5.1 U.S. Space Assets: Unparalleled Advantage

From the American perspective, China is rapidly becoming a space-age superpower and this is altering the status quo in outer space, which has been viewed as a realm of unchallenged U.S. dominance and defined by international cooperation since the end of the cold war. The U.S. is uniquely vulnerable to Chinese counter-space weapons as it operates nearly half of the 270-plus military satellites in orbit as well as hundreds of civil, commercial and dual-use satellites that can be potentially used for military operations. And while many of the details concerning the U.S. military space architecture are highly classified, a review of the open source literature is revealing. In terms of IMINT, the U.S. is reported to have three operationally deployed 15 ton-plus "Crystal" KH-12/13 electro-optical reconnaissance satellites, which operate in Lower Earth Orbit (LOE), that are believed to be able to image objects down to the tens of centimeters in width.[187] These IMINT platforms are further supplemented by an advanced version of the KH-12/13 reconnaissance imaging spacecraft codenamed "Misty" that is reported to utilize a unique stealth technology to evade detection and tracking.[188] Like the KH-12/13 and other national security satellite

[187] Bill Sweetman, "Spatial Awareness: Satellite Imaging Systems Span the Globe," *Jane's International Defence Review*, May 2007, 46.

[188] Charles P. Vicks, "Misty/AFP-731: The Stealth Reconnaissance Imaging Spacecraft,"

platforms, Misty satellites (of which there are thought to have been two launched to date with one currently operational and a third scheduled for launch some time before 2009) are designed to be nuclear war, laser and battle hardened spacecraft.[189] The U.S. also operates three "Lacrosse" synthetic aperture radar (SAR) imaging satellites in LEO that are all-weather (being able to use radar to see through cloud cover) and can image targets in the dark to resolutions less than 2 meters.[190] Lacrosse satellites are also reported to be able to image targets underground or underwater to an unknown depth.[191] Aside from imagery, the U.S. military also relies on satellites for signal intelligence (SIGINT), and is reported to have three giant "Mentor" satellites parked in geostationary/geosynchronous orbits (GEO) for the purpose of collecting radio emissions with radio reflecting dishes estimated to be 100 meters in diameter.[192] Also in GEO, 4-5 Defense Support Program (DSP) satellites utilize infrared sensors to provide worldwide coverage and early warning of missile launches and nuclear explosions.[193] DSP satellites were used in the 1991 Iraq war to detect Scud missile launches and provided early warning to population centers as well as coalition forces, and are now sufficiently sensitive to detect short-range missile launches

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GlobalSecurity.org, April 26, 2007 and Bill Sweetman, "Spatial Awareness: Satellite Imaging Systems Span the Globe," *Jane's International Defence Review*, May 2007, 48.

[189] Ibid.

[190] Ball, June 14, 2007. See also Lacrosse at Encyclopedia Astronautica and Globalsecurity.org page on Lacrosse as well as Wikipedia's page on Lacrosse satellites and Bill Sweetman, "Spatial Awareness: Satellite Imaging Systems Span the Globe," *Jane's International Defence Review*, May 2007, 46.

[191] Ibid.

[192] "Jonathan's Space Report," No. 369, August 22, 1998. See also Wikipedia's page on Mentor satellites.

[193] U.S. Air Force Fact Sheet, "Defense Support Program Satellites," Air Force Space Command, Peterson AFB, http://www.af.mil/factsheets/factsheetasp?id=96 accessed April 22, 2008.

in real-time.[194] In terms of communications, five "MILSTAR" communication satellites provide secure, jam resistant, worldwide communications for high priority military users,[195] and nine Defense Satellite Communications System (DSCS) Phase III spacecraft, which allow for high priority command and control communication, orbit in near GEO space over 22,000 miles out.[196] Twenty-four (plus spares) Global Positioning System (GPS) satellites provide highly accurate positioning, navigation, velocity and timing information worldwide to both military and civilian users.[197] GPS spacecraft allow allied troops to navigate trackless desert, and guide Joint Direct Attack munitions with pinpoint accuracy, allowing for the bombing of enemy targets with minimal collateral damage.[198] This combination of military space assets, which provide vital intelligence, secure communications, navigation, missile guidance, meteorology and, crucially, early warning and missile defense, gives the U.S. an unparalleled advantage in modern warfare, and is driving its "Revolution in Military Affairs" (RMA).

