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CASIC's "Coastal Defense System"

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In a Fortnight

CHINA UNVEILS SEA DEFENSE SYSTEM TO COUNTER AIRCRAFT CARRIER

By L.C. Russell Hsiao

The modernization of China’s aerospace capabilities was prominently on display at the Eighth China International Aviation and Aerospace Exhibition (2010 Zhuhai Air Show). The biannual air show, which is taking place from November 16-21 in the southeastern province of Guangdong, involves more than 600 domestic and foreign aerospace defense manufacturers and exhibitors. Apart from the state-of-the-art weapon systems displayed at the show, the roll out by Chinese-defense manufacturers in this year’s expo stood apart from previous years in significant ways.

While much has been reported about the capabilities of China’s new weapon systems (e.g. unmanned technologies, missiles, etc.), much less have been said about how Chinese military planners intend to deploy these systems on the battlefield. Taking into account the Chinese proclivity to “keep a low profile,” especially when it comes to military planning, it has come as a surprise to outside observers that state-owned China Aerospace Science & Industry Corporation (CASIC)—one of the country’s largest defense manufacturers—displayed a detailed diagram in the main hall of the international air show depicting, in not-so-subtle terms, an integrated “Coastal Defense System” of Chinese ground, naval, air and space assets coordinating an attack on an un-flagged aircraft carrier group approaching a small island off the coast of China (*Global Times*, November 16; *Wen Wei Po* [Hong Kong], November 17). Additionally, it was reported by *Defense*

News that in one promotional video, a CASIC-made unmanned aerial vehicle (UAV) can locate an aircraft carrier and relays the information for a follow-on attack by Chinese anti-ship missiles (*Defense News*, November 16).

It is no surprise that Chinese defense planners are concerned about the presence of aircraft carriers in the Western Pacific, yet the CASIC exhibit is the first time that it publicly showed 'how' Chinese forces may counter the advances of an aircraft carrier group. The multiple platforms on display provide a glimpse into Chinese defense thinking on how the various capabilities offered by some of its advanced weapon systems may be integrated and deployed in operations to counter an aircraft carrier.

According to the CASIC diagram, China can monitor the carrier's movements with submarines and UAVs, which will then relay information to a coastal command center. Chinese forces can then attack the carrier group with fighter jets and cruise and ballistic missiles. As part of China's far sea defense system, three different missiles would be deployed simultaneously to attack the approaching carrier. Noticeably absent in the display was the DF-21D anti-ship ballistic missiles (*Global Times*, November 16; *Wen Wei Po* [Hong Kong], November 17).

The missiles on display were the C-602, C-705 and C-802A, which are all domestically made by the Third Academy under CASIC, and together attack the carrier from the ground, air and water. This so-called "anti-aircraft carrier system," which has become the focus of the Chinese-media, has prompted the media to dub the missiles the "the three anti-aircraft carrier musketeers." The attack is assisted by space-based satellites and high altitude UAVs, which are used to assess and relay battlefield communications (*Global Times*, November 16; *Wen Wei Po*, November 17).

C-602 (YJ-62) is a sub-sonic and long range anti-ship cruise missile (ASCM) for use by surface ships. The mid-course guidance system of the C-602 is a combination of Inertial Navigation System (INS) and Beidou Positioning System. The YJ-62 also has a terminal guidance system and active radar seeker at the terminal phase of flight (approx 40 km) that raises its hit rate (China Defense Mash Up, October 11, 2008).

C-705 is an air-launched anti-ship missile, which is the latest variant of the C-701 series, featuring a maximum range of 75 km without the rocket-booster, or 170 km when fitted with a rocket-booster. The mid-course guidance system is based on a combination of GPS and INS. The missile carries

a 110 kg warhead and flies at an altitude of 12.15 m above the sea level.

C-802A (YJ-82) is an improved variant of the YJ-82 subsonic missile with terminal guidance radar seeker. The mid-course guidance system is based on the INS. The missile has a 165 kg armor-piercing warhead. The missile's flight altitude varies from 20-30 m cruise to 7 m at the terminal stage with range extended to 180 km. C-802A missile length 6.8 m, diameter 360 mm, weight 682 kg, can carry 165 kg of warhead weight.

While these weapon systems alone do not represent major advances in China's military capabilities—many of these systems actually made their debut in previous shows—the diagram expresses a conceptual model that presents integrated weapon platforms executing an attack, which demands a high degree of interoperability and integrated war-fighting planning. This model appears consistent with trends in some Chinese military exercises in the East and South China Sea.

As China continues to modernize its aerospace capabilities, it will increasingly be able to integrate existing weapon platforms and alter the calculus of forces required for sea control. While the CASIC diagram is only a model, it does represent a trend in Chinese defense thinking toward greater interoperability and a layered defense strategy for near- and far-sea defense. The prominent role of UAVs at the air show also suggests that its battlefield applications are becoming more defined in Chinese defense planning. As China strengthens its C4I (Command, Control, Communications, Computing and Intelligence) structure and integrates its other operating weapon systems, it could greatly enhance the Chinese military's capability to execute near- and far-sea defense missions and an effective anti-access/area denial strategy.

L.C. Russell Hsiao is Editor of The Jamestown Foundation's China Brief.

