

The Assassin Under the Radar

China's DH-10 Cruise Missile Program

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Of all the asymmetric weapons or “assassin maces” China has been developing and deploying across the Taiwan Strait, perhaps none has been as poorly understood and as chronically underreported as China’s rapidly emerging DH-10 (DongHai-10), “East Sea-10”, cruise missile program. This owes much to the thick veil of secrecy and misinformation that surrounds China’s cruise missile programs. Furthermore, unlike its ballistic missile, submarine and anti-satellite weapon programs, China’s cruise missiles have been largely successful at remaining off the international media’s radar screen.*

Yet at both the tactical and strategic levels, China’s latest generation of cruise missiles have very serious implications for regional security in the Western Pacific and beyond. Like China’s highly successful ballistic missile systems, cruise missiles allow for stand-off strikes that are technologically challenging (and expensive) to defend against. However, unlike ballistic missiles, cruise missiles are able to strike from any direction and fly at very low altitudes, making them even harder to detect and defend against. Cruise missiles are also far more accurate and inexpensive to build than ballistic missiles and, because of their relatively small size, can be launched from a wide variety of platforms, furthering their stealth and agility. They also represent a major proliferation risk given China’s past willingness to sell cruise missiles to unsavory regimes and the missiles’ compatibility with a wide variety of warheads, including tactical nuclear weapons.

However, what truly makes this particular Chinese cruise missile program notable is that after more than two decades of development and testing, the DH-10 has entered production and deployment at break-neck speeds. It also appears that the development of the DH-10 may have unlocked key technologies that have implications for China’s highly-valued anti-ship ballistic missile (ASBM) program.

The DH-10 Cruise Missile: Unknowns, Secrecy and Misinformation

There is a great deal of opacity surrounding China’s DH-10 land attack cruise missile (LACM) in the available literature. For instance, a recent report from the National Air and Space Intelligence Center (NASIC) states the launch mode, range and deployment of the DH-10 are all “undetermined.”¹

*The latest reports also refer to the DH-10 as the ChangJian-10 (CJ-10), or “Long Sword 10”.

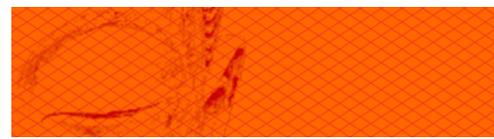
Yet, in 2008 the Department of Defense (DOD) estimated the DH-10 to have a range of over 2,000 kilometers (km), and pointed out that the PLA was developing both air and ground launched variants.² The latest 2009 DOD estimates state that by “April 2008 the PLA had 150-350 DH-10 ground-launched cruise missiles” with a range of a range of over 1,500 km.³ It is not known why the DOD changed its estimates concerning the range of the DH-10 in 2009 and failed to make any estimates concerning the number of air-launched DH-10s in the PLA inventory.

The lack of a precise estimate suggests that the DOD knows much less about the status of China’s cruise missiles than it does China’s ballistic missile systems.⁴ Notably, the DOD report does not even attempt an estimate at the number of air-launched or possible sea-launched variants of the DH-10.



Image: Artist conception of DH-10A cruise missiles
Source: Chinese Internet

It is possible that the Pentagon’s difficulty in making precise assessments of the DH-10 program stems from the unusually high level of secrecy that surrounds this program, and the fact that so much of the already limited Chinese source material available on the subject appears to be part of a misinformation campaign. One example of this can be seen in the wide-scale, apparently intentional, confusion of the DH-10 LACM program and the DF-11 short-range ballistic missile (SRBM) program on the Chinese internet.



