category. The comment about swords and shields in our analytic example could be categorized, in isolation, as polemic. But in the context of the larger article it is clear that it is just a

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<sup>13</sup> Huang Hanwen, "Weixing Haiyang Mubiao Jianshi Xitong Fenxi yu Fazhan Shexiang (An Analysis and Tentative Development Plan for Satellite Ocean Target Observation Systems)," *Zhuangbei Zhihui Jishu Xueyuan Xuebao (Journal of the Academy of Equipment Control Technology)*, October 2004, Vol. 15, No. 5, pp. 44-49.

literary device used to characterize observed phenomena, and not an assumption about the way the world works that prejudices what the authors observe. The comment about American space war games in our polemic example could be seen as a review of a relevant event. Yet it is obvious, even in isolation, that the author was less interested in the details of the games than he was in the fact that they took place immediately after President Bush assumed office, as if the timing were self-evidently indicative of the new President's hostile intentions toward China.

If understood and used properly, all four types of sources provide meaningful information about Chinese interests and concerns regarding anti-satellite weapons. Review articles present a fairly detailed record of Chinese concerns about various technologies, particularly foreign technologies. Analytic articles provide insights into how Chinese concerns are internalized and may be acted upon. Polemical articles provide a view of domestic Chinese debates on these issues and contain language, concepts and prejudices that inform Chinese foreign and domestic positions on ASAT issues—positions that may need to be addressed in informal discussions or formal negotiations. Technical analyses reveal useful information about Chinese research and development programs and the capabilities these programs can produce.

### **History of Chinese References to ASAT Technology**

One of the advantages of looking at a large number of sources selected from a database with over 30 million Chinese-language articles dating back to 1915 is that the results returned from the search expose patterns in Chinese writing about ASAT technology that emerge over time. These patterns not only reflect developments in Chinese views on ASAT technology, but they also reflect broader trends in Chinese history, Chinese education, Chinese publishing and the relationship between Chinese intellectuals, Chinese institutions and the Chinese political leadership. Understanding these trends is essential to interpreting the content and relevance of information from Chinese sources.

Analysts should find this broader context useful in identifying when China became interested in ASAT technology, which Chinese individuals and institutions expressed that interest and how their work on ASAT technology evolved. This set of sources can provide better information and richer analysis to policy makers than what is currently being produced from small, unrepresentative samples of the Chinese literature taken out of their historical, institutional and political context.

#### *Chinese References to ASAT Technology in the 1970s*

The earliest Chinese article referring to ASAT technology returned in our search was published in 1971, less than a year after China launched its first satellite.<sup>14</sup> Despite the Cultural Revolution-era title “Imperialist America’s Laser Weapons Development Plan,” the article dispassionately summarizes two articles published a year earlier in *Aviation Week & Space Technology*. The two *Aviation Week* articles describe early U.S. laser weapon research carried out by the Defense Advanced Research Project Agency and the U.S. Air Force in the late 1960s and early 1970.<sup>15</sup>

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<sup>14</sup> No named author, “Meidi Jiguang Wuqi Fazhan Guihua (Imperialist America’s Laser Weapons Development Plan)” in *Lixue Jinzhan (Advances in Mechanics)*, 1971, No. 4, pp. 3-5.

<sup>15</sup> No named author, “Laser Weaponry Seen Advancing, *Aviation Week & Space Technology*,” Vol. 92, No. 2, January 12, 1970, pp. 16-17 and No named author, “Laser Advances May Evolve New Weapons,” *Aviation Week & Space Technology*, Vol. 92, No. 10, March 9, 1970.

The next three of the thirteen articles from the 1970s returned in our search discuss anti-satellite weapons in the context of the Cold War competition between the U.S. and the U.S.S.R. Again, *Aviation Week and Space Technology* is cited as the source of information about U.S. and Soviet satellite launches and ASAT tests. In addition there are, however, some noteworthy observations from the author of all three of these articles: Ye Huaming. Ye was one of a handful of young scholars who were sent to study in the Soviet Union, where he graduated from the Moscow Rozovskii Military Aerospace Engineering Institute. He went on to hold high-level positions in the Chinese Ministry of Defense and appears to have had the ear of senior Chinese policymakers, such as Premier Zhou Enlai.<sup>16</sup>

In one of these early articles Ye argues that the United States was not concerned about the apparent gap between U.S. and Soviet ASAT capabilities because, in his view, the Americans believed the threat from ballistic missiles was more pressing. Ye noted that U.S. research and development on missile defense had produced capabilities that could be used to “track, approach, discriminate and destroy” satellites.<sup>17</sup> This early connection between missile defense and ASAT technology is a persistent theme in Chinese discussions about the two technologies that continues today.