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[194] Ibid.

[195] U.S. Air Force Fact Sheet, "MILSTAR Satellite Communications System," Air Force Space Command, Peterson AFB, http://www.af.mil/factsheets/factsheet.asp?fsID=118 accessed April 22, 2008.

[196] U.S. Air Force Fact Sheet, "Defense Satellite Communications System," Air Force Space Command, Peterson AFB, http://www.af.mil/factsheets/factsheet.asp?ID=95 accessed April 22, 2008.

[197] U.S. Air Force Fact Sheet, "Global Positioning System," Air Force Space Command, Peterson AFB, http://www.af.mil/factsheets/factsheet.asp?ID=119 accessed April 23, 2008.

[198] Ibid.

5.2 U.S. Space Assets: Unparalleled Vulnerability

During the recent Iraq war, 68% of munitions were satellite guided, a massive increase from the merely 10% of satellite guided munitions used in the 1991 Iraq War.[199] One senior Air Force officer said that thanks to satellite technology the U.S. no longer fights in the fog of war, but in a "huge cloud of electrons."[200] However, because four-fifths of America's military data is transmitted through unhardened commercial satellites, and a single Global Hawk unmanned surveillance drone flying over the middle east can consume several times more bandwidth than was used in the whole of the 1991 war against Iraq, Air Force officers commonly describe space as being America's "Achilles Heel."[201] Referring to China's ASAT test, General Hamel of the Air Force's Space and Missile Systems Center said "if they take our asymmetric advantage in space, we go from an information age war machine to an industrial age war machine…shifting the balance, the edge will go to the adversary."[202] Many specialists also argue that aside from the U.S. military dependency on orbital space, the U.S. economy, and in turn, much of the world economy, is also rapidly becoming dependent on space-based systems. They posit that, in effect, the U.S. is now a "space faring" nation whose very way of life is tied to the myriad capabilities provided by the orbital

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199 "Military Uses of Space," *Parliamentary Office of Science and Technology*, December 2006, No. 273.

200 *The Economist*, 18.

201 Ibid., 18-19.

202 Richard Hughes and Jon Lowe, "We Need a Civil Reserve Space Fleet," *The Wright Stuff*, April 17, 2008.

space medium.[203] War games conducted as part of U.S. national security protocols, such as the Army-After-Next, Navy Global and Air Force Global Engagement series, Space Game 2 and Schriever 1 & 2, as well as the privately conducted "DEADSATS" war games, conducted from the late 1990s to the early 2000s, confirm this view. According to some space experts who were intimately involved with the war games, the exercises exposed "a critical national Achilles heel that politicians, economists and corporate CEOs have largely ignored…losses in space can quickly affect the economic, social, and national security fabric not only of the united States, but of the entire world."[204] These experts further speculate that "large military powers," such as the United States, could "be held hostage by the unknowns inherent in a new kind of war."[205] These concerns are directly linked with China's ASAT threat and their potential applicability in any future U.S.-Sino conflict.

Clearly any possible U.S. military contingency in the Taiwan Straits would require secure satellites as the U.S. becomes ever more reliant upon its space systems. Moreover, reconnaissance satellites are thought to limit the risk inherent in the build-up of forces that both the PRC and the U.S. could be expected to deploy to the region in the event of a crisis.[206] However, if the U.S. was blinded as the result of a preemptive

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[203] Ibid.

[204] Michael J. Coumatos et al., *Space Wars: The First Six Hours of World War Three* (New York: Forge, 2007), 8.

[205] Ibid., 9.

[206] Richard Bush and Michael E. O'Hanlon, *A War Like No Other: The Truth about China's Challenge to America* (Hoboken: John Wiley & Sons, 2007), 114.

Chinese ASAT attack, the conflict could quickly escalate to a dangerous level. According to two experts on the subject, "if there is a great-power war in the twenty-first century, our crystal ball says that it will be between the United States and China over Taiwan, with a very serious potential for a horrible escalatory process."[207] This underscores the gravity of the topic as well as the negative impact the Chinese shift towards fielding counter-space weapons could have.