The DH-10 is widely reported on the Chinese language internet to be a product of the China Aerospace Science and Industry Corporation's (CASIC) Ninth Academy (also known as the Sanjiang Aerospace Group, or 066 Base) in Hubei, China.⁵ According to these reports, the chief designer of the DH-10 and "Father of China's cruise missile" is the Ninth Academy's Party Committee Secretary and Vice President Liu Shiquan.⁶

Liu Shiquan, who has made headlines in China for his scientific achievements, is a winner of the National May Day Labor Medal, the National Advanced Worker Title and the Young Scientists Award. He was an alternate member of the 16th Central Party Committee (CPC) from 2002-2007, and is currently serving as an alternate member of the 17th CPC.⁷

However, a close reading of an interview he gave with the Chinese media reveals that Liu Shiquan is not the father of the Chinese cruise missile, but of the DF-11A (*DongFeng-11A*) SRBM.⁸ The DF-11A, an extended range, more accurate variant of the DF-11, was first fielded by the PLA's Second Artillery Corps in 1999,⁹ and remains the Ninth Academy's main product.¹⁰

Liu Shiquan's deep involvement in the ballistic missile field is also further suggested by his lead role in the 2003 publishing of a four hundred page book entitled "Techniques for Defeating Ballistic Missile Defense," which discusses the development of ballistic missile defense (BMD), and the many ways in which ballistic missiles can defeat BMD shields.¹¹



Image: DH-10 on Parade in Beijing, October 1, 2009
Source: www.china-defense-mashup.com

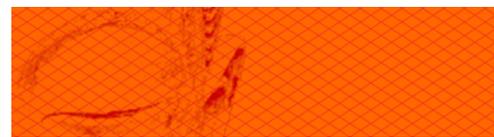
Yet despite the confusion caused by the Liu Shiquan case and others like it, the layers of misinformation and secrecy surrounding the DH-10 appears to be thinning. Recent developments and publications have begun to unravel some of the mysteries that have long plagued outside research into this program, especially in the areas of development and deployment.

From Red Bird to DH-10A: Development and Deployment

After years of hiding behind a curtain of strictly maintained secrecy, the PLA is now preparing to publicly unveil the DH-10 at the 60th anniversary of the October 1st founding of the People's Republic of China parade. Already, emerging photos of the DH-10 from the September 6th rehearsal parade in Beijing have revealed that the ground-launched DH-10 is deployed in a three-missile tube variant on a road-mobile transporter vehicle. This move by Beijing to showcase the DH-10 also reveals a strong sense of confidence in the DH-10 LACM program, as this is the first time China has ever openly demonstrated its LACM capabilities.¹²

Recent reports have also shed further light on the development and deployment of the DH-10. According to a recently published, highly-detailed breakdown of the Chinese aerospace industry, the DH-10 was developed and is manufactured by CASIC's Third Academy, which was formed in Beijing in September 1961. The Third Academy is directed by Liu Erqi, and employs an estimated 13,000 people, including 6,000 technicians. The Third Academy's assets were valued at U.S. \$2.5 billion (RMB 17.3 billion) in 2007.¹³ It is likely that the Third Academy's Deputy Director Huang Xingdong, who until recently directed the Third Academy's 3rd Design Department, has played a major role in the development of the DH-10.¹⁴

The DH-10 stems from the Hong Niao, or "Red Bird," family of long-range cruise missiles, which began development in 1977. Building upon its experience in the development of anti-ship missiles, the Third Academy in 1985 tested the X-600, which consisted of Silkworm missile type body, thought to be a Hai Ying-4 (HY-4) or Ying Ji-6 (YJ-6), coupled with a turbojet engine which was especially developed for the project.



This evolved into the Hong Niao-1 (HN-1), which began development in 1988, and later the longer-range Hong Niao-2 (HN-2), which was first thought to have been tested in either 1995 or 1997, with a ground-launched test in August 2001.¹⁵ The HN-2 is more commonly known as the DH-10, and is modeled on existing U.S. and Russian technologies. The DH-10 is based largely on U.S. Tomahawk cruise missile technologies obtained by aggressive PLA buyers in Iraq, Serbia and Afghanistan and elsewhere U.S. Tomahawks, or parts thereof, have been lost.¹⁶ China is reported to have acquired at least two unexploded Tomahawk missiles from Osama bin Laden after the U.S. fired 75 Tomahawks into Afghanistan on August 20, 1998 in a failed attempt to kill him.¹⁷