Twelve of the fourteen articles from the 1970s returned in our search are from one publication, *Modern Defense Technology*, which ran Ye’s articles in its inaugural edition. The journal is published by the No. 2 General Design Department of the Second Academy, where Ye served in a leadership role during the 1960s and 1970s. At the time it was part of Fifth Academy of the Chinese Ministry of Defense. Established in 1956, the Fifth Academy was China’s first official aerospace organization. The General Design Department of the Second Academy was one of numerous subsidiary organizations that became independent of the Fifth Academy as the Chinese aerospace industry grew. Eventually these institutes were reorganized and consolidated into large commercial enterprises that are no longer a part of the Ministry of Defense but still retain strong ties to the military. Today the General Design Department, which continues to publish *Modern Defense Technology*, is a subsidiary of the China Aerospace Industrial Corporation (CASIC), the crown jewel of China’s high-tech industries and one of the country’s largest state-owned enterprises.<sup>18</sup>

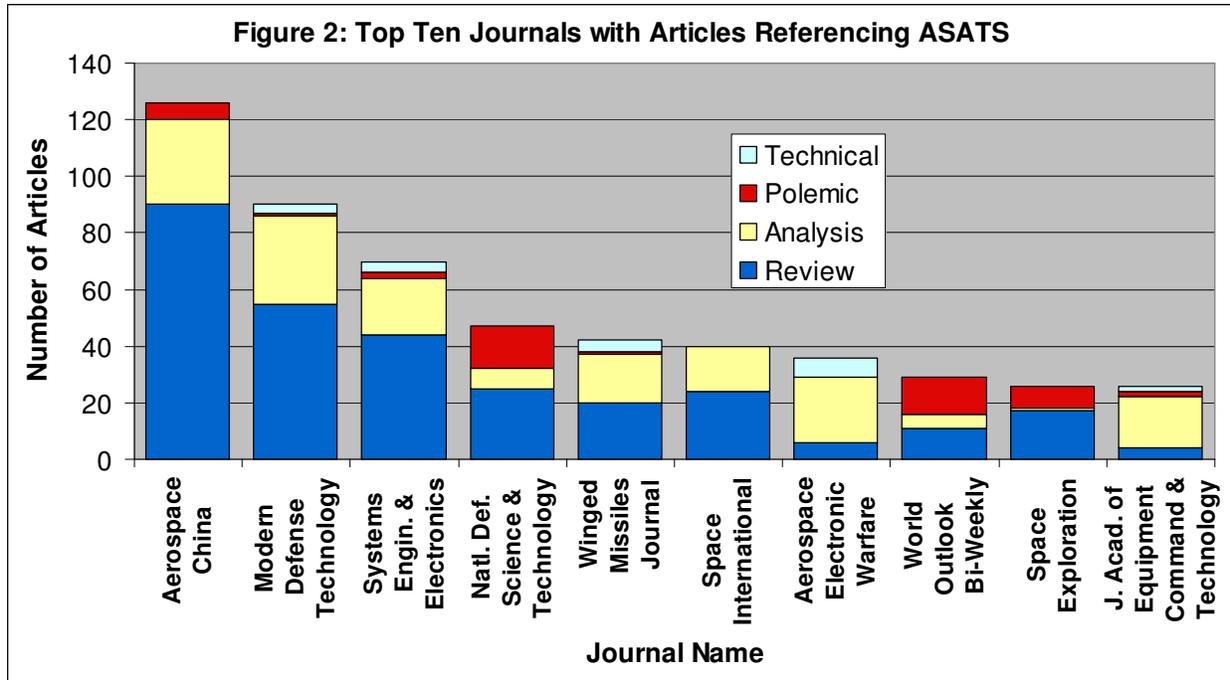
Over the years *Modern Defense Technology* grew into its role as a trade journal for the Chinese aerospace and defense industry. It is the second leading source of Chinese articles that refer to ASAT technology, behind another CASIC publication, *Aerospace China*, which began publishing in May 1978 under the title of *World Missiles and Aerospace* (see Figure 2).

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<sup>16</sup> His father was Ye Jian, a leading military personality who was killed in a plane crash in 1946. Afterwards Zhou Enlai raised Ye Huaming as his adopted son. Ye worked in the Fifth Academy under Chinese aerospace legend Qian Xuesen, and later became the Vice-Director of the Second Academy, which published the journal *Modern Defense Technology* where his articles appeared.

<sup>17</sup> Ye Huaming, “Sulian he Meiguo de Fanweixing Wuqi Gaikuang (USSR and U.S. ASAT Weapons Situation),” *Xiandai Fangyu Jishu (Modern Defense Technology)*, Vol. 1, 1973.

<sup>18</sup> Today CASIC employs over 100,000 people, including 40,000 engineers and technicians, and comprises 180 subsidiary organizations, enterprises and research institutions.



That a high-ranking, well-trained and well-connected individual like Ye would rely on information from U.S trade magazines like *Aviation Week and Space Technology* speaks volumes about the small size and meager resources of the Chinese aerospace community during the 1970s. His first article was published in the waning years of China’s Great Proletarian Cultural Revolution (1966-76), which had devastated Chinese higher education. Colleges and universities were dysfunctional, intellectuals were sent to the countryside and the unqualified “graduates” of the worker-peasant-soldier schools came to occupy positions of authority in the bureaucracy that many of them continued to hold for decades after the Cultural Revolution ended. This may be why trade journals like *Modern Defense Technology* had to rely so heavily on articles based on foreign sources to help their readers keep pace with developments in the field.

The Ministry of Defense and the Fifth Academy were somewhat insulated from the political turmoil of the time, and China managed to launch its first satellite on April 24, 1970 during the middle of what many Chinese scholars now call the “ten years of chaos.” Despite this accomplishment, however, the international isolation and economic stagnation of the period imposed serious constraints. A severe shortage of qualified scientists, engineers, technicians and managers would inhibit Chinese progress for a generation.

#### *Chinese References to ASAT Technology in the 1980s*

Throughout the 1980s China worked to fill the gaps left by the Cultural Revolution with information and expertise from abroad. They hired foreign experts to work and teach in China, sent their own students and scholars to foreign universities and negotiated contacts with foreign firms designed to facilitate technology transfer.