5.3 U.S. Response: Space Build-up

While most of America's national security satellites are in high-earth orbit and will not remain vulnerable to Chinese ASAT weapons like the one that destroyed FY-1C in the near-term, the reported Chinese interest in jamming vulnerable GPS signals[208] is causing the U.S. to set-up backup ground stations in case the main GPS control center outside Colorado Springs is disabled.[209] The National Geospatial-intelligence Agency (NGA) has added at least 11 more shared monitor stations to strengthen the GPS land-based infrastructure as well.[210] The U.S. is also planning to deploy a new generation of GPS satellites with higher-power signals to make jamming more difficult,[211] and is experimenting with

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[207] Ibid., 159.

[208] Chase, September 19, 2007.

[209] *The Economist*, 28.

[210] U.S. Air Force Fact Sheet, "Global Positioning System," Air Force Space Command, Peterson AFB, http://www.af.mil/factsheets/factsheet.asp?ID=119 accessed April 23, 2008.

[211] Keir A. Lieber and Daryl G. Press, "Superiority Complex: Why America's growing nuclear

laser communication systems, which can carry more data and are less prone to interference than radio waves.[212] In ways large and small, the Chinese ASAT test is leading to an arms race in space and on land, with the U.S. already looking at countering the PRC counter-space threat with "prompt global strike" weapons such as modified, non-nuclear intercontinental ballistic missiles, stealth bombers armed with "bunker buster" bombs, and high-speed, long-range cruise missiles that could target Chinese ASAT missile sites very rapidly from modified Ohio-class nuclear submarines.[213] The U.S. military is also expected to improve its surveillance and intelligence of space threats while further hardening its low-orbiting spy satellites with "passive defenses," such as lens shutters to shield from laser blinding such as those which occurred in August/September 2006. Other passive defenses may include satellite redundancy (having back-up satellites), as well as turn-off systems to avoid Chinese tracking and targeting.[214]

Prior to the successful January 11, 2007 Chinese ASAT test the U.S. had already announced that it would develop "capabilities, plans and options to ensure freedom of action in space" and would "deny such freedom of action to adversaries" if directed, while opposing "the development of new legal regimes or other restrictions that seek to prohibit of limit US access to space."[215] Pentagon reports also spoke of interest in maneuverable satellites that could be used as rams, ground

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supremacy may make war with China more likely," *The Atlantic* (July/August 2007): 90.

[212] *The Economist*, 28.

[213] Lieber and Press, 88.

[214] Gertz, March 30, 2007.

[215] "U.S. National Space Policy (unclassified portion)," *National Security Council*, August 31, 2006.

based lasers, and space-based weapons firing 100kg tungsten bolts.[216] However, the defense budget passed by Congress this year did not provide any money for a missile defense "space test-bed," nor did a Center for Strategic and Budgetary Assessments (CSBA) study recommend the U.S. invest in space-based weapons because "ground-based systems were almost always more cost effective and reliable than space-based weapons, whether used to attack missiles, enemy satellites or targets on land."[217] In reference to the possibility of the U.S. deploying offensive space weapons systems General Moseley noted: "There's a 1996 convention on military activity in space, and, as you would expect us to do, we actually live within the law and attempt in every way to stay within the policy guidance. So we, in fact, do that."[218] For the moment, it seems that despite the Chinese ASAT test, U.S. policymakers are content to continue the bolstering of the U.S. military space architecture while avoiding the weaponization of orbital space. This is reflected in the DoD's military space budget and acquisition plans.

5.4 U.S. Space Budget and Acquisition Plans

The spike in military space spending some expected after the PRC ASAT test has failed to materialize, and, while the U.S. Air Force's classified research and development (R&D) budget increased from 9.6

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[216] Matthew Davis, "Dominating the Final Frontier," *BBC News*, October 19, 2006.

[217] Study cited in *The Economist*, January 19, 2008, 28.