Beijing Wages Economic Diplomacy to Counter "China Threat" Theory

By Willy Lam

Beijing is waging an economics-focused diplomacy of reassurance to counter the "China Threat" theory and to augment its political clout particularly

in the Asia-Pacific and European regions. In the last two years of its term of office, the Hu Jintao leadership is expected to use the country's economic muscle to convince the global community that the quasi-superpower's precipitous rise will bring about win-win scenarios particularly on the business and trade fronts. This is in view of foreign-policy setbacks that China has suffered in the past ten months due mainly to heightened territorial disputes with countries including Japan and India, as well as members of the Association of Southeast Asian Nations (ASEAN). Friction between China and its neighbors has apparently allowed the Barack Obama administration, which has reiterated America's desire to "come back to Asia," to make new headway in what Beijing perceives as an "anti-China containment policy."

In the past month or so, senior Chinese diplomats and commentators have cited a new foreign-policy dictum coined by President Hu, who heads the Chinese Communist Party's (CCP) policy-setting Leading Group on Foreign Affairs. The instruction – "insist upon hiding one's capacities and biding one's time; enthusiastically seek [concrete] achievements" – is an amplification of the eight-character mantra laid down by late patriarch Deng Xiaoping in the early 1990s: *taoguangyanghui, yousuozuowei* ("Hide one's capacities and bide one's time; seek [concrete] achievements"). Hu's motto was first unveiled in a closed-door conference of overseas-based diplomats held in Beijing in mid-2009 (Xinhua News Agency, August 14; China.com.cn, November 7).

By adding the qualifier "insist upon," the Hu leadership wants to impress upon the global community—particularly China's nervous neighbors—that China does not harbor expansionist tendencies despite the leaps-and-bounds growth in its economic and military might. By underscoring the fact that China should "enthusiastically" go after diplomatic achievements, Hu has given solid indications that the Middle Kingdom would be proactively pursuing objectives that befit the country's elevated status. Yet, Beijing also took pains to point out that these ambitious goals are mostly economic in nature. As the official *Outlook Weekly* pointed out in a commentary last week, China is pursuing "economics-focused diplomacy" by ensuring that "political maneuvers will be in the service of economic goals" and vice versa (*Outlook Weekly*, November 7; *People's Daily*, November 7; Xinhua News Agency, November 7). In light of the country's \$2.5 trillion foreign-exchange reserves, Beijing has an unprecedentedly large war chest to engage in economic diplomacy.

This shift in Chinese diplomacy is evidenced by

the marathon overseas forays made by Politburo Standing Committee (PBSC) members after the plenary session of the CCP Central Committee last October, which settled the succession question by inducting Vice-President Xi Jinping into the Central Military Commission as vice chairman. The missions have included Hu's trips earlier this month to France and Portugal, in addition to his attendance of the just-completed G20 Meeting in Seoul and the Asia-Pacific Economic Cooperation (APEC) forum in Yokohama, Japan. Also in the past fortnight, Chairman of the National People's Congress (NPC), Wu Bangguo, visited Cambodia, Thailand and Indonesia, while his PBSC colleague, Chinese People's Political Consultative Conference Chairman Jia Qinglin, toured Syria, Poland, Oman and Kazakhstan. Meanwhile, Vice-President Xi set off this week on a tour of Singapore, South Africa, Angola and Botswana (*Ming Pao* [Hong Kong], November 9; Xinhua News Agency, November 12).

Most eye-catching have been inroads that Beijing has made in Europe. For reasons including fostering a "multi-polar world order," it has been a long-standing tradition for Beijing to bolster ties with the European Union when it is encountering hiccups in relations with the United States. Beijing seems to be reviving the old game of playing favorites, which is a time-honored tactic to help stymie the development of a transatlantic approach to China. Hu firmed up a "new-era comprehensive strategic partnership" with France in his three-day trip to the country, during which he met with counterpart Nicholas Sarkozy five times. The two leaders signed trade and investment deals worth \$22.8 billion. Sarkozy, who two years ago was pilloried by Beijing for meeting the Dalai Lama, spoke glowingly of the PRC's global contributions. "To resolve the big problems in the world we need China," he said. "China should not be seen as a risk but an opportunity," the French President added. "It's not by reproaching people for things that you make progress" (*People's Daily*, November 8; Reuters, November 5). Last week, China also played host to British Prime Minister David Cameron, who was making his first trip to Beijing with a record number of business executives. While the British signed deals worth a mere \$1.6 billion, selected British financial institutions were given access to the China market ahead of their American competitors. While both Sarkozy and Cameron discreetly touched upon human rights in private talks with Chinese leaders, no strong public calls were made for Beijing to improve its treatment of dissidents, including the incarcerated Nobel Peace Prize laureate, Liu Xiaobo (BBC News, November 9; The Guardian [London], November 10; *Financial Times*, November 12).

While Portugal is not considered a heavyweight EU

member, Hu's trip to the country is emblematic of the quasi-superpower's role in taking advantage of the situation and shoring up the recovery of European countries that are still reeling from the international financial crisis. "We are ready to back, through concrete measures, Portugal's efforts to face the impact caused by the international financial crisis and broaden our economic and trade cooperation," Hu said while meeting Portuguese Prime Minister José Sócrates. The two signed deals and contracts in infrastructure, renewable energy and tourism worth \$1 billion. Sócrates, whose government was struggling with debts and weak exports, highlighted the two countries' "excellent political ties" and vowed to give "priority" to bolstering a Portuguese-Chinese partnership (The Associated Press, November 7; Theportugalnews.com, November 3). Earlier, Beijing bought \$600 million worth of government debts issued by Spain, another weak link in the Eurozone economy. While in Greece last month, Premier Wen Jiabao pledged to purchase substantial amounts of the financially beleaguered country's bonds in addition to setting up a \$5 billion fund to help Greek shipping companies buy made-in-China vessels (Balkans.com, November 8; *Ming Pao*, November 7).

