2.1 Three Interpretations of ASAT Test

There is a rich body of literature in the form of newspaper and journal articles as well as congressional testimonies and military reports that dwell on China's military assertiveness in outer space and its January 11, 2007 direct ascent ASAT test. However, due to the brevity inherent in such works, and due to the time constraints they have been produced under, they often raise just as many questions as they answer. To date there is has been a serious lack of academic works focusing on the PRC's deepening level of military assertiveness in space and its implications for the U.S., and those that do exist seem to follow old viewpoints and arguments, thus failing to recognize the singular nature and true importance of this issue. This chapter will discuss the current viewpoints, not so much for the purpose of testing them theoretically, but rather to point out where they have erred and to link the key questions they share in order to provide a comprehensive analysis of the problems intrinsic to China's ASAT test.

Interestingly, the three broad views that have emerged in the wake of Beijing's anti-satellite test: 1) the view that China's test was intended to challenge the U.S. control of space, 2) the view that Beijing was seeking to force the U.S. into signing a space weapons treaty, and 3) the view that the ASAT test was a mistake which resulted from bureaucratic

miscommunication, all agree that the PRC test, which created the worst-ever cloud of man-made debris in the heavens,[60] was "deservedly met with international opprobrium."[61]

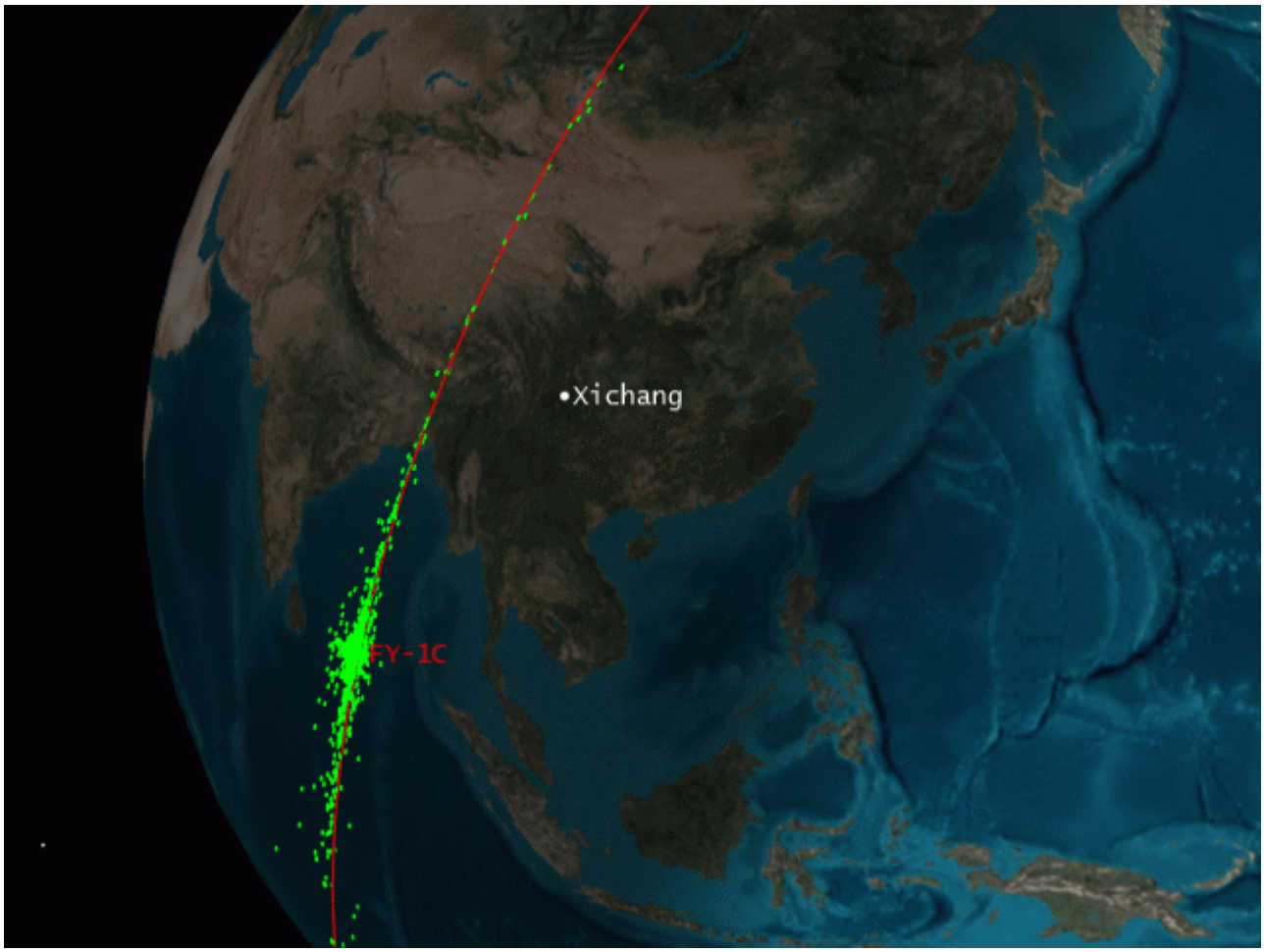

Figure 5: *Feng Yun*-1C debris five minutes after impact

Source: www.nautilus.org

[60] "The Militarisation of Space: Dangerous driving in the heavens," *The Economist*, January 19, 2008, 13.

[61] Theresa Hitchens, "U.S.-Sino Relations in Space: From 'War of Words' to Cold War in Space?" *China Security* (Winter 2007): 13.

2.2 ASAT Test and Space Debris