These trends in the country’s economic and intellectual development facilitated an expansion of China’s space activities that is reflected both in the increased number of articles mentioning ASATs and in the increased number of journals that published these articles. During the 1980s, *Modern*

*Defense Technology* and *Aerospace China* were joined by 28 other publications in featuring articles referring to ASAT technology. In the lead was another Second Academy publication, *Systems Engineering and Electronics*. Established in 1979, it accounts for 55 of the 198 ASAT references from the 1980s returned in our search, and is the third leading source overall. Interestingly, only 15 additional ASAT references appear in *Systems Engineering and Electronics* from 1990 to the present. The reason for this is not clear. It may reflect a shift in the interests of the journal editors as increasing specialization and growing numbers of Chinese engineers made *Systems Engineering and Electronics* into a journal with a more specialized audience of engineering professionals rather than just a trade publication of the aerospace community.

The range of topics and the quality of Chinese observation and analysis appearing in Chinese aerospace publications steadily improves throughout the 1980s as Chinese writers become more familiar with the technology and with the foreign literature they review. More than half of the articles published in the 1980s were review articles and three quarters of these were reviews of foreign publications, policy statements, or events. As Chinese analysts stepped up their observations of others, they also started to exhibit evidence of independent research. The first three Chinese technical analyses returned in our search were published towards the end of the decade. Moreover, the foreign sources that appear in Chinese review articles shift from trade publications like *Aviation Week and Space Technology* to more scholarly sources, like the conference proceedings of the Institute of Electrical and Electronics Engineers (IEEE) and the American Institute of Aeronautics and Astronautics (AIAA).

At the same time, articles referring to ASAT technology also start appearing in journals with broader and less informed authors and audiences, such as *Liaowang*. This news and opinion weekly is run by the New China News Agency and began publishing in 1981. Not surprisingly, given the role of political propaganda in Chinese news magazines, 80% (19 of 24) of the articles from *Liaowang* that refer to ASAT technology fall into the polemic category. Based on citations in U.S. reports on Chinese military space programs, FBIS has translated a disproportionate number of articles from *Liaowang* while ignoring more serious and, according to our search results, more numerous Chinese sources of information about ASAT technology. This is akin to Chinese intelligence officers focusing their assessments of American intentions on a disproportionate selection of citations from the editorial pages of the *Washington Times*, which is known for reflecting a particular view of these issues.

Chinese social scientists also start to weigh in on military space issues during the 1980s. Nine articles from our search appear during the later half of the decade in *Soviet, Central Asian & East European*, the journal of an institute of the same name that is part of the Chinese Academy of Social Science (CASS). These articles are all focused on the arms race between the Soviet Union and the United States, especially the Reagan administration's "Star Wars" initiative. The references to ASAT technology in these articles are tangential, an item in lists of the military advantages and disadvantages of the two superpowers. But they appear in the context of serious discussions about the importance of advanced technology, market economics, and science education. The authors argue the emerging American advantage in the Cold War competition between the two technologically advanced powers demonstrates that particular weapon systems or military capabilities are less important to a nation's security than a dynamic economy driven by scientific and technological development.

The conclusions of these social scientists matched Chinese funding and policy decisions. Their publication coincided with a letter penned by four senior Chinese scientists urging the Chinese

leadership to respond to America's "Star Wars" program. In March 1986, Deng Xiaoping decided to support the scientists' key recommendation: the establishment of a massive project to promote Chinese scientific and technical research. Project 863, like many Chinese initiatives, takes its name from the date of Deng's decision. The leadership struggled for six months over the question of whether to focus on the military research and development program called for by the four scientists, or on a much broader program focused on basic scientific research—a strategy advocated by other Chinese scientists. The State Council and the Central Committee put together an ad hoc group of 100 of the nation's leading scientists and engineers to debate this question, but they could not come to a consensus either. In December 1996, Deng stepped in to settle the dispute in favor of supporting basic research and civilian development programs, while instructing the military to focus on dual-use technologies that could also be used to boost China's military capabilities.<sup>19</sup>

Deng's policy did not require every Chinese military research and development program to be focused on dual-use technologies—some focused on technologies with direct military applications. According to interviews with Chinese colleagues familiar with the history of the development of kinetic energy interceptors, such as that used in China's January 2007 ASAT test, the program began at about this time, most likely as a direct result of the concerns about "Star Wars" expressed by the four Chinese scientists.<sup>20</sup>

#### *Chinese ASAT References to ASAT Technology in the 1990s*

Many American analysts argue that Chinese interest in ASAT technology grew out of concerns within the Chinese military about the use of space technology in the 1991 Gulf War.<sup>21</sup> Lt. Col. Mark Stokes, whose research on Chinese ASAT technology is cited frequently by American analysts, called this "China's Gulf War Syndrome." He defined it as "a rude awakening for the CMC [China's

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<sup>19</sup> Wang Semei, *Shenzhou Internal Report (Shenzhou Neibu Baogao)*, New World Press, Beijing, 2005, pp. 10-12.

<sup>20</sup> Gregory Kulacki and Jeffrey Lewis, "Understanding China's Anti-satellite Test," *Nonproliferation Review*, Vol. 15, No. 2, July 2008, pp. 335-347.