Beijing has also used economics-based diplomacy to try to steal the thunder of President Obama's just-ended Asian expedition, which is interpreted by Chinese commentators as an effort to expand Washington's "encirclement policy" against China (*Global Times*, November 8; *Ming Pao*, November 12). For example, NPC Chief Wu Bangguo toured Jakarta just prior to Obama's historic visit to Indonesia, where he spent four years of his childhood. While the U.S. President made headlines with rhetoric such as "prosperity without freedom is just another form of poverty," Wu seemed to be able to offer Indonesians something more tangible. The top parliamentarian pledged to invest \$6.6 billion in much-needed infrastructure projects in the relatively poor Asian nation. Chinese Vice-Foreign Minister Zhang Zijun pointed out that his country had "long experience in infrastructure development, and now we have the budget as well as the technology." China's trade with the largest ASEAN member this year is worth an estimated \$22.5 billion, compared to America's \$15.6 billion (*Financial Times*, November 10; *Jakarta Globe*, November 8). Given China's still-festering border problems with India, it would be hard put for Beijing to prevent Obama from consolidating America's newly minted strategic partnership with India during his 68-hour stay in the world's most populous democratic country. Yet Premier Wen is due to call on New Delhi next month, when the Chinese leader is expected to stress growing trade and investment links between the two Asian

giants (*Economic Times* [New Delhi] November 13; *Hindustan Times*, November 11).

There is also evidence that the Hu leadership's new-found diplomatic flexibility is being applied to Japan. Sino-Japanese ties dipped to the lowest level in recent memory after the captain of a Chinese fishing vessel was seized by Japanese coast guard close to the disputed Senkaku Islands (known in China as the Diaoyu Islands). While in Yokohama for the APEC forum, Hu squeezed in a 20-minute meeting with Japanese Prime Minister Naoto Kan. This was the first dialogue between the two countries' leaders since the sovereignty row. The official Xinhua News Agency's report of the Hu-Kan meeting made no mention of the territorial squabbles. It quoted Hu as putting emphasis on reviving the two neighbors' "strategic relationship of mutual benefit." "China and Japan being major partners in economic and trade cooperation, both sides should continue to deepen their mutually beneficial bilateral cooperation," Hu said (Xinhua News Agency, November 13; Kyodo News Agency, November 13).

The Chinese leadership's "economic-focused diplomacy" seems to have worked to some extent at the G20 and APEC meetings, when Hu and his aides were able to prevent Obama from targeting Beijing's apparent undervaluation of the yuan (Renminbi). While the G20 communiqué urged members to "move toward more market-determined exchange rate systems and enhance exchange rate flexibility," no specific country was singled out for criticism. While a host of countries including Japan, the U.S. and Germany had wanted the G20 forum to discuss China's withholding its exports of rare earth, the issue was apparently left off the table due to behind-the-scenes maneuvers by the Chinese delegation (*New York Times*, October 22; China News Service, November 14; AFP November 12). The two forums provided Hu with a platform to highlight China's contribution to global economic recovery. "We must adopt an attitude responsible to history and the future... [and] work in concert for strong, sustainable and balanced growth of the world economy," Hu said at the Seoul conclave (*Los Angeles Times*, November 11; Xinhua News Agency, November 12; *Asahi Shimbun* [Tokyo], November 12).

Beijing's determination to use new strategies to mend fences with different countries has been indirectly reflected by various experts' realistic assessment of recent contretemps in the country's foreign policy. In a recent interview with the Chinese media, Renmin University international relations professor Shi Yinhong expressed disappointment with China's diplomatic performance. "We can do with

some soul-searching," said Shi. "In many respects, China's qualifications [for being a global actor] have improved, yet conditions on the diplomatic front have worsened." Similarly, popular military commentator General Zhang Zhaozhong indicated that Beijing faces the most serious challenges in 30 years. "Countries like Japan, South Korea, and several Southeast nations suddenly turned their backs on China and followed the United States," he wrote. "This is a very serious matter" (*Wen Wei Po* [Hong Kong] October 24; Nanfengchang Magazine [Guangzhou], October 22; People's Daily website, November 1).

Doubts, however, linger as to whether the CCP leadership is indeed willing to turn a new page in its foreign relations. Beijing's obdurate stance on the Liu Xiaobo issue is a case in point. Chinese diplomats have the past fortnight put pressure on numerous European and Asian countries not to send their emissaries to the award-presentation ceremony in Oslo next month. Earlier, Beijing had indefinitely shelved meetings with Norwegian officials on bilateral issues including the establishment of a China-Norway Free Trade Area (AFP, November 5; Straits Times, November 9; The Telegraph [London] October 11). Such apparent bullying is a continuation of the much-criticized hardball tactics that Beijing employed to intimidate the Nobel Peace Prize Committee into denying Liu the honor. Until the world sees more concrete evidence of Beijing's readiness to "hide its capacities" and keep a low profile, yuan diplomacy alone may not be sufficient to showcase China's status as a responsible stakeholder in the global community.

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China Eyes "Dual Use" Applications for its Supercomputers

By Matthew Luce

As of November 15, the world's fastest supercomputer officially belongs to China, according to the most recent listing of the world's

Top 500 computers [1]. China has pushed the United States out of the top spot as well as putting a third machine into the top ten, providing another indicator of China's rise as a world technological power. Yet this year's results should come as a surprise to no one. China has been pouring investments into high performance computing for the last decade and gradually edging the United States out of the top ten. Increased funding and an official policy commitment have propelled China from a technological backwater that in 2001 did not have a single machine in the Top 500 into a supercomputing superpower [2].