[218] John Tirpak, "Space and Counterspace," *Air Force Magazine*, (June 2006): 43.

billion in the fiscal year (FY) 2007 to 11.3 billion FY 2008,[219] the procurement budget actually *declined* from 15.3 billion FY 2007 to 13.9 FY 2008.[220] The DoD's request for military space projects in FY 2009 is reported to "not include a dramatic boost from last year despite…a growing number of threats, including that posed by last year's Chinese anti-satellite test" rising only slightly from 11.3 billion FY 2008 to 11.9 billion FY 2009.[221] However, the PRC's counter-space effort is leading to U.S. military space officials emphasizing the importance of improving space situational awareness in order to understand what satellites and objects are in space as well as what those objects may represent in terms of capabilities and potential threats. The Air Force plans to field a revamped series of ground-based sensors designed to track objects orbiting in space called the "Space Fence" to be operational by 2015.[222] This system will be augmented by the Space-Based Space Surveillance system, for which the FY 2009 request is 120.7 million in R&D, with procurement funding to begin in FY 2012.[223] In terms of counter-space systems, the Pentagon has requested 104 million, 75 million in R&D and 29 million in procurement, which includes the Counter Communications System (CSS) and the Rapid Identification Detection and Reporting System (RAIDRS). CSS is designed to deny potential adversaries, such

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[219] Steven M. Kosiak, "Classified Funding in the FY 2008 Defense Budget Request," *Center for Strategic and Budgetary Assessments*, July 25, 2007.

[220] Ibid.

[221] Amy Butler, "AF-Led Milspace Budget Stays Flat," *Aviation Week & Space Technology Online*, February 5, 2008 accessed April 25, 2008. See also *Aviation Week & Space Technology*, February 11, 2008, p. 30-31.

[222] Butler, February 5, 2008.

[223] Ibid.

as the PRC, access to military satellite communications, and RAIDRS provides geo-location for the origin of interference with U.S. satellites.[224] Both of these counter-space systems are arguably far more defensive in nature (being temporary in effect and reversible in nature) than the PRC's direct ascent, counter-space forces which are designed primarily to destroy enemy satellites outright.

Other major programs included in the FY 2009 budget request are also more defensive in nature. The largest program element is 2.3 billion for the Space-Based Infrared System (SBIRS),[225] the next-generation missile warning system which will also provide greatly expanded capabilities for intelligence, surveillance and reconnaissance (ISR) missions with a total of six orbital platforms as well as fixed and mobile ground-based assets.[226] Spending requests on the GPS III and the Transformational Satellite (TSAT) systems increased to 73 million and 84 million, respectively, with competition for both programs under way.[227]

No precise budgeting information is available on a new generation of IMINT platforms long under development under "Future Imagery Architecture" (FIA) project, but the NRO was reported to have spent 10 billion on the program as of 2005.[228] The combined electro-optical

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[224] Ibid.

[225] Ibid.

[226] "Space Based Infrared System-High (SBIRS High)" *Lockheed Martin Corporation 2008* website, http://www.lockheedmartin.com/products/SpacedBasedInfraredSystemHigh/index.html accessed April 25, 2008.

[227] Butler, February 5, 2008.

[228] Sweetman, 46.

(EO)/space radar (SR) plan is believed to have settled on a 12-24 satellites in the 5-7 ton range (much smaller than the 15 plus ton IMINT spacecraft now in operation) with the first launch scheduled for 2009.[229] A detailed study released in early 2007 envisaged a constellation of nine SR satellites which could image large areas at 1 meter resolution, with 0.1 meter (roughly 4 inches) resolution achievable in spotlight mode.[230] The SR portion of the FIA project, however, may not see its first launch until after 2015, and the entire FIA program is reported to have suffered from delays and massive cost over-runs.[231] It is highly unlikely that the program will be able to offer the ability to target moving vehicles, with the basic challenge being that from the perspective of the satellite the ground is moving so fast (7 km/s) that the speed of any ground target is insignificant in comparison, and therefore the FIA will continue to observe fixed targets (albeit at far greater resolution and with greater timeliness).[232] In the interim, the U.S. military is acquiring more imagery from commercial satellites apparently developed primarily for U.S. government consumption. The DigitalGlobe Worldview-1, launched September 2007, delivers imagery that is too detailed to be legally sold to non-U.S. government clients, as will the GeoEye-1 to be launched August 2008. Commercial spacecraft such as Worldview-1 and GeoEye-1, which are beginning to approach the performance of classified satellites, are increasingly meeting the overhead imagery and

[229] Ibid.