On January 11, 2007 a People's Liberation Army (PLA) mobile, solid-fuelled, KT-1 or KT-2 missile's kinetic-kill-vehicle (KKV) smashed head-on into the FY-1C weather satellite at an extremely high speed, creating over two million pieces of blast fragments according to the Union of Concerned Scientists.[62] These fragments then instantly became hazards to other satellites as they zipped around highly used orbits from 200km to 3,800km in altitude.[63] At 35,000 pieces larger than 1cm, according to estimates from NASA's Orbital Debris Program Office, the test was clearly the "worst single debris event ever."[64] NASA's official statement called the test "the single worst contamination of low Earth orbit during the past 50 years."[65] According to Heiner Klinkrad, head of the European Space Agency's space debris office, "Destroying a satellite at this altitude, in a sun-synchronous orbit, presents a debris problem about as serious as you can get" and he went on to speculate that some debris could stay in orbit for hundreds of years.[66] Air Force engineers later calculated that it will take a century for all the

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[62] Dale Armstrong, "Space preservation or space destruction?" *The Space Review*, March 12, 2007. available online at: http://www.thespacereview.com/article/825/1

[63] Craig Covault, "China's Asat Test Will Intensify U.S.-Chinese Faceoff in Space," *Aviation Week & Space Technology*, January 21, 2007. available online at: http://www.aviationnow.com/aw/generic/story.jsp?channel=awst&id=news/aw012207p2.xml

[64] Frank Morring Jr. "China Asat Test Called Worst Single Debris Event Ever," *Aviation Week & Space Technology*, February 11, 2007. available online at: http://freerepublic.com/focus/f-news/17903/posts

[65] Kevin Whitelaw, "The Problem of Space Debris," *U.S. News and World Report*, December 17, 2007. available online at: http://www.usnews.com/article/news/2007/12/04/the-problem-of-space-debris.html

[66] Peter B. DeSelding, "Debis from FY-1C Destruction Poses Long-Term Concern," *Space News*, January 29, 2007, 6.

pieces to fall out of orbit.[67]