Supercomputers, or high-performance computers, are an enabling technology that opens up a wide range of research frontiers previously closed to Chinese institutions, not least in defense applications. They are an increasingly important tool in intelligence as well as weapons design, and a crucial link in any national innovation chain. China emphasizes the civilian applications of its supercomputers [3], but a quick glance at China's history and R&D architecture would indicate that they will see significant military use. At the same time, while China's triumph in supercomputing is a milestone, it should not be seen as a signal that China has exceeded the innovative power of the West, but rather as a launch pad for further technological development.

A DUAL-USE TECHNOLOGY

By devoting national R&D resources to developing domestic supercomputing capabilities, the Chinese government is betting on a return on its investment in the form of heightened R&D capabilities in a wide range of fields. Heightened commercial and civilian research capabilities are certainly among the payoffs of building such a powerful computer, but China's military will certainly benefit greatly as well [4].

Supercomputers can be put to work on one complex problem or multiple decentralized ones, but it stands to reason that they are usually employed for issues that require the quadrillions of calculations per second that they are capable of. The complex mathematical analysis involved in cryptanalysis and sensor signal processing today are problems that can only be tackled practically by computers with these "super" capabilities. China's efforts to develop a secure satellite communications network as well as data fusion systems for missile tracking are critically dependent on a capability to process encrypted data at a very high rate of calculations per second.

While China's newest and fastest supercomputer is ostensibly for civilian research [5], it is highly significant that it was built by the National University of

Defense Technology (NUDT), China's premier military technology university and one of its top research centers. The bulk of the world's supercomputer processing power and most likely China's as well is devoted to commercial and academic research, but any modernizing military like China's also has an increasing need for supercomputing capabilities. In the 1990s China was accused of diverting supposedly civilian supercomputers purchased from the United States for military ends [6], so it would not be the first time China used the fig leaf of "civilian usage" to mask military supercomputing programs. At NUDT, supercomputer development labs like the National Key Lab for Parallel and Distributed Processing operate on the same campus as the respective National Key Labs for C4ISR and Automatic Target Recognition [7]. These are the very same kinds of research facilities that would be expected to have need for supercomputers to support their work.

Additionally, supercomputers provide indispensable services for a nation in the process of modernizing its nuclear and conventional armament. Since all nuclear test explosions are precluded under the Comprehensive Nuclear Test Ban Treaty (CTBT), nuclear blast modeling can be performed only by large computers. Missile, jet engine, and conventional explosive design and modeling are also increasingly done using supercomputers. With a much improved supercomputer arsenal, China also has an increased capability for the R&D necessary to bring its armed forces into the 21st century.

China's possession of supercomputer technology may also constitute a proliferation risk. As a result of their military applications and in particular their cryptanalytic functions, much of the technology in a supercomputer is defined as "dual-use" according to the Wassenaar Arrangement on Export Controls [8]. Supercomputers can be compared to any dual-use technology like a rocket engine or a nuclear reactor: they can be used for commercial civilian projects or they can be used to produce weapons. Since the PRC is the only major supercomputing power that is not a signatory of the Wassenaar Arrangement, there is an elevated risk that supercomputers could be sold to rogue states to assist their nuclear programs.

POPULAR MISPERCEPTIONS

China now has the most powerful computer in the world, but that does not mean that their ability to innovate has eclipsed that of the United States, nor does it mean that China has a military or intelligence collection advantage. The ascent of the Chinese to the number one spot is based more upon political will to invest in technology than any significant

indigenous technological breakthrough.

Building a more powerful computer is accomplished today by linking together an incrementally larger cluster of processors and writing software that allows them to operate together, rather than (in most cases) designing a new and groundbreaking computing technology. The cost to build a top supercomputer has also dropped precipitously in the past ten years, meaning that the Chinese had to invest a relatively smaller sum compared to the amount spent by U.S. institutions to develop top supercomputers just ten years ago.

This is not to say that China's newest and most powerful supercomputer, the Tianhe-1A (which translates as "Milky Way") is not innovative. It combines its CPUs with GPUs (graphics processing units) to increase performance, consumes significantly less energy than its peers in the United States [9], and possesses a Chinese-designed interconnect chip and software that links the cluster together. The system also contains 2048 Chinese-made Galaxy FT-1000 processors with an undisclosed purpose [10], likely as a memory controller/synchronizer to boost the speed of the system. The bulk of its hardware, however, is still designed by Intel and NVIDIA, which are both based in California. This means that while Chinese labs may be working hard to produce entirely indigenous supercomputer systems, they currently still rely on foreign imports.

Just having a faster machine does not in itself provide any advantage for Chinese researchers either. In some sense building the Tianhe-1A only provides China with a showy muscle car: it might be able to go from 0 to 60 mph in 3 seconds, but that doesn't provide much added utility if the owner is only using it to drive to work. The real test of innovative ability will be in designing specific applications for the computer's power so that it does not lie idle for most of the day. Building such a large cluster will also be a waste if it is used for decentralized or cloud computing instead of concentrating on a few very large and knotty problems, since smaller and cheaper computer systems could be used for easier tasks.