<sup>21</sup> The claim appears in many American analyses. Some of the more prominent are James A. Lewis, *China as a Military Space Competitor*, Center for Strategic and International Studies, August 2004, [http://www.csis.org/media/csis/pubs/040801\\_china\\_space\\_competitor.pdf](http://www.csis.org/media/csis/pubs/040801_china_space_competitor.pdf), accessed June 1, 2006; Phillip Saunders, Jing-dong Yuan, Stephanie Lieggi, and Angela Deters, "China's Space Capabilities and the Strategic Logic of Anti-Satellite Weapons," Center for Non-proliferation Studies, July 2002, <http://cns.miis.edu/pubs/week/020722.htm>, accessed June 1, 2006; David O. Meteyer, *The Art of Peace: Dissuading China from Developing Counter-Space Weapons*, INSS Occasional Paper 60, USAF Institute for National Security Studies, USAF Academy, Colorado, August 2005, p. 12; Mark A. Stokes, "Space, Theater Missiles, and Electronic Warfare: Emerging Force Multiplier for the PLA Aerospace Campaign," presented at *Chinese Military Affairs: A Conference on the State of the Field*, 26-27 October 2000, Fort McNair, Washington DC, Aerospace I Panel, [http://www.ndu.edu/inss/China\\_Center/CMA\\_Conf\\_Oct00/paper16.htm](http://www.ndu.edu/inss/China_Center/CMA_Conf_Oct00/paper16.htm), accessed June 1, 2006; and Mary C. FitzGerald, "China's Evolving Military Juggernaut," in *China's New Great Leap Forward: High Technology and Military Power in the Next Half-Century*, Hudson Institute, 2005, [http://www.hudson.org/files/publications/China\\_Great\\_Leap\\_Forward.pdf](http://www.hudson.org/files/publications/China_Great_Leap_Forward.pdf), accessed June 1, 2006. The assertion was also a focal point of a review of China's space program presented by Dean Cheng of the Center for Naval Analysis (CNA) at the Henry L. Stimson Center on March 3, 2005 (<http://www.stimson.org/?SN=WS20050307785>, accessed November 8, 2008). A somewhat less definitive agreement with this consensus appears in Joan Johnson-Freese, "Strategic Communication with China: What Message about Space?" *China Security*, Issue No. 2, 2006, World Security Institute, p. 51, [http://www.wsichina.org/attach/china\\_security2.pdf#search='Strategic%20Communication%20with%20China:%20Space'](http://www.wsichina.org/attach/china_security2.pdf#search='Strategic%20Communication%20with%20China:%20Space'), accessed June 1, 2006.

Central Military Commission] and the military-industrial complex.”<sup>22</sup> According to the Chinese articles returned in our search, however, China’s military-industrial complex began following the development of ASAT technologies as early as 1971, and by the end of the 1980s they had established an increasingly competent community of analysts who were publishing technically detailed reviews and analyses of U.S. military space technology in journals established by key aerospace research institutes with very close ties to the Chinese military. Moreover, in response to what leading scientists in the Chinese military-industrial complex were observing in the United States and the Soviet Union, China started the research and development program that led to the technology used in the January 2007 ASAT test five to six years before the Gulf War.

The mistake Stokes makes in interpreting Chinese thinking based on his use of Chinese sources is revealing, and it is one that is repeated, regularly, by American analysts who cite Chinese publications without considering their historical, institutional, and social context. There was a significant expansion of the number of published articles referring to ASAT technology following the Gulf War, but it was not within the aerospace community or the Chinese military-industrial complex. The war was a global media phenomenon that carried the now iconic televised images of “smart bombs” to hundreds of million of Chinese viewers for whom television itself was advanced technology. In the wake of this media event, a new and very different group of Chinese authors began writing about military space technology for a new audience. The authors were not aerospace or military experts writing for Chinese military leaders, but non-experts writing for average Chinese people who were, like many others all over the world, rudely awakened by the images of modern warfare they saw on TV.

The different Chinese reactions to the Gulf War, expert and non-expert, are evident in the number of articles returned in our search. What we see is that while the number of articles written for non-expert audiences grows significantly, the number written for expert audiences actually declines.

In particular, the number of articles referring to ASATs in the top three aerospace community journals—*Aerospace China*, *Modern Defense Technology*, and *Systems Engineering and Electronics*—declined from 129 during the 1980s to 76 during the 1990s.

Three additional journals—*Winged Missiles*, *Aerospace Electronic Warfare* and *Space International*—begin publishing articles that refer to ASAT technology around this time, and are the fifth, sixth and seventh most prolific sources in our search results. *Winged Missiles* and *Aerospace Electronic Warfare* are published by CASIC-affiliated research institutes. *Space International* is published by the Beijing Academy of Space Technology Information. This academy is affiliated with the China Aerospace Corporation (CASC), the nation’s other state-run aerospace conglomerate, which, like CASIC, has close ties to the Chinese military.

Together these three journals published an additional 29 articles that refer to ASAT technology during the 1990s. Even when combined with the articles published in the top three Chinese aerospace journals, the total number of articles from these six expert sources published during the 1990s is still less than of the number with ASAT references published by the top three alone during the previous decade.

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<sup>22</sup> Mark A. Stokes, “China’s Strategic Modernization: Implications for the United States,” Strategic Studies Institute, U.S. Army War College, September 1999, p. 12.

It is not clear what the reason is for this decline in post-Gulf War articles referring to ASAT technology in the Chinese aerospace journals that are most closely associated with China's military-industrial complex. It occurred even though the number of experts employed by this complex continued to grow at a steady pace. Throughout the 1990s an increasing number of college graduates with advanced degrees in science and engineering found opportunities for employment in an expanding aerospace industry, especially after the Chinese leadership committed to a piloted space program in 1992. The growing interest within the expert community in the piloted program, along with an increase in commercial Chinese space launches, may have contributed to the decline as scientists and engineers switched to these new areas.