The PLA's ASAT test represents an unprecedented environmental problem in this most heavily used realm of near-earth space. Not only did the test threaten the International Space Station (ISS), which has seen shrapnel from the test pass dangerously close, it also threatened hundreds of satellites owned by numerous companies and governments around the world. These satellites will continue to be at risk of debris strikes for decades to come.[68] The Air Force Space Command has identified and is tracking 2,229 pieces of debris produced by the test that are at least as large as a softball, "anything that size…would equate to instantaneous death for a satellite," according to Lt. Col Michael Mason.[69] Mason went on to say that the space surveillance network at Vandenberg Air Force Base saw a 20 percent jump in its space objects of concern after the test, and that in an average week there will be up to 200 incidents where one of America's 400 satellites will see a shard of FY-1C pass within three miles.[70] As a result of the test, international space-walking astronauts and China's own *Taikong Ren* or Taikonauts will also need to worry about debris strikes as well. The dangerous level of debris caused by the ASAT test is already more than apparent as over the past year satellites have been forced to move periodically to avoid the shrapnel.[71]

Mark Stokes, who as one of the Pentagon's top China specialists watched the Second Academy's development of counter-space weapons

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[67] Whitelaw, December 17, 2007.

[68] Hitchens, 14.

[69] Whitelaw, December 17, 2007.

[70] Ibid.

[71] *The Economist*, 13.

throughout the 1990's, also points out that "GAD's (General Armaments Department) Xian Space Tracking Center, which gets inputs from several locations, keeps meticulous records of space debris and would understand the implications of destroying a satellite at an altitude of around 800 kilometers."[72] International relations scholar Bates Gill observed that "in performing the test, Beijing not only demonstrated its capacity to threaten U.S. military assets in space but also showed a lack of concern for other countries' interests in the safe operations of satellites for day-to-day civilian activities, such as weather forecasting, financial transactions, and telephone calls."[73] The space scholar Theresa Hitchens pointed out that China's "cavalier attitude toward endangering other's satellites raises serious questions about Beijing's credibility as a responsible space-faring nation."[74] Michael Krepon, a strong advocate for an international treaty to ban weapons in space, said the test was a "predictable" and "unfortunate" response to U.S. space policies.[75] A Bush administration official stated "It's unfortunate that China is going down this path, no one has done this in over 20 years, and in that time, international cooperation is space has come so far. It is a bustling commercial, scientific and research arena."[76] A Russian Major General called the test "hooliganism"[77] despite the strategic partnership that

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[72] Email exchange with Mark Stokes, March 20, 2008.

[73] Bates Gill and Martin Kleiber, "China's Space Odyssey: What the Antisatellite Test Reveals About Decision-Making in Beijing," *Foreign Affairs* (May/June 2007): 4.

[74] Hitchens, 14.

[75] Marc Kaufman and Dafna Lizner, "China Criticized for Anti-Satellite Missile Test," *Washington Post*, January 19, 2007, 1.

[76] Ibid.

[77] "Intelligence Brief: Russia Wary of China's Anti-Satellite Capabilities," *Power and Interest News*

bonds Moscow and Beijing, and the fact that Russian technology sales form the basis of China's space program.[78] In short, whatever else their disagreements, international observers seemed to unanimously agree that China's ASAT test was a negative development. Britain, Australia, Canada, India, Japan, Taiwan, South Korea and the European Union all joined the United States in protesting China's actions.[79] However, when faced with the question of what motivation lay behind the Chinese decision to risk international criticism and an arms race in space, observers' views differed markedly.