[230] Ibid., 48-49.

[231] Ibid., 45.

[232] Ibid., 49.

communications needs of the U.S. military.[233]

5.5 Continuing Vulnerability

Because platforms such a Worldview-1 and GeoEye-1 are commercial in nature, and not subject to expensive add-ons and countermeasures which would enhance their survivability, these commercial satellites are highly vulnerable to potential PRC interference and destruction. Indeed, such satellites would present the PRC with an attractive target set in any future cross-strait crisis because the disabling of commercial satellites would serve a valuable military purpose without greatly escalating a crisis. Theoretically the adversary would be blinded (at least partially) and yet would have no legal grounds to declare war. The PRC employed just such a strategy in the 1995-96 Cross-Strait Missile Crisis, using radar-jamming to blind a commercial SAR imagery satellite that was providing Taiwan with intelligence on PLA exercises and the PLA military buildup opposite Taiwan.[234] Given this, the U.S. government's partial (and growing) reliance upon commercial satellites for imagery and communications certainly does represent an Achilles' heel likely to be exploited by the PRC in any future conflict. How far such exploitation might go, and what affects it might have are subjects for the next chapter.

In conclusion, this chapter has sought to describe the expanding U.S. reliance upon satellites, noting their economic value while primarily

[233] Ibid.

[234] Interview with Mark Stokes

focusing on their military utility, to illustrate some of the ways space platforms are vital to the U.S. military's revolution in military affairs. The Chinese ASAT test shows that the U.S. military's unparalleled space infrastructure, while serving as an essential force-multiplier that gives the U.S. a tremendous edge in modern warfare, also represents a weakness in the sense that it is particularly vulnerable to asymmetric interference and attack. This state of affairs is exacerbated as the U.S. military increasingly turns to commercial satellite providers to offset budget overruns and scheduling delays in government-funded programs. Interestingly, the semi-classified military space budget did not drastically increase in the wake of the Chinese direct-assent ASAT test of last year despite the PRC action representing a significant, and troubling, alteration of both the PRC's capabilities and intentions. We now turn to the next chapter to discuss the level of significance the Chinese development of counter-space weapons could have for U.S.-Sino relations in the coming years.

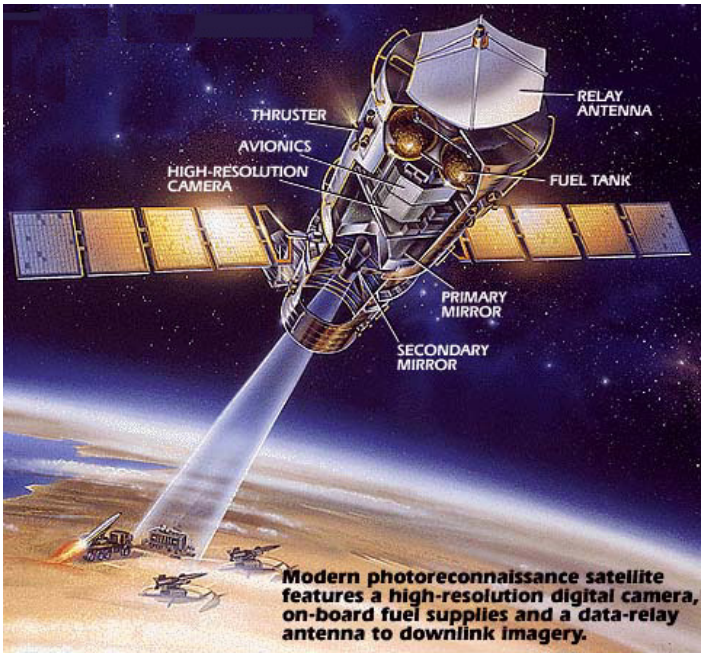

Figure 15: U.S. EO Reconnaissance platform Source: www.mprofaca.cro.net