Aside from reverse engineering U.S. technology, China's DH-10 has also thought to have benefited from an improved turbofan engine based upon the Russian TRDD-50 engine used in the SS-N-21 and AS-15 missiles, which began manufacture in China after 1992.¹⁸ China's procurement of at least six Kh-55 Russian Raduga cruise missiles from Ukraine in the 1990s is also thought to have provided key technology for the development of the DH-10.¹⁹

It has also been reported that in 1992 China established the Xinxin Factory in Shanghai with Russian expertise and equipment to develop air and submarine launched LACMs.²⁰ Similarly, it has been alleged that in 1995 China hired and moved a Russian design team to Shanghai as part of a cruise missile manufacturing technology procurement effort which opened the door to the transfer of radar and infrared signature-reduction technology.²¹ These reports suggest that Shanghai has played an important role in the development of China's second and third generation LACMs, though the claims are yet to be validated.²²

It is known that the Hong Niao-3 (HN-3) or DH-10A, a stealthier, more accurate HN-2 upgrade, was successfully tested on August 10, 2004. The DH-10A is reported to have a circular error probability of less than 10 meters, and relies on a combination internal navigation system (INS), global positioning system (GPS) and terrain comparison (TERCOM) for guidance. It has gone into mass production and is

deployed with the PLA's Second Artillery Corps.²³

The latest generation DH-10A is also believed to be deployed on China's H-6K bomber, a re-engined and improved variant of the Xian H-6 that has six underwing hardpoints to carry large air-to-surface missiles. Images released on the Chinese internet show the H-6K carrying missiles roughly the same size and shape as the Tomahawk, with a "pinched" nose cone profile like the Tomahawk Block IV, making it more stealthy.²⁴

According to one report by the Bulletin of Atomic Scientists, at least 20 H-6 bombers have been modified for nuclear attack missions and up to 15 air-launched DH-10s are armed

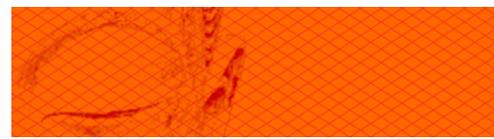


Top-right image: New H-6K bomber armed with ASCMs as seen on magazine cover, caption reads: "American Military Experts Concerned by Liberation Army's Latest Long-range Attack Platform"

Right image: H-6K Bomber carrying what appears to be D-10As, note the stealthy profile

Source: Chinese Internet





with tactical nuclear warheads.²⁵ However, these claims are somewhat contentious, as they would mean that the Second Artillery has surrendered a nuclear attack mission to the PLA Air Force (PLAAF), which seems to have been historically limited to tactical, non-nuclear missions for organizational and logistical reasons.²⁶ One specialist on the subject pointed out that while the DH-10 is nuclear-capable, it would be a mistake to assume that it is nuclear armed at this stage.²⁷ The vast majority of DH-10s are thought to be armed with conventional high explosives, and Chinese media reports suggest that the air-launched DH-10A has been attached to the extended-range H6K bomber for the purpose of being able to accurately strike U.S. bases on Guam.²⁸

The Ying Ji-63 (YJ-63) “Strike Eagle” air-launched, anti-ship cruise missile (ASCM) is also deployed on the H6, but suffers from a range limited to around 200 km. Third Academy studies have researched and promoted the development of a wide variety of ASCM variants matching the description of the DH-10 for the purpose of striking U.S. carriers, some of which would be air-launched.²⁹

In terms of known ground-launched DH-10 deployments, the PLA’s Second Artillery Corps has formed at least two operational, road-mobile, DH-10 Brigades: the 821 Brigade, 96215 Unit in Liuzhou, Guangxi Province; and the 824 Brigade, 96317 Unit in Dongkou, Hunan Province.³⁰ There are also unconfirmed reports of a third DH-10 Brigade in Jianshui, Yunnan Province.³¹ These DH-10 Brigades target Okinawa, Taiwan, South East Asia and the South China Sea area. Given their locations, it appears that China has intentionally positioned these missiles far inland in order to maximize their protection against detection and counter-strikes. A thick web of advanced air defense S300-PMU1 and PMU-2 surface-to-air missiles (SAM) buffers these DH-10 brigades from U.S. or Taiwanese counter-strikes, and their distance inland means they are a far more difficult to detect, track and target.³²

Looking Ahead: China Ramping Up Cruise Missile Production

China has prioritized the DH-10 program and has invested considerable resources into its development. There are now strong indications that the Third Academy has been accelerating its manufacturing of the DH-10A, while rapidly expanding in size in order to accommodate the development of China’s next generation cruise missile.