China's supercomputer dominance cannot then be taken as a signal of U.S. technological inferiority. If U.S. researchers and policymakers are to take any lesson from the November 2010 Top 500 listing, it is that the playing field has been leveled. By investing heavily in high performance computing and making it a feature of the 11th 5-year Plan for Technology [11], Beijing has proved that it is serious about its goals for high performance computing and is willing

to devote the necessary resources for research and development. China's supercomputing research labs may not be superior to similar facilities in the United States, but they currently enjoy generous funding and directives from central planners to develop faster machines.

Now that China has demonstrated its commitment and ability to build faster machines, it seems likely that the United States will respond to the challenge. After Japan's surprise coup for the fastest computer, which lasted from 2002-2004, the U.S. responded with an increase in research funding for supercomputer projects and managed to push Japan entirely out of the top ten by 2007 [12]. Today U.S. institutions have the capability to build faster machines, but according to Jack Dongarra, the computer scientist at Oak Ridge Labs and the University of Tennessee who oversees the judging of the Top 500, "it's a question of will." According to an October 2010 report by the National Center for Computational Sciences, two new supercomputers, each capable of more than 20 petaflops, are respectively under construction at Lawrence Livermore and Oak Ridge National Labs, but the systems will not be operational until 2012 and few details are available as to their systems [13].

CONCLUSIONS

This new wave of Chinese supercomputers has the potential to give Chinese research institutions a leg up on the United States in terms of future defense and commercial technological innovation, but the real test will be in software and applications that may still be in development. A fast computer is a trove of research potential, but if it lies untapped then the placement of a Chinese machine into the number one spot will be nothing more than flag-waving.

Nevertheless, Chinese defense technology research labs now have the means, motive, and opportunity to take advantage of high performance computing resources. China's conventional and nuclear weapons design programs as well as its intelligence and signal processing architecture have already progressed to the stage where they can make efficient use of a growing supply of supercomputers. Access to machines like the Tianhe-1A thus opens up new horizons for Chinese defense researchers and cryptographers, and chips away at the technological and military advantages of the United States.

Observers will have to come to terms with the fact that this is not a fluke or a one-time effort to build a single machine and briefly upstage the Americans. While American computing labs may be able to

recover their lead in a few years, this year's display of Chinese supercomputing power is only the latest technology being churned out by Chinese research labs in a concerted push to become a leading global innovator.

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NOTES:

1. Top 500 Supercomputers: <http://www.top500.org/>.
2. See technological objectives in China's 11th 5-year plan: http://english.gov.cn/2006-03/06/content_219817.htm.
3. List of National Supercomputing Center Applications: <http://www.nscj.gov.cn/list.asp?id=83>.
4. The wide range of major supercomputer applications includes subjects as diverse as petroleum prospecting, neutron science, genetic modeling, astrophysics, climate change modeling, nuclear reactor design, nuclear blast modeling, advanced materials science, missile design, cryptanalysis, and encrypted signals processing.
5. List of National Supercomputing Center Applications: <http://www.nscj.gov.cn/list.asp?id=83>.
6. "China and Supercomputers," NTI publications, <http://www.nti.org/db/china/supercom.htm>.
7. NUDT Research & Development listings, http://english.nudt.edu.cn/sub_index.asp?classid=13&child=3&typeid=0.
8. Wassenaar Agreement classifications, <http://www.wassenaar.org/controllists/index.html>. See Category 4: Computers.
9. "NVIDIA Tesla GPUs Power World's Fastest Supercomputer," NVIDIA press releases, http://pressroom.nvidia.com/easyir/customrel.do?easirid=A0D622CE9F579F09&version=live&prid=678988&releasejsp=release_157.
10. Hong Zhaofeng, *tianheyihao zueiniou! gaosینگneng jisuan TOP1000 wu kandian* (Tianhe No. 1 Fastest! Five Observations about High Performance Computing Top100), *IT-168*, http://server.it168.com/a2010/1028/1118/000001118977_all.shtml.
11. Technological objectives in China's 11th 5-year plan http://english.gov.cn/2006-03/06/content_219817.htm.

12. Top 500 List Releases: <http://www.top500.org/lists>.

13. Patrick Thibodeau, "U.S. building next wave of supercomputers," *Computerworld*, http://www.computerworld.com/s/article/9196378/U.S._building_next_wave_of_supercomputers_.

Hambantota, Chittagong, and the Maldives – Unlikely Pearls for the Chinese Navy

By Daniel J. Kostecka

Much of the discussion regarding China's maritime ambitions in the Indian Ocean has revolved around the so-called "String of Pearls" strategy that Beijing is alleged to be pursuing. As part of this strategic construct it is claimed that Beijing is building a comprehensive network of naval bases stretching from southern China to Pakistan. This theory, a creation of a 2004 U.S. Department of Defense contractor study entitled *Energy Futures in Asia*, is now accepted as fact by many in official and unofficial circles [1]. While the study contains some useful arguments, certain elements of it have been selectively quoted as singular evidence of Beijing's strategic intent in this region. In spite of the lack of evidentiary proof supporting the assertion that China intends to turn these facilities into military bases, claims regarding future bases in these locations for the Chinese Navy continue to this day, particularly in the United States and India [2]. This is somewhat ironic given that in past six months, Sri Lanka's president and Bangladesh's foreign minister stated publicly that China's investments in port facilities in their nations are strictly commercial while over the past year the Maldives under the leadership of a new pro-Indian president reached out to New Delhi, not Beijing, to assist with maritime security for the island archipelago (*The Times of India*, June 28; BBC News, May 17; IndianExpress.com, August 13, 2009).