The decline in articles in our search from Chinese aerospace publications associated with the military-industrial complex stands in sharp contrast to the 64% overall increase in the total number of articles in our search published in the 1990s. This is due to a five-fold increase in the number of Chinese journals publishing articles referring to ASATs—up from 30 during the 1980s to 155 during the 1990s. This increase reflects a growing general interest in these issues as well as changes in Chinese publishing, which was rapidly expanding. There were 5,751 Chinese periodicals in 1990 and the number grew to 8,187 by the end of the decade—a 70% increase.<sup>23</sup> More Chinese people were reading more publications.

The additional articles that refer to ASAT technology are spread across a wide variety of periodicals but two main types account for most of them: (1) publications owned by institutes and organizations either directly under the Chinese Academy of Science (CAS) or under a scientific association such as the Chinese Physics Society, and (2) publications owned by institutes and organizations in the PLA.

Many of the mentions of ASAT technology that appear in the first group of publications are tangential—they consist of one or two sentences and are not the principal subject of the article. This is illustrated by several articles in *Modern Physics*, the journal of the Chinese Physics Society. The journals in this first group of publications are intended for the wider science community rather than military scientists. Many are targeted at students and faculty, such as *Knowledge is Power*, a journal of the Chinese Society of Science and Technology. ASAT references in these educational publications sometimes occur in the context of broader discussions about modern military and space technologies. One interesting example occurs in a discussion of directed energy technologies in an article in *Modern Physics* entitled “Physics and Modern Warfare.” The authors end a general discussion of modern warfare by noting that “physics can be used not only to make weapons, but at the same time to make weapons obsolete and prevent war.”<sup>24</sup> As in many of the articles returned by our search that are in science-related publications, the tone and purpose of this article is didactic, intended to engage the larger, non-military community of Chinese physicists in a discussion of the broader military relevance of their profession.

The references to ASAT technology in the second major group above—PLA publications—are less erudite but equally didactic. China's military colleges and institutes are very different than their U.S. counterparts. They are the product of decades of political struggle that produced a system where the Party, and not the State, controls the gun. Chinese military colleges and institutes are administered by the Political Department of the PLA, whose primary function is to insure that every soldier in the Chinese military remains loyal to the Chinese Communist Party. Like Chinese universities, military academies are becoming more professional, but their classes in “military theory,” like the classes in

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<sup>23</sup> National Bureau of Statistics of China, <http://www.stats.gov.cn/>, accessed February 4, 2008.

<sup>24</sup> Li Bin and Du Xiangwan, “Physics and Modern Warfare,” *Modern Physics*, Vol. 20, July 1991, pp. 577-580.

“political theory” taught in every other Chinese educational institution, are meant to inculcate the worldview of the Chinese Communist Party. Most articles on ASAT technology in Chinese military publications should be interpreted in this context, not as articles intended to give the reader detailed insight into Chinese military policy.

The PLA publication with the most articles referring to ASAT technology during this period is *China Militia*, published by the People’s Armed Militia Committee, which reports to the Central Military Commission.<sup>25</sup> Like many PLA publications, *China Militia* is a vehicle for communicating basic information to the rank and file, their families, and the general public. The articles referring to ASATs it published are clearly aimed at a general audience with little or no expertise. For example, four of the twelve articles that refer to ASATs are from a series entitled *Advanced Military Technology: 100 Questions and Answers*.<sup>26</sup> Another article is from the third in a four part series on political education called ‘95 *People’s Militia Political Education Four Lessons (3): People’s War under Modern Conditions*.

Chinese readers would refer to these types of articles as “propaganda,” a word that does not always have the negative and ideological connotations in China that it does in the United States. The articles in *China Militia* use language and phraseology that suggests the author’s intent is to place the advent and use of military space technology in a larger frame of reference, not to discuss specific Chinese policies. The political disturbances in Tiananmen Square in 1989, the 1991 Gulf War, and the collapse of the Soviet Union were all important parts of the political environment that shaped Chinese perceptions of the period. Military authors, writing to educate general audiences or indoctrinate soldiers, depict military space technology as a tool the United States could use to exercise global hegemony. They were written to help Chinese soldiers and their families understand the political and ideological implications of military space technology, not to signal a shift in Chinese military strategy.

Many of the articles we found in publications from more prestigious PLA educational institutions serve the same didactic and political functions, including those that appear in journals like *National Defense*, which is published by the Chinese Academy of Military Science. Although many U.S. analysts view the Academy as a leading authority on Chinese military doctrine, many of its publications, including *National Defense*, are often used to provide political and ideological guidance to Chinese military officers. The articles in our search from *National Defense* published during the 1990s are slightly more sophisticated versions of the articles in *China Militia*, written for a more educated audience, but designed to present the same basic information and the same political frame of reference, rather than to discuss details of Chinese military policy.

When interpreted in this context, the explosion of PLA articles on military space technology in the 1990s, which American analysts like Mark Stokes refer to as China’s “Gulf War Syndrome,” does not represent a dramatic shift in the priorities of the Chinese military-industrial complex or new Chinese military doctrine. The articles were part of a political campaign meant to reassure both soldiers and officers that the Chinese leadership was aware of the changing nature of modern military technology and would take steps to prepare the PLA to respond to these developments, but without saying in a detailed or authoritative way how it would respond.