China’s defense industry has been working overtime to support the demanding development schedule. According to

authoritative sources, the Third Academy’s Beijing Xinghang Electromechanical Equipment Factory (159 Factory), which is the final assembly facility for the DH-10A, implemented a rigorous schedule of 24 hour work days, seven days a week and canceling all weekend days off during the entire month of March this year in order to “efficiently implement...a critical mission...as it enters into its most difficult stage of development.”³³

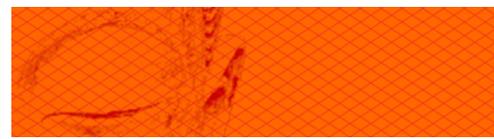
Likewise, the Beijing Hangxing Machine Building Factory (239 Factory), which also plays a critical role in the manufacturing of the DH-10A, was working to “develop and manufacture a mission at an extremely busy pace,” found that its workers were often too busy to eat, and had to open a 24 hour cafeteria to accommodate their schedules. In an interview, one young worker spoke of how the pace of work at the factory on “project 51” and “project 11” kept him from going home to visit his family over the Chinese New Year.³⁴

CASIC recruiting goals for the year 2009 also indicate that the Third Academy is looking to expand considerably. Recruiting tables show a need for 265 new, highly-educated hires (230 in the Beijing area) this year, seeking qualified candidates including 23 PhDs, 198 Master’s degree holders and 44 technical graduates. This constitutes the largest recruiting drive in China’s entire aerospace community save for the Second Academy, which develops air defense systems and is closely associated with the Third Academy.³⁵



CASIC Exhibition hall in Beijing Suburbs near 159 Factory
Source: Chinese Internet

These reports, as well as statements made by both current and former defense officials interviewed for this paper, suggest that the DH-10A program is growing rapidly in size and scale. According to one former DIA official, this program represents a “very very big threat” to regional security. He pointed out that while the U.S. is developing a number of systems to counter Chinese cruise missiles, the sheer size of the buildup “could mean that they will be able to overwhelm our defenses.”³⁶



He also pointed out that in many respects, cruise missiles are an even greater threat than SRBMs in any Taiwan scenario due to their versatility. Chinese cruise missiles launchable from a mix of mobile platforms and are able to fly around the island's mountains (as opposed to over them) to hit crucial targets on Taiwan's East coast such as the doors to the underground hangars at the Hualien airbase where Taiwan keeps many of its most advanced fighters. Due to Taiwan's steep mountainous terrain, and the constraints inherent in ballistic trajectories, such targets would not be vulnerable to China's large SRBM stockpile. He also suggested that a stealthy cruise missile with a subsonic cruise speeds and a supersonic terminal phase would be the greatest challenge to the islands defense infrastructure.³⁷ Chinese reports indicate that this is the precise goal of the next-generation follow-on to the DH-10A.

Global Strike and the Chinese Anti-Ship Cruise Missile: HN-2000

China is currently developing its next-generation cruise missile, the Hong Niao-2000 (HN-2000). This missile will reportedly be equipped with millimeter wave radar, infrared image mapping, laser radar, synthetic-aperture radar (SAR) and the Chinese *Beidou* satellite guidance system, for accuracies of 1-3 meters. This missile will also incorporate the latest stealth technologies and have a supersonic terminal flight phase, with an expected range of 4,000km.³⁸