From the Chinese perspective, in June 2009 Senior Captain Xie Dongpei of the PLA Navy stated that China's port construction in Sri Lanka, Bangladesh, and Pakistan was strictly commercial (*The Straits Times*, June 24, 2009). Further, in a 2004 article Senior Captain Xu Qi discussed Chinese investment in port facilities in the Indian Ocean within the same context as Chinese commercial investments in Russia, Africa, and the Caribbean as well the importance of China's membership in the World Trade Organization [3]. Yet, despite strident denials from high level officials, rumors of Chinese military activity in these

nations will not cease. This article will examine allegations of Chinese military facilities in Sri Lanka, Bangladesh, and the Maldives to include the practical benefits of these locations for China's security.

Hambantota (Sri Lanka): While Hambantota is not listed as one of China's "pearls" in *Energy Futures in Asia*, numerous (later) sources have since associated Chinese investment in the port with China's wider naval ambitions in the region. These include *Joint Operating Environment 2008* by U.S. Joint Forces Command along with an article by an Indian analyst claiming that Hambantota will provide extensive replenishment facilities for Chinese warships and submarines [4]. China has provided \$360 million for the development of Hambantota that includes building a harbor, cargo terminals and a refueling depot (*Sri Lanka Guardian*, June 16). The construction agreement was signed on March 12, 2007, between the Sri Lanka Ports Authority and the Consortium of China Harbor Engineering Company Limited and Sino Hydro Corporation Limited.

Beyond Chinese financing of commercial port construction, there is little else to support the contention that Hambantota will one day serve as a base for Chinese warships. On a map, a Chinese-funded naval base in Sri Lanka looks like a dagger pointed directly at India. From an historic standpoint, the idea of a Chinese naval base in Sri Lanka provides further intrigue because for centuries the island nation served as a key nexus of China's maritime trade in the Indian Ocean. Sri Lanka was even visited by all seven of Zheng He's Treasure Fleets and represents one of the few places that Zheng He led troops in combat [5].

In reality, such a base, due to its proximity to India, would be a liability in a serious conflict as Sri Lanka lies less than 50 nautical miles from India at its nearest point. Given the small size of Sri Lanka's air force and navy, without the addition of substantial air defenses and hardened infrastructure that Sri Lanka cannot afford to provide, any Chinese military forces on Sri Lanka would find themselves vulnerable to strikes by the Indian military. At the same time, a robust base at Hambantota or anywhere else in Sri Lanka is a costly investment for the support of forces engaged in counter piracy and peacetime presence patrols that would have the added negative effect of inflaming China's relations with India. Additionally, President Mahinda Rajapaksa of Sri Lanka envisions Hambantota, which is in his home district, as a second Colombo, Sri Lanka's largest port, in order to further economic development of his nation. That he has sought and secured Chinese funding for the project should not be taken as indicator that a large

foreign military presence, Chinese or otherwise, would be welcome in an area he is committed to opening up to development, trade and tourism (*Sri Lanka Guardian*, June 16).

Chittagong (Bangladesh): China's interest in investing in the container port of Chittagong in Bangladesh was reported in *Energy Futures in Asia* in 2004 with the claim that China could be seeking more extensive naval and commercial access to Bangladesh although the report admits that China's interest in Chittagong for military purposes could not be confirmed [6]. As with other claims surrounding China's alleged "String of Pearls" strategy, *Energy Futures in Asia* is consistently cited as credible evidence of China's long term intentions in Bangladesh.

Like Hambantota, there is no evidence to suggest the end state of China's investment in Chittagong will be a base for Chinese warships. Additionally, like Hambantota, there is reason to conclude that Dhaka will not permit China to develop a naval base at Chittagong. First, simple economics do not support arguments that Chittagong is becoming a "Chinese Pearl." According to the Bangladeshi Foreign Minister, Dipu Moni, China has agreed to help finance an \$8.7 billion expansion of Chittagong, already Bangladesh's primary port, which handles approximately 90 percent of the nation's foreign trade. Yet, Bangladesh's leaders have an expansive vision for the port that is commercial, not military. Bangladesh envisions Chittagong as a transshipment hub for trade flowing into and out of India, Nepal, Bhutan, Burma, and China through a developing network of river, road, and rail links (*China Daily*, March 25). In fact, just as Dhaka is negotiating with Beijing for investment in Chittagong and is considering road and rail links from Chittagong through Burma to Kunming in China's Yunnan Province, Dhaka signed an agreement with New Delhi in May 2010 for the transshipment of Indian goods through Bangladesh to the land locked state of Tripura in northeastern India (Bangladesh Sangbad Sangstha, May 31; *China Daily*, March 25). India in turn agreed to provide dredging equipment to assist Bangladesh in its efforts to dredge rivers for improved flood control, navigation and access (UNB Connect, January 12). Also, while China and India are Bangladesh's number one and two trading partners with Bangladesh suffering from a substantial trade imbalance with both nations, in 2008, Bangladesh's exports to India were over three times higher than its exports to China [7]. This in addition to Bangladesh receiving electricity from India's power grid arguably makes India the more important trading partner (UNB Connect, January 12).

Second, the geography of Chittagong, or what Alfred Thayer Mahan calls position, is not in China's favor. With the exception of a small section of its southeastern border, Bangladesh shares its entire land border with India. Given that, it is difficult to envision a set of circumstances that would cause Dhaka to risk antagonizing a major trading partner that also surrounds it on three sides by permitting a foreign power to develop a naval base there. Foreign Minister Moni is on record as stating that she views Bangladesh as a bridge between India and China hoping to capitalize on its position between the two nations while being careful not to offend either. She stated specifically, "I don't believe if China helps us build this sea port that China will be able to use it for other purposes. Bangladesh will never let any part of its territory be used for any kind of attacks or anything like that" (BBC News, May 17).

Marao (Maldives): One of the more sensationalistic claims regarding China's military ambitions in the Indian Ocean revolves around reports that China has developed a submarine base in the Maldives Islands, a chain of over 1100 atolls and islets approximately 400 nautical miles south and east of India. Press reports began circulating in 1999 that the government of the Maldives leased Marao Atoll to China to set up a monitoring station. Additional reports followed a 2001 visit to the Maldives by Chinese Prime Minister Zhu Rongji claiming that China intended to build a submarine base on Marao to be completed in 2010 [8]. One article by an Indian analyst even claimed a PLA Navy officer welcomed the possibility that the Maldives could be submerged by 2040 due to global warming because an underwater base would be "ideal for submarines" (Dhivehi Observer, May 8, 2005). In 2000 President Gayoom of the Maldives attempted to assure New Delhi that his nation was not negotiating with China for the development of a naval base but was not entirely successful as the story continues to propagate (Minivan News, October 9, 2006). Contributing factors are likely general Indian paranoia over even rumored Chinese military activity on its periphery and public criticism in 2006 and 2008 by political opposition leaders over perceptions of then President Gayoom's close relationship with Beijing (Dhivehi Observer, June 12, 2008; Minivan News, September 18, 2006). Regardless, as late as 2009, articles were still being written by Indian security analysts and retired military officers about China's attempts to encircle India that included mention of China's base in the Maldives [9]. In February 2010 a professor at the University of Pennsylvania wrote that China's submarine base in the Maldives represented a direct challenge to the American air and naval base at Diego Garcia (Japan Times Online, February 12).

Assertions aside, there is no Chinese submarine base in the Maldives. In fact, it is unlikely that any of the atolls that make up the Maldives could even handle the type of sophisticated infrastructure required to support submarines (Dhivehi Observer, May 8, 2005). It also makes no sense for the government on Male Atoll to risk relations with its closest neighbor by permitting a potentially hostile power to develop a naval base among its islands as India is the island group's primary security partner. The Indian Army and Navy conduct exercises with the Maldivian National Defense Forces, officers from the Maldives train in Indian military schools, and in 2006 India donated a fast attack craft to the Maldives (IndianExpress.com, August 13, 2009). India also sent ships and aircraft to the Maldives to assist with tsunami relief in 2004, and in 1988 the Indian military sent 1600 troops to the Maldives to defeat an attempted coup against President Gayoom by Tamil mercenaries (IndianExpress.com, November 4, 2008; Asian Defence, October 16, 2009). More important, in 2009 the Maldives under the leadership of the new pro-Indian President Mohamed Nasheed approached India about becoming integrated into India's security grid in order to enhance existing security cooperation agreements and out of growing fears that a Maldivian island resort could be taken over by terrorists (*The Hindu*, October 22, 2009). According to Indian press, as a result of this request the Indian Navy and Coast Guard will each base one helicopter in the Maldives, India will install coastal radars on Maldivian atolls, where there are currently only two such devices as well as integrate them with India's maritime surveillance network, and Indian patrol aircraft now conduct flights over the islands (IndianExpress.com, August 13, 2009).

Given the Maldives reliance on India for security assistance, it is inconceivable that China or any other nation would be permitted to develop military facilities there. It would not only undermine Maldivian security but, given the small size of the atolls that make up the Maldives, any such facility would be small and difficult to defend, making it a vulnerable target for India's navy and air force. India showed in both 1988 and 2004 that the Maldives are within its operational reach and while those missions were to provide assistance against a coup attempt and a natural disaster, the point is still instructive for any nation that would seek to use the Maldives as a base to undermine Indian security.

CONCLUSION

Despite almost a decade of speculation there appears to be no hard evidence that suggests China plans to base warships in Bangladesh, Sri Lanka or the

Maldives, or that these nations even desire a Chinese military presence. In fact, all three of these nations' proximity to India and their desires to balance their relations between India and China indicate that China will not develop military facilities in these countries. While the Chinese are heavily investing in developing infrastructure for improved access into the Indian Ocean, which in turn is helping it gain political influence in these countries, the extent to which it has improved access and infrastructure will translate into basing arrangements remains to be seen.

China will no doubt continue to maintain positive relationships with Sri Lanka, Bangladesh and the Maldives, but this does not mean China will seek to establish a military presence in any of these countries or that such a presence would even be permitted as it would not only undermine their security, it would do very little to enhance China's. Recent denials of future Chinese naval bases in Bangladesh and Sri Lanka by leaders of those nations and the Maldives' reliance on India for security assistance should be taken as clear signs that such arrangements are farther from reach than some may think, and reflect the growing concerns over the intentions of these nations regarding the possibility of Chinese military bases on their soil.

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Capabilities and Implications of China's *Jiaolong* Submersible

By Michael S. Chase

In late August the Ministry of Science and Technology and State Oceanic Administration (SOA) of China announced that on July 13 the *Jiaolong* manned deep-water submersible, which is named for a mythical sea dragon, had successfully completed a test dive to a depth of 3,759 meters below the surface of the South China Sea. The submersible's operators took pictures and videos, collected marine life samples and used a robotic arm to plant a Chinese flag on the seabed (*Xinhua News Agency*, August 27). With the sea tests of the *Jiaolong*, China gained membership in an exclusive club, becoming only the fifth country with a manned submersible capable of diving deeper than 3,500 meters [1]. Chinese media noted that China joined the United States, Japan, France and Russia as the only countries to have demonstrated such impressive deep diving capabilities. High-level science and technology officials also lauded the accomplishment. "The successful diving trials of *Jiaolong* marked a milestone in our country's deepwater equipment and technology development," said Vice Minister of Science and Technology Wang Weizhong (*China Daily*, August 27). Echoing this message, one Chinese media report praised the *Jiaolong* as "one of the most advanced vessels of its kind in the world" (CNTV, August 27).