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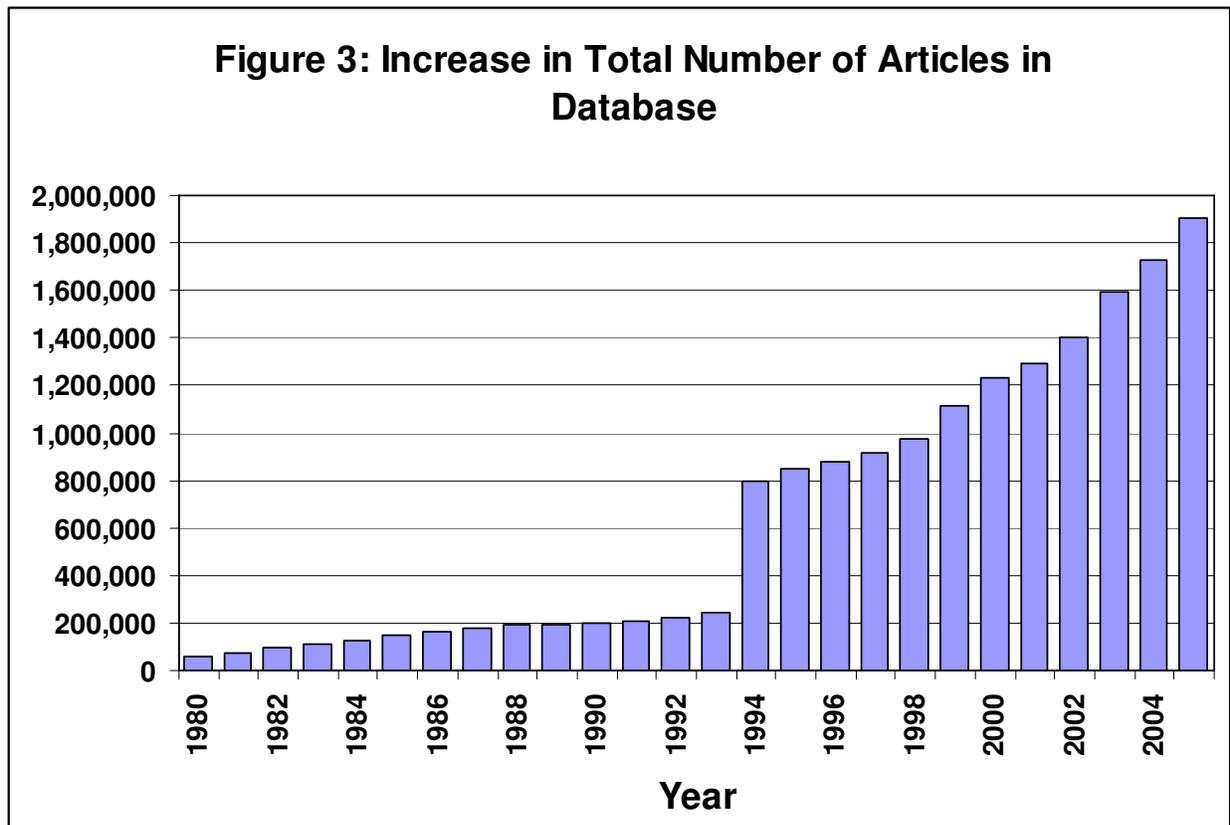
<sup>25</sup> *Zhongguo Minbin*, a monthly magazine published by the PLA Press beginning in 1984.

<sup>26</sup> They appear in the June, July, August and November editions of *China Militia* in 1994.