Highly-detailed, authoritative Chinese sources have shed light on the direction of China's future cruise missile development and underscore the importance of cruise missiles in Chinese strategic thinking. One such article revealed interest in "super long range" and intercontinental cruise missiles with striking distances of 5,000 to 8,000 km and over 8,000 km, respectively. This article, a product of CASIC's Third Academy, also revealed a strong interest in using long-range cruise missiles with a supersonic terminal phase to attack U.S. aircraft carriers, and discussed ways to defeat U.S. air defense.³⁹ China has studied U.S. air defense capabilities and techniques in great detail, and is working hard on finding ways to defeat them in conjunction with the Second Academy.⁴⁰

China has also studied the U.S. common aero vehicle (CAV) program in great detail, and is looking at combining elements of both cruise and ballistic missile technology to develop a "Qian Xuesen Missile" for anti-ship and global strike missions.⁴¹ While the U.S. Navy is deeply concerned by China's evolving ASBM program,⁴² much less attention has

been paid to the role that cruise missile technology featured in the ASBM program or the fact that China is developing long-range cruise missiles such as the DH-2000 for anti-carrier strikes as well.



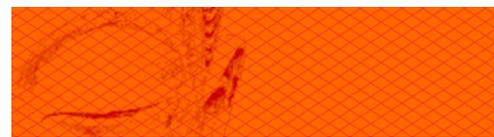
Image: Alleged photo of DH-10 test firing
Source: Chinese Internet

Recent unconfirmed Chinese reports state that the PLA Navy (PLAN) has deployed large numbers of long-range cruise missiles to the South China Sea for the purpose of "dealing with" U.S. carriers.⁴³ And one Chinese journalist writing on behalf of the PLA Daily, Li Wenqi, reportedly left an interview with Third Academy researchers convinced that the success of the DH-10's recent flight test meant that China now had a long-range, anti-carrier weapon.⁴⁴

It is possible that China has already developed an air or submarine launched variant of the DH-10A for anti-ship missions, and unconfirmed reports indicate that future, supersonic variants of the DH-10A, such as the DH-2000, will be deployed aboard China's Type 093 nuclear attack submarines, giving China's military the ability to strike strategically vital targets as distant as Guam's Andersen Air Force Base and Hawaii's Camp Smith, the headquarters of U.S. Pacific Command (PACOM).⁴⁵

Implications

The implications of China's rapid cruise missile build-up should be startling for security professionals and strategic



planners in the Western Pacific and beyond. This is especially the case for Taiwan, where a recent warming in cross-strait relations was expected to bring some kind of peace dividend.

Contrary to expectations, however, China has actually *increased* the pace of its coercive military build-up vis-à-vis Taiwan. As a result, regional security experts fear that “Taiwan faces what is probably the most difficult land attack cruise missile threat of any country in the world.”⁴⁶

Consequently, Taiwan continues to purchase U.S. Patriot Missiles and developed an unknown number of indigenous road-mobile Tien Kung-3 (Sky Bow) air-defense missiles to augment its static, silo-based Tien Kung-2 air-defense missiles. Like the U.S. Patriot missile system, these are thought to be effective against both ballistic and cruise missiles.⁴⁷ However, the limited number of high-performance, air defense missiles Taiwan is capable of fielding means that in any conflict, Taiwan’s leaders will be forced to make painful trade-offs regarding the defense of population centers versus key radar installations, air bases, naval bases and command and control facilities. This is expected to result in a catastrophic loss of defensive capabilities within hours of the first salvo of missile strikes.⁴⁸

From the U.S. perspective, China’s cruise missile deployments mean that U.S. forces operating from Okinawa to the South China Sea risk falling prey to precise stand-off attacks from cruise missiles which may be capable of overwhelming and penetrating U.S. air defense networks. Given China’s poor track record on missile proliferation, U.S. troops may also come under cruise missile attack from Chinese client states such as Iran, Burma and North Korea.⁴⁹

Looking farther ahead, it appears that the DH-10A and its derivatives may be able to eventually hold U.S. aircraft carriers hostage in any cross-strait conflagration. It is likely that in the near-to-mid-term China will deploy both long-range ASBMs and ASCMs to counter U.S. carriers.⁵⁰