Official Chinese media reports and expert commentators also compared the rigors involved in testing a submersible to that depth to the

technological challenges encountered in the manned space program and China's nuclear program. Jia Yu, a research fellow with the China Institute for Marine Affairs, said, "Deep-sea technology is considered an innovative and high-end technology as important as space and nuclear technologies" (*Beijing Review* No. 38, September 23). In addition to emphasizing that the *Jiaolong* sea tests reflected China's growing scientific and technological prowess, Chinese officials and PRC media reports highlighted some of the specific ways in which the *Jiaolong* is capable of contributing to deep-sea scientific research and marine resource exploration activities. Yet international media reports and commentaries also noted the potential military applications of China's deep submergence accomplishments, giving rise to several questions for analysts concerned with China's growing naval power: What are the capabilities of China's new *Jiaolong* deep submersible? How has the *Jiaolong* program developed over the past decade? How is it likely to evolve in the future? Lastly, what are its strategic implications?

CHARACTERISTICS AND CAPABILITIES OF CHINA'S *JIAOLONG* SUBMERSIBLE

The *Jiaolong* is a manned deep-ocean submersible made in China. Like many other submersibles, the *Jiaolong* operates with a mother ship. For its sea trials, the *Jiaolong* operated with the *Xiangyanghong 09*, an oceanographic research ship subordinate to the North Sea Branch of SOA [2]. Built in Shanghai's Hudong shipyard in 1978, the *Xiangyanghong 09* was recently modified to serve as the mother ship for the submersible's sea tests. The hull of the *Jiaolong* is made of titanium, and it is designed to reach a maximum depth of about 7,000 meters, making the submersible capable of reaching 99.8 percent of the world's sea areas, according to an official website [3]. Chinese media reports state that the submersible is equipped with "foolproof life support systems and two oxygen supply systems" (*Beijing Review* No. 38, September 23). The *Jiaolong* can remain submerged for up to 12 hours. Chinese media reports indicate that the *Jiaolong* is about 8.2 meters long, 3 meters wide and 3.4 meters high. It weighs nearly 22 tons (*Global Times*, September 25). This makes it roughly comparable in size to *Alvin*, a U.S. Navy-owned deep submergence vehicle operated by Woods Hole Oceanographic Institution (WHOI) that is perhaps best known for locating a lost hydrogen bomb in the Mediterranean Sea in 1966 and surveying the wreck of the Titanic 20 years later [4].

Chinese media reports state that *Jiaolong* has "a unique hovering and locating ability" and "possesses advanced micro-acoustic communication and

undersea topography detection capabilities, enabling high-speed transmission of images and voice and detection of small marine targets" (*Beijing Review* No. 38, September 23). Chinese media reports also state that it is "equipped with a variety of high-performance tools enabling it to complete complex tasks such as on-the-spot sampling and core drilling in specific marine environments and geological conditions" (*Beijing Review* No. 38, September 23).

According to a journal article by three Chinese specialists involved in the project, Liu Feng, Cui Weicheng, and Li Xiangyang, the submersible is capable of cruising at a constant height above the sea bottom, hovering at a designated position and resting on the sea bottom [5]. With these impressive capabilities, they write, *Jiaolong* can carry out a variety of tasks, including taking samples of mineral deposits or sea creatures, measuring water temperature and collecting water samples, making high-resolution maps with its bathymetric side-scan sonar, taking pictures and recording video of underwater objects such as marine wrecks, deploying or recovering devices, and inspecting and maintaining marine structures such as pipelines and cables [6].

The *Jiaolong* operates with a crew of three "oceanauts." Chinese media reports indicate that Beijing began selecting its "oceanauts" in 2006. According to one report, "The requirements are as strict as those for astronauts. An oceanaut must be familiar with the structure, equipment and control of a submersible" (*Beijing Review* No. 38, September 23). Among the specific requirements, the "oceanauts" must be under 35 years of age and hold a bachelor's degree or above in shipbuilding, machinery or electronics. They must also pass a rigorous physical examination. Today, the members of the *Jiaolong's* crew are the only three fully trained "oceanauts" in China, but there will soon be several more. According to Liu Xincheng, an official with the SOA, China intends to begin training more candidates, with a goal of reaching a total of six fully qualified "oceanauts" (*Beijing Review* No. 38, September 23).

After selecting and training its first three "oceanauts," China began demonstrating the *Jiaolong's* capabilities last year. The *Jiaolong* has conducted a series of sea tests over the past 15 months. According to one Chinese media report, "Since August 2009, *Jiaolong* has successively been tested at 1,000 meters and 3,000 meters below sea level. In the South China Sea test from May 31 to July 18, 2010, *Jiaolong* completed 17 dives. Seven surpassed 2,000 meters and four reached as deep as 3,000 meters. The deepest reached 3,759 meters"

(*Beijing Review* No. 38, September 23). During its longest dive, the *Jiaolong* operated underwater for more than nine hours. Chinese media reports characterize the sea tests as successful. According to one report, "The tests have also fully verified the functionality and the technical capability of *