## Contemporary Chinese References to ASAT Technology

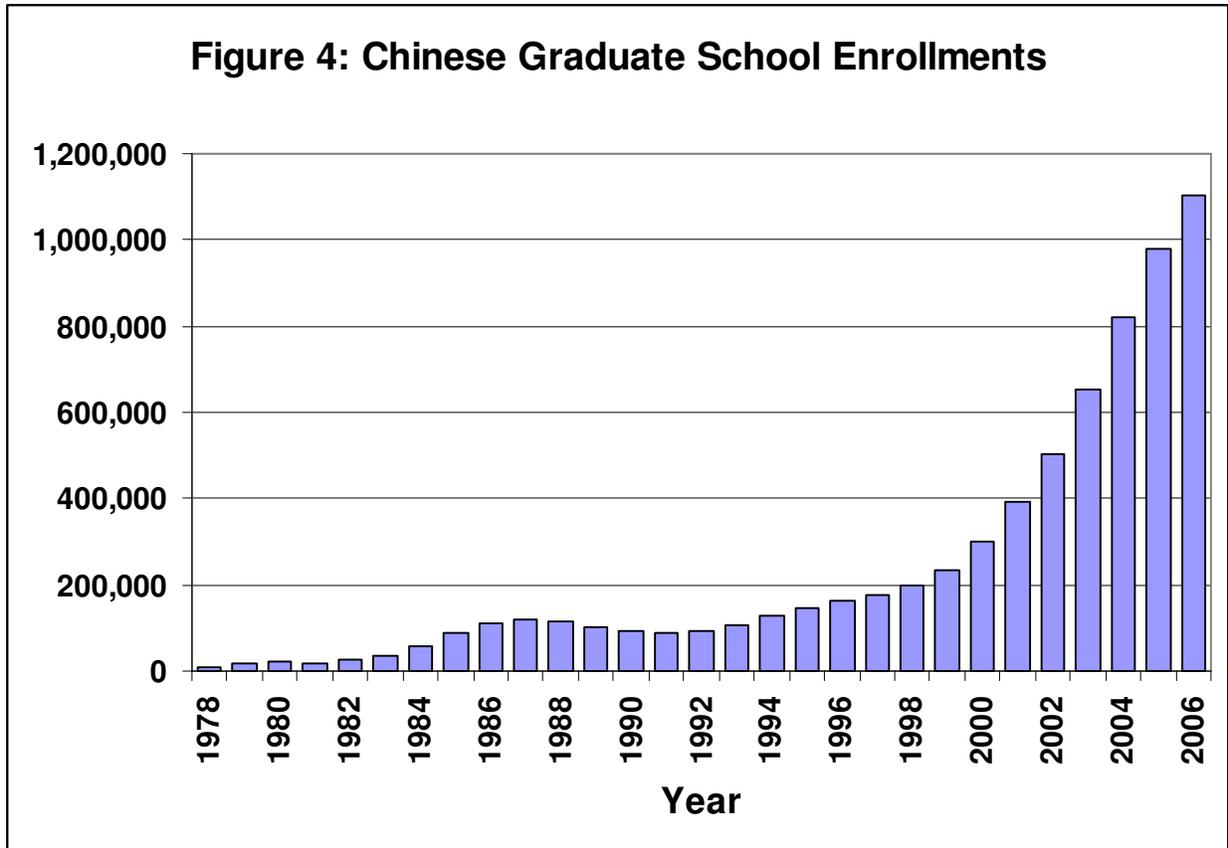
The number of Chinese articles referring to ASAT technology returned in our search rose sharply in recent years. It increased from 198 in the 1980s to 328 in the 1990s to 780 during the period from 2000 to 2007. The number of journals publishing these articles continued to expand as well, from 30 in the 1980s to 155 in the 1990s to 207 by 2007. And unlike in the 1990s, there was a modest increase in the number of articles in our search from the leading Chinese aerospace journals published by institutions closely associated with the Chinese military-industrial complex.

The dramatic rise in the number of these articles since 2000 follows a general growth of the total number of articles in the periodical database we used to conduct the search, which reflects in part an expansion of Chinese publishing that started in the 1990s (Figure 3).<sup>27</sup> The increase also occurs in the context of an equally impressive rise in Chinese graduate school enrollments (Figure 4).<sup>28</sup> These broad trends demonstrate that China no longer suffers from the shortage of highly trained intellectual workers that it experienced in the wake of the Cultural Revolution. Thus, a large part of the increase in articles mentioning ASAT technology since 2000 can be attributed to the increased intellectual output of a greater pool of Chinese authors writing for an increasing number of Chinese journals.



<sup>27</sup> In 1994 the Chinese government encouraged all Chinese publications to switch over to a digital publishing format so that articles would immediately enter the CNKI databases upon initial publication. This could explain the dramatic one-year jump in the number of articles in the periodical database from 1993 to 1994.

<sup>28</sup> China National Bureau of Statistics, <http://www.stats.gov.cn/tjsj/ndsj/2005/indexch.htm>, accessed May 25, 2006.



As this new generation of Chinese intellectuals emerges, many of the senior scientists and engineers who helped shape Chinese military technology policy since the founding of the People’s Republic are retiring. A younger and much larger generation of Chinese scientists and engineers now staffs the country’s growing military-industrial complex. This is especially true in the Chinese aerospace industry, where the average age of the cadre of scientists and engineers working on the Shenzhou piloted space program is just under thirty-five.<sup>29</sup>

In the early days of the People’s Republic the peasant revolutionaries who took over the country, especially Mao Zedong, did not understand the science behind Hiroshima and Sputnik. They did appreciate the military utility of science and valued the advice of the handful of Chinese scientists and engineers at their disposal, most of whom were educated and employed abroad. Qian Xuesen, the founder of China’s space program, was educated and worked at Caltech. Deng Jiaxian, the father of China’s nuclear bomb, was a graduate of Purdue. Recent histories of the development of China’s nuclear weapons and space programs document how this small group of trusted scientists and engineers helped the political leadership understand and apply modern military technology. Today, a much larger Chinese scientific and technological establishment engages China’s political, military and economic elites in decision-making processes that are less intimate and more complex. Powerful corporate and bureaucratic interests now play a greater role in Chinese decisions about the production and procurement of advanced military technology.

<sup>29</sup> Zhongguo Hangtian Wancheng Rencai Daiji Kuayue, <http://edu.people.com.cn/GB/1053/3766013.html>, accessed May 25, 2006.

The challenge for American analysts is determining how the new generation thinks about space and security, and what kinds of advice they are providing to the Chinese military and political leadership. Given the breathtaking social, economic, and technological changes that are shaping the world view of this new generation, it is unwise to rely on the past as a guide, or to assume China's emerging leaders will make decisions about advanced military technologies like anti-satellite weapons in the same way as their predecessors.

The articles that refer to ASAT technologies that appear in recent Chinese publications also need to be interpreted in the context in which they were written. Highly technical articles published in the leading aerospace journals sometimes begin with a cursory reference to how their research might be relevant to ASAT technology or space warfare. However, while technically correct, these statements often have little to do with the rest of the paper and may not indicate an interest in or pursuit of such applications.