As a result, the U.S. Missile Defense Agency (MDA) is funding the development of the Network Centric Airborne Defense Element (NCADE) which, if successful, would combine AIM-120 air-to-air missiles with the Standard Missile-3’s (SM-3) maneuvering kill vehicle, to provide for affordable ballistic and cruise missile defense from a variety of platforms, including fighters and UAVs.⁵¹

However, given the speed with which China is building its missile systems (as evidenced by the DH-10A program) the U.S. and her regional allies may find themselves hard pressed

to keep up with the growing threat they will be facing. It would not be hard to imagine China deploying well over 1,000 DH-10As by 2015.

In the years ahead, the cruise missile/anti-cruise missile race will only intensify as China increases its rapidly expanding arsenal of LACMs and ASCMs, and Taiwan, the U.S. and her regional allies continue their efforts to keep pace with the threat. In that sense, the unveiling of the DH-10 represents the dawning of a new and potentially dangerous era in the Pacific. In the words of one enthusiastic Chinese blogger, the age of the Chinese cruise missile has begun.

¹ “Ballistic and Cruise Missile Threat,” *National Air and Space Intelligence Center Wright-Patterson Air Force Base*, 2009, p.29.

² Office of the Secretary of Defense, “Military Power of the People’s Republic of China,” *Department of Defense Annual Report to Congress*, 2008, p. 56.

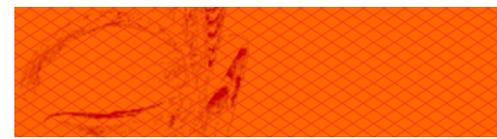
³ *Ibid*, p. 22.

⁴ For comparison, on the same page the report states that by “September 2008 the PLA had 1,050-1,150 SRBMs,” a numerical range half the size of the DH-10’s. This suggests that the DOD has a much greater understanding of China’s Short-Range Ballistic Missiles (SRBMs) systems, as reflected in its more precise estimates concerning the numbers of these missiles. The DOD estimates concerning China’s longer range MRBMs and ICBMs are even more precise. See page 66 for the complete estimates.

⁵ For the official overview see: “China’s Sanjiang Aerospace Group” (Zhongguo sanjiang hangtian jituan), <http://www.cnsa.gov.cn/n615708/n620172/n677085/65549.html>, accessed July 3, 2009. For one of the most detailed Chinese internet reports claiming the DH-10 is a product of the Sanjiang Aerospace Group see: “Chinese Cruise Missile’s Development” (Zhonggong xunyifeidan de yanfa yu bushu), March 19, 2009, <http://www.cnjunshi.com/Article/erpao/846.html?jdfwkey=y4cxl>, accessed July 3, 2009.

⁶ “Mad Scientist: Brief Official History of Liu Shiquan, the Father of China’s Cruise Missile” (Mengke: Zhongguo xunhangdaodan zhifu – Liu Shiquan guanfangjianli), July 4, 2009, http://military.china.com/zh_cn/critical3/27/20080704/14949742.html, accessed July 22, 2009. See also: “Father of the Cruise Missile: China Developing Global Strike, Super Sonic Cruise Missile” (Xunhangdaodan zhifu: Zhongguo zai yanfa quanqiu gongji chaoyinsu xunhangdaodan), November 2, 2008, <http://ouhua.fxbee.com/html/47/n-34047.html>, accessed July 3, 2009.

⁷ “Brief Introduction to Comrade Liu Shiquan” (Liu shiquan tongzhi jian jie), CASIC, September 6, 2008, <http://www.casic.com.cn/n16/n1250/n10984/n17506/17710.html>, accessed August 3, 2009. For English introduction to Liu Shiquan see: “China Vitae: Introduction to Liu Shiquan,” *ChinaVitae.org*,



http://www.chinavita.org/biography/Liu_Shiquan%7C4082, accessed July 22, 2009.