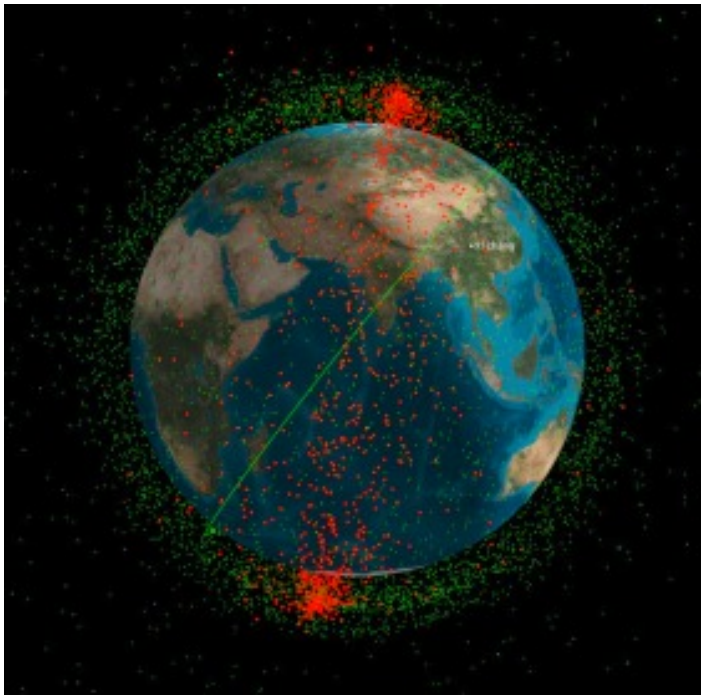

Figure 6: Debris attributed to Chinese ASAT test shown in red along with the orbit of the International Space Station represented by green line, other debris in green

Source: www.secureworldfoundation.org

Report, January 22, 2007. available online at: http://www.pinr.com/report.php?ac=view_report&report_id=605&language_id=1

[78] Vladimir Isachenkov, "Trial begins for Russian space company chief accused of leaking rocket technology to China," *Associated Press*, May 25, 2007, 2.

[79] Hitchens, 21.

2.3 ASAT as Challenge

The initial reaction to the untimely January 11, 2007 demise of the FY-1C satellite was a sense that China was sending a warning shot across the bow of U.S. military power.[80] U.S. Secretary of Defense Gates called it "troubling"; General Pace, Chairman of the Joint Chiefs of Staff, called it "very worrisome"; and Senator Kyl claimed it was a "threat" and a "provocation."[81] U.S. Air Force Chief, General Moseley, went even farther calling the test "a strategically dislocating event" that was "on par with the October 1957 Sputnik launch."[82] Jeffery Kueter, president of the George C. Marshall Institute, a nonprofit space and defense think tank stated, "They're saying they can hold our space-based, war-fighting capability at risk, and are putting into doubt our ability to challenge them. They're a rising space competitor."[83] Roger Cliff, a China specialist at the RAND Corporation, described it as part of China's military build-up which is intended to help China supplant the U.S. within a decade as the dominant military power in East Asia.[84] Another author agreed saying: "Beijing's rulers intend to acquire unequaled political, diplomatic, economic, and military power…They seek to become so strong that no other Asian nation can contemplate any major step without first gaining China's consent, a contemporary form of the tribute that China's

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[80] Gill and Kleiber, 1.

[81] Robert S. Dudney, "Moseley's Warning," *Air Force Magazine* (June 2007): 2.

[82] Anderson, 30.

[83] Kaufman and Linzer, 1.

[84] Roger Cliff, "China's Challenge," *San Diego Union-Tribune*, July 29, 2007. available online at: http://www.signonsandiego.com/uniontrib/20070729/news_lzle29cliff.html

emperors once demanded of vassal states."[85]

However, these perspectives on the Chinese ASAT test, while very ably explaining the *what* of the matter in limited institutional terms (what China did and what it means to certain concerns in the U.S.), fails to fully explain the more subtle *why* (why did they do it?) and the more important *what* (what do China's actions portend overall and what are China's intentions?). The idea that China's sophisticated muscle-flexing was little more than a warning shot meant to signal China's arrival in military space and the PRC's intention to dominate Asia seems superficial, and primarily motivated by preexisting institutional and political biases. While many in U.S. security and political circles seem aware of how significant Beijing's ability to shoot down a satellite in such a manner is, few seem willing to go beyond the surface level, knee-jerk reaction to delve into the deeps of China's intentions and motivations. Undoubtedly, the secretive, classified nature of military space and the highly charged political nature of U.S.-China relations greatly limit their ability to fully express themselves on the matter.

2.4 ASAT as Negotiation Tactic

The second commonly seen viewpoint on the Chinese ASAT test holds that Beijing authorized the ASAT test in a "ham-fisted attempt to focus international attention on the need to ban weapons in space."[86]

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[85] Halloran, 24.

[86] Gill and Kleiber, 1.

Indeed, in the wake of the explosive news that the PRC had broken the spirit (if not the letter) of existing international law governing outer space, many arms control advocates in the U.S. attempted to use the incident to advance their agendas. The director of the China Program at the World Security Institute, Eric Hagt, argues that the message behind the Chinese test was a rather "benign" one: the Chinese were reacting to growing U.S. threats they perceive in space. He claims "the test is consistent with both China's notion of active defense and its deterrence doctrine."[87] And Mr. Hagt goes on to say that the Chinese were reacting to America's pursuit of space control vis-à-vis its development of ASAT systems and space weapons which "pose an intolerable risk to China's national security."[88] Ultimately, he concludes that "part of the solution may come in the form of a renewed push for a space weapons ban treaty, a test ban treaty, a 'rules of the road' for all activities in space…"[89] In other words, Mr. Hagt (like many others) is arguing that the Chinese were acting defensively, and the U.S. should seek to accommodate them.

However, according to a special report in *The Economist*, the reality is that since the fall of the Berlin Wall the United States has "held back from putting weapons in space" and instead uses "space to preserve and extend the pre-eminent military power it enjoys on earth" with non-offensive, non-weaponized communications, reconnaissance and global positioning satellites.[90] This assessment is confirmed by a

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[87] Eric Hagt, "China's ASAT Test: Strategic Response," *China Security* (Winter 2007): 31.

[88] Ibid., 33.

[89] Ibid., 44.

[90] *The Economist*, 13.

number of official studies which point out the prohibitive costs, vulnerabilities and political repercussions of putting weapons in orbit.[91] Hagt's argument therefore falls somewhat flat, as it is hard to react to weapons which haven't been deployed nor are even funded for future development.[92] However, in fairness to Mr. Hagt, the U.S. military's evolving missile defense shield does have inherent ASAT abilities, as was clearly shown in a recent U.S. Navy shoot-down of a potentially dangerous, crippled intelligence satellite code named USA 193 that was on a collision course with earth.[93] In any event, it is questionable for some to assert that the Chinese ASAT test was intended to bring the U.S. to the bargaining table for two other reasons. The first is that according to Hagt's own assessment, the U.S. doesn't historically reward bad behavior (i.e. threats, breaches of international protocol, etc.). Beijing acting "irresponsibly" is more likely to strengthen calls in Washington for space weapons, and thus undermine such a treaty settlement rather than strengthen it.[94] The second reason is that, according to many pundits and experts alike, there is, unfortunately, no arms control solution to this problem.

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[91] Steven M. Kosiak, *Arming the Heavens: A Preliminary Assessment of the Potential Cost and Cost-Effectiveness of Space-Based Weapons* (Washington, D.C.: Center for Strategic and Budgetary Assessments, 2007), ii-iii.

[92] Benjamin S. Lambeth, "Footing the Bill for Military Space," *Air Force Magazine*, (August 2003): 1-2. See also: *The Economist*, January 19, 2008, 28.

[93] Robert Burns, "Shot at Satellite May come Wednesday Night," *The Associated Press*, February 19, 2008, and "US Missile Hits 'Toxic Satellite'," *BBC News*, February 21, 2008. See also Keir A. Lieber and Daryl G. Press, "U.S. Nuclear Primacy and the Future of the Chinese Deterrent," *China Security*, (Winter 2007): 66-89. For a counterpoint see Baker Spring, "The Still Enduring Features of the Debate Over Missile Defense," *Backgrounder* (February 6, 2007): 1.

[94] Eric Hagt, 36-40.

According to the scholar Ashely Tellis, because of the opaque, secretive nature of China's space program, not only would any space treaty be virtually impossible to verify, it also would not be in the national interest of the PRC to follow any such treaty even if it did sign it.[95] This point will be explored in greater detail later in the paper, but suffice it to say for now that the U.S. would arguably gain far much more in signing a verifiable space weapons ban treaty than China, because the U.S. has far more to lose in space than China, and the Chinese know it.[96] Another point well worth considering is that China's track record on adhering to international law and international treaties of this nature is historically poor. According to Even Medeiros, a China expert at the RAND Corporation and Bates Gill, an expert on China's security diplomacy, China is making some progress, but "many concerns remain regarding China's record and commitment to nonproliferation and arms control."[97] China has had (and in many cases continues to have) serious proliferation-related ties to Iran, North Korea, Pakistan, Saudi Arabia, Libya, Iraq and Syria. These include the sale of advanced and sensitive weapons and technologies, such as ballistic missile, nuclear and chemical weapon systems and technologies to the abovementioned states.[98] Beijing has also worked successfully to prevent the use of "national

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[95] Ashely J. Tellis, "China's Military Space Strategy," *Survival* (Autumn 2007): 44.

[96] Theresa Hitchens, *Future Security in Space: Charting a Cooperative Course* (Washington, D.C.: Center for Defense Information, 2004), 69-71.

[97] Bates Gill, *Rising Star: China's New Security Diplomacy* (Washington, D.C.: Brookings Institution Press, 2007), 75. See also Evan Medeiros, "Chasing the Dragon: Assessing China's System of Export Controls for WMD-related Goods and Technologies," *RAND Corporation*, September 26, 2005.

[98] Gill, 74-80.

technical means," or spy-satellites, to verify compliance to the Comprehensive Test Ban Treaty (CTBT). China made it considerably more difficult for countries to execute on-site inspections, and was the only country to conduct nuclear weapons tests through the final stages of the CTBT negotiations.[99] This history suggests to many that China would either cheat outright or work to water down any outer space weapons ban treaty, presuming that the definition of "space weapons" could even be agreed on, which is highly dubious.[100] According to China's own defense white paper, released in the year 2000, "The Chinese government resolutely opposes the attempts of some countries to use arms control and disarmament to weaken other countries" such as China.[101] Clearly, a space weapons ban treaty is not an attractive or practical option when it comes to China, and China's diplomatic double-speak on the militarization of space and its ASAT weapons testing only underscores a deepening sense of mistrust. Para-phrasing one pundit: Like so many other treaties, it is not needed for the countries that would comply, and it will be of no use for those who cheat.[102]

Many observers in the arms control typology, however, still give the views of those like Mr. Hagt credence, although with a twist. They take the view that China, as the "victim" of U.S. space dominance, has no other option than to use its ASAT weapons tests and its growing space

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[99] Ibid., 95-96.

[100] Tellis, 85.

[101] "China's National Defense in 2000," *Information Office of the State Council*, October 2000. available online at: http://news.xinhuanet.com/zhengfu/2002-11/18/content_633170.htm

[102] Jon Kyl, "China's Anti-Satellite Weapons and American National Security," *Heritage Lectures*, February 1, 2007. available online at: http://www.heritage.org/Research/NationalSecurity/h1990.cfm

technology as a "diplomatic trump card." This view argues that the U.S. and others have unfairly "sought to isolate the Chinese space program in ways large and small" such as blocking transfers of military technology to the PLA, blocking Chinese scientists' access to important space conferences and blocking Chinese participation in the international space station.[103]

But this argument simply falls apart under close scrutiny for two reasons. To begin with, it is difficult for many to sympathize with the notion that Beijing is the "victim" of international technology sanctions when one recognizes that the current bans on duel-use technology transfers began after the 1989 Tiananmen Square Massacre, which saw the PLA engage in the massacre of thousands of unarmed protesters (most of whom were young students) as well as an attack on the living quarters of U.S. embassy personnel. During end stages of the crack down, PLA soldiers sprayed the walls of a U.S. embassy apartment complex with machine gun fire, missing several American toddlers by inches. The attack was premeditated, and the Beijing government never apologized or admitted any wrongdoing for either Tiananmen or the U.S. embassy complex attack.[104] Since that time, the Chinese government has repeatedly rejected calls for political reform, and its Leninist political

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[103] Jim Yardley, "China uses space technology as diplomatic trump card," *International Herald Tribune*, May 24, 2007.

[104] James Lilley, *China Hands: Nine Decades of Adventure, Espionage, and Diplomacy in Asia* (New York: Public Affairs, 2004), 326-329.

90 James Mann, *About Face: A History of America's Curious Relationship with China, from Nixon to Clinton* (New York: Vintage, 2000), 348. James Mann, *The China Fantasy: How Our Leaders Explain Away Chinese Repression* (New York: Penguin Group, 2007).

system, despite some impressive reforms on the economic front, remains unchanged in any substantial way.[105]

It is also very important to note, as Bates Gill does, that in 1998 it was Chinese technology that allowed North Korea to conduct a surprise test-launch of a three-stage ballistic missile capable of reaching the U.S. It was this test that led President Clinton to sign legislation requiring the United States to deploy a national missile defense shield as soon as it was technically feasible.[106] Likewise, it was the Chinese proliferation of ballistic missile technology to Pakistan (from where it traveled to Iran and North Korea) that led the Bush administration, on September 1, 2001, to level new sanctions on China which prevented the resumption of most space-related cooperation with Beijing.[107] It is thus a combination of American and international concerns about China's human rights record, its authoritarian political system and its proliferation record that have kept China out of the international space community, not any malevolent intent on the part of the U.S. government. Furthermore, recent espionage cases have bolstered the sense that those concerns are well founded.

Another strong rationale behind Washington's avoidance of deeper space cooperation with the PRC is the significant threat of Chinese espionage. According to a recent Department of Defense report to congress, "U.S. Immigration and Customs Enforcement (ICE) officials have rated China's aggressive and wide-ranging espionage as the leading

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[106] Gill, 82-83.

[107] Ibid., 94-95.

threat to U.S. technology."[108] Another report warned that "Chinese espionage in the United States, which comprises the single greatest threat to US technology, is straining the US counterintelligence establishment."[109] Yet despite that fact (and the protests of many in the U.S. national security community), NASA's top administrator Michael Griffin made a historic visit to China in 2006, accepting an invitation to cooperate with the PRC, and even stated his belief that China had a future on the International Space Station.[110] The U.S. Congress was also showing signs of softening its stance on space cooperation with China in the run-up to the ASAT test.[111] Therefore, despite its past record, the PRC government was actually making inroads into the international space community prior to its ASAT test, and Beijing was not being backed into a corner as some would suggest.

2.5 ASAT as Mistake

The third and final viewpoint most commonly seen in the available literature argues that in conducting the provocative ASAT test "Beijing's

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[108] OSD, 2007, 28-29.

[109] "China pursuing aggressive spying program: US commission," *Washington (AFP)*, November 15, 2007. For a specific case of Chinese espionage see Jeremiah Marquez, "FBI: Letters link indicted engineer to Chinese official," *Associated Press*, March 30, 2007. See also "US Arrests Four 'Chinese Spies.'" *BBC News*, February 11, 2008.

[110] "NASA Administrator to Grad Students: China Trip is 'First Step,'" *NASA News*, September 25, 2008. available online at: http://www.nasa.gov/about/highlights/griffin_china.html

[111] Hagt, 39.

right hand may not have known what its left hand was doing."[112] Or in the words of the U.S. National Security Advisor, Stephen Hadley: "the question on something like this is, at what level in the Chinese government are people witting, and have they approved?"[113] Indeed, as Bates Gill points out: "This would not be the first time that the PLA concealed its operations from other parts of the Chinese security and foreign policy apparatus."[114] This argument is more persuasive when one views the PLA's recent track record because the PRC's military in the April of 2001 did not fully disclose what it knew about the collision of a Chinese fighter jet into a U.S. EP-3 reconnaissance plane off the coast of Hainan Island,[115] and this lapse resulted in the frustration of diplomatic efforts to quickly resolve the crisis.[116] Similarly, the PLA suppressed information about the spread of Severe Acute Respiratory Syndrome (SARS) in early 2003, despite military doctors being aware of the outbreak in southern China since January. Even when the deadly disease spread to large military hospitals in Beijing in February and March, the PLA did not report these cases to civilian authorities. In fact, it was only when an Army doctor leaked the story to *Time* magazine, which appeared in early April, did the Chinese Communist Party begin to confront SARS.[117] Likewise, in November 2004 the PLA's Navy did not

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[112] Gill and Kleiber, 2.

[113] David E. Sanger and Joseph Kahn, "U.S. Tries to Interpret China's Silence Over Test," *New York Times*, January 21, 2007.

[114] Gill and Kleiber, 2.

[115] Bill Gertz, "The Last Flight of Wang Wei," *Air Force Magazine* (July 2001): 52-53.

[116] Gill and Kleiber, 2.

[117] Ibid.

inform the Foreign Ministry its plans to transit a Han-class nuclear submarine through Japanese territorial waters, inciting another international incident.[118]

Thus, the argument that the ASAT test was a diplomatic blunder resulting from a PLA cover-up or miscommunication is not altogether unconvincing. However, as will be shown, that was not the case. In fact, the party leadership has been fully backing a broad range of ASAT testing for years, and prior to China's successful January 11, 2007 test, China had conducted three other similar direct-assent ASAT tests, all of which failed for various reasons, as well as a number of ground-based laser ASAT tests.[119] Therefore, no amount of PLA- Party-Foreign Ministry communication could have preventing the January 11, 2007 test because the communist party leadership had long before decided that the strategic, national security goals of the PLA were far more cogent than the Foreign Ministry's desire to placate and assure the world that China's rise would be a peaceful one.

In summation, there are three broad viewpoints or typologies one can gleam from the available literature in the wake of the Chinese ASAT test. The first focuses upon the idea that China's test was meant to be a warning shot signaling both Beijing's desire to deter U.S. actions and China's willingness to oppose the U.S. strategically in the Western Pacific. This line of thinking is most intelligently articulated by Ashely Tellis's,

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[118] Kevin Pollpeter, "Motives and Implications Behind China's ASAT Test." *China Brief*, January 24, 2007. available online at: http://www.jamestown.org/news_details.php?news_id216

[119] Tellis, 43.

"China's Military Space Strategy," in the journal *Survival*. The second typology argues that China's actions represent the PRC's desire to force the U.S. to the negotiating table. Eric Hagt's work "China's ASAT Test: Strategic Response," in the journal *China Security* is a good example of this viewpoint. And the final typology, represented by Bates Gill and Martin Kleiber's, *Foreign Affairs* article "China's Space Odyssey: What the Antisatellite Test Reveals About Decision-Making in Beijing," argues that the Chinese ASAT test was the result of bureaucratic "stove-piping" and miscommunication.

This study will seek to both link and expand upon the available literature, viewing China's militarization of space from the system, national/strategic and domestic levels in order to achieve a more nuanced and realistic interpretation of China's military space program, and the PRC's ASAT testing in particular. In order to do so, this study will draw upon the above-mentioned works as well as a number of other works which focus on China's military space program, the militarization of space, China's security diplomacy, and China's unique party-military relations. Having discussed the current literature, let us now move to the subject of China's military space program.

Figure 7: *Feng Yun*-1C Satellite

Source: www.defensetech.org