For example, the forward of a recent article in *Systems Electronics and Engineering* on the radar recognition of non-cooperative space objects includes a few sentences on U.S. and Soviet ASAT research in the 60s and 70s as well as the danger of space debris. Interestingly, however, after providing this justification for their research, which is funded by Project 863, the authors go on to summarize foreign and domestic research on radar recognition and tracking of space objects but never return to the security issue raised in the opening paragraph. In this case the authors were working at a national lab affiliated with the National University of Defense Technology in Changsha, but similar statements appear in many other articles from authors working in non-military aerospace research institutes.

This pattern of mentioning ASAT technology and space warfare in the context of research being described by Chinese authors writing for the technical journals most closely associated with the Chinese military industrial complex suggests two possible explanations. The first is that the propaganda spread by non-experts in the mass media and the "theorists" in China's war colleges during the 1990s have had an influence on the new generation of Chinese aerospace professionals and these ideas form the context for their work. The second and more likely explanation is that researchers seeking grants may feel the need to suggest real-world applications and offer national security justifications for some of their research in order to secure the approval of funding from military agencies. This practice is also common in the west. Interviews with researchers in Chinese institutions affiliated with the aerospace industry support this interpretation.<sup>30</sup>

An important question for U.S. analysts is whether the behavior of China's new generation of military technocrats is an indication that the Chinese leadership is aggressively pursuing certain space warfare technologies. Or, are the comments we see in the research papers of Chinese engineers published since 2000 little more than a cursory nod from the aerospace community to a propaganda line from the center known to influence grant awards. The consistent vacuity of the language on space warfare in these technical articles strongly suggests that professional opportunism rather than military doctrine, is behind the ASAT references we observe in most of the open source literature. On the other hand, if Chinese scientists and engineers feel they have to kowtow to space war propaganda to get their research funded, what does that say about the government's view of this issue, and about the rationality and integrity of the funding process and the new generation taking over China's military-industrial complex?

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<sup>30</sup> This observation is based on informal conversations with more than fifty Chinese students and scholars in several leading Chinese aerospace research centers from 2002 to 2007.

## Concluding Remarks

American policy makers know less than they could about the history and current status of China's anti-satellite research, development, and testing programs. Correcting this situation should be a priority for U.S. policymakers since erroneous and incomplete information about these programs can lead to ineffective or counterproductive policies and responses.

There is a large and rapidly growing set of open source Chinese-language publications that refer to anti-satellite weapons. These sources have widely varying levels of credibility, and are written for different purposes and different audiences. The value of these sources depends on the analyst's ability to accurately interpret and understand both the information they contain as well as the audiences they are meant to serve. This requires the analyst to understand the historical, cultural and institutional context in which they were written. Consumers of American reports on Chinese ASAT technology must be aware that reports presenting quotes or ideas from Chinese articles without this context can be misleading or simply wrong.

Some observers in the U.S. military do seem to be aware there are problems with U.S. intelligence and analysis on China. Unfortunately, the Pentagon does not yet seem to be taking effective steps to address these shortcomings.

Increasing the number of linguistically proficient American analysts with an adequate understanding of the historical, social and institutional influences expressed in the Chinese literature could remove at least some of the ambiguity from U.S. perceptions of Chinese intentions. U.S. policy makers should take meaningful steps to deal with the persistent shortage of properly trained analysts.

While working to improve their understanding of Chinese publications, American analysts should also keep in mind that their reports on Chinese military space programs, and American reports on military space issues generally, are featured prominently in Chinese publications and read carefully by Chinese analysts. Of the 780 articles that refer to ASAT technology published in China during the last seven years, 309 of them focus on foreign military space technology. Of those 309 articles, 251 (81%) focus on the reports and activities of the United States. This aspect of the Chinese ASAT literature demonstrates that American aerospace professionals, military planners, and policymakers have a significant influence on the discussion of ASAT technology in China. Consequently, U.S. authors may want to think carefully about the messages they are sending to their Chinese counterparts through their publications.

Finally, the intelligence value of the interaction between Chinese and American analysts that occurs through their respective examination of each other's publications could be improved by personal interaction between the two analytical communities through exchanges, conferences, and other more direct forms of communication. In addition to increasing their Chinese language proficiency, especially with the less formal and constantly changing aspects of the language that cannot be acquired at a distance, increased contact with their Chinese counterparts can help U.S. analysts make more informed judgments about the quality of what they read, the motivations of Chinese authors, and the ability of these authors to influence Chinese policy makers or Chinese military doctrine. In fact, regular exposure to Chinese individuals and experience functioning in Chinese social or professional settings may be necessary for U.S. analysts to place what they read in the proper context.

Based on our analysis, it is both the limited set of Chinese publications read by U.S. analysts, and the failure of these analysts to properly contextualize the information they find, that is primarily responsible for the poor quality of much of the existing U.S. analysis of the Chinese literature on ASAT technology.

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Gregory Kulacki is Senior Analyst and China Project Manager in the Global Security Program at the Union of Concerned Scientists. He is fluent in Mandarin Chinese and an expert on cross-cultural communication between the United States and China. Dr. Kulacki received his PhD in political science from the University of Maryland in 1994, and lived in China for ten years, facilitating exchanges between academic, governmental and professional organizations in both countries. Since joining the Union of Concerned Scientists in 2002 he has focused on promoting and conducting dialog between Chinese and American experts on nuclear arms control and space security, as well as promoting the use of a broader set of Chinese-language documents in U.S. analysis.