⁸ “Interview with 17th CPC Representative: Sanjiang Aerospace Group Party Secretary Liu Shiquan” (Shiqi da daibiao fangwen: Sanjiang hangtian jituan dangwei shuji Liu Shiquan), *ChinaDaily.com*, October 15, 2007, http://www.chinadaily.com.cn/hqzg/2007-10/15/content_6174797.htm, accessed July 22, 2009. Statements made in this interview confirm Liu Shiquan’s lead role in the DF-11A program, which he refers to as *xinghaojia* or “Model A.” For example, he refers to watching the unveiling of “Model A” at the PRC’s 50th anniversary military parade in Beijing on October 1, 1999, which was when the DF-11A was unveiled. He also refers to his work going into mass production thereafter in order to meet the needs of national defense and to elevate China’s international status, which also fits with the DF-11A.

⁹ “DongFeng 11 (CSS-7) Short-Range Ballistic Missile,” *sinodefence.com*, February 18, 2009, <http://www.sinodefence.com/strategic/missile/df11.asp>, accessed August 9, 2009. Also, the DOD estimates that as of September 2008 China had 700-750 DF-11s deployed, and a comparison of the DOD’s 2008 and 2009 reports shows that the Ninth Academy produced 25-75 DF-11s from 2007-2008.

¹⁰ Mark A. Stokes, “China’s Evolving Conventional Strategic Strike Capability,” *Project 2049 Institute*, September 14, 2009, p. 56.

¹¹ “Techniques for Defeating Ballistic Missile Defense” (Dandaodaodan tufang jishu daolun), *maihaoshu.com*, (Buy a Good Book), <http://www.maihaoshu.com/books/311866.htm>, accessed August 2, 2009.

¹² Wendell Minnick, “Beijing Rehearsal Shows Off New Missiles,” *DefenseNews*, September 8, 2009, <http://www.defensenews.com/story.php?i=4266694>, accessed September 9, 2009.

¹³ Stokes, p. 48.

¹⁴ This can be inferred given his success leading the 3rd Design Department and subsequent promotion. The 3rd Design Department has played the key role in the design of the DH-10 and is now engaged in the development of the next generation follow-on to the DH-10 under the leadership of Gao Wenkun, who took over for Huang Xingdong in July, 2009.

¹⁵ “Missile Threat: HN-2,” *Missilethreat.com*, http://www.missilethreat.com/cruise/id.54/cruise_details.asp, accessed July 27, 2009.

¹⁶ *Ibid.* See also Richard Fisher, “China’s New Strategic Cruise Missiles: From the Land, Sea and Air,” *International Assessment and Strategy Center*, June 3, 2005, http://www.strategycenter.net/research/pubID.71/pub_details.asp, accessed July 3, 2009.

¹⁷ “Bin Laden may have sold cruise missiles to Beijing,” *Taipei Times*, October 21, 2001, <http://www.taipetimes.com/News/front/archives/2001/10/21/108045>, accessed August 22, 2009.

¹⁸ “Missile Threat: HN-2.”

¹⁹ Minnick, September 8, 2009.

²⁰ “Key Element in the Taiwan Straits Military Situation” (Taihai junshi taishi de guanjian), *Asia-Pacific Defense Magazine (Yatai fangwu zazhi)*, February 2009, Vol. 10, pg 35.

²¹ Geoffrey T. Lum, “China’s Cruise Missile Program,” *Military Review*, January-February, 2004,

http://findarticles.com/p/articles/mi_mOPBZ/is_1_84/ai_n6112517/?tag=content:col1, accessed August 22, 2009.

²² An interview with a former high-ranking Taiwan military official in March 2009, calls the source of these reports into question. A Hong Kong-based China security expert in August 2009 also denied the role Shanghai has played in China’s LACM programs. It is possible that these reports have misrepresented actual activities at Third Academy factories in Beijing, claiming they occurred in Shanghai.

²³ “Key Element in the Taiwan Straits Military Situation” (Taihai junshi taishi de guanjian), pgs. 35-36.

²⁴ Robert Hewson, “Chinese air-launched cruise missile emerges from shadows,” *Jane’s Defense Weekly*, January 31, 2007, p. 5.

²⁵ Robert S. Norris and Hans M. Kristensen, “Chinese nuclear forces, 2008,” *Bulletin of the Atomic Scientists*, July/August 2008, pg. 43.

²⁶ These claims are also contentious because it is still debatable whether or not China has ever developed tactical nuclear warheads to be fitted onto cruise missiles. The declassified CIA reports that Norris and Kristensen reference are not definitive, but do suggest research was conducted in the 1990s that could certainly be applied to the development of such a weapon. Given the strides China has made in the field of the miniaturization of nuclear warheads, the production of a DH-10 armed with a tactical nuclear warhead would probably well within the technological grasp of Chinese engineers if it was deemed a requirement. In the meantime, it may be safe to assume that China has at least 20 H6K bombers specially designed to deliver nuclear-capable, but *conventionally* armed, DH-10s.

²⁷ See Jeffery Lewis, “DH-10,” *ArmsControlWonk.Com*, July 14, 2008, <http://www.armscontrolwonk.com/1945/dh-10>, accessed September 21, 2009.

²⁸ “U.S. Publication: China’s Newest H6 Can Accurately Hit Guam Base” (Meikan: Zhongguo xin hongliu ke jingque daji guandao jidi), *China Review News (Zhongguo pinglun xinwen)*, May 4, 2007, <http://www.chinareviewnews.com/doc/1003/6/1/1/100361195.html?coluid=70&kindid=1850&docid=100361195>, accessed July 3, 2009.

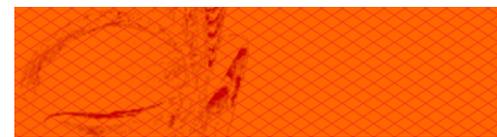
²⁹ Guan Shiyi, “Diversification of Cruise Missile Development (Xiang duo jihua fazhan de feihang daodan),” *Missiles and Space Vehicles (daodan yu hangtian yunzai huojian)*, June 2002, pp. 20-27. Song Fuzhi, “Countering Aircraft Carrier: Cruise Missiles Better Than Ballistic Missiles” (Dui hangmujian—xunhang daodan youyu dandaodaodan), *Tactical Missile Technology (zhanshu daodan jishu)*, April 2006.

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³⁶ Interview, Taipei, Taiwan, July 2009.

³⁷ Ibid.

³⁸ "Key Element in the Taiwan Straits Military Situation" (Taihai junshi taishi de guanjian), pg. 36.

³⁹ Guan Shiyi, Zhu Kun and Song Fuzhi, "Some Issues of Guided Weapon Systems of Winged Missile," (Guanyu feihang daodan tixi de jige wenti), *Tactical Missile Technology (zhanshu daodan jishu)*, May 2004, pgs. 1-10.

⁴⁰ This can be inferred from the high level of exchange that has occurred between the two organizations, especially in terms of leadership. For example, the current director of the Third Academy, Liu Erqi, was formerly the Deputy Director of the Second Academy, and Song Qin, who he replaced, appears to have moved into the Second Academy as its new Director. The cooperation between the two organizations in the field of anti-ship cruise missile research can also be inferred from the high volume of published research the two organizations have produced on the subject, often in an overlapping fashion.

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⁴⁷ Interview with Taiwanese Military Official at Taipei Aerospace and Defense Technology Exhibition and Conference (TADTE), August 14, 2009.

⁴⁸ Conversations with Taiwan defense experts, Taipei, Taiwan, August 2009.

⁴⁹ See Bates Gill, *Rising Star: China's New Security Diplomacy* (Washington, D.C.: Brookings Institution Press, 2007), p. 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.

⁵⁰ Interview, Taipei, Taiwan, July 2009.

⁵¹ "NCADE: An ABM AMRAAM-Or Something More?" *Defense Industry Daily*, November 20, 2008, <http://www.defenseindustrydaily.com/ncade-an-abm-amraam-03305/>, accessed September 20, 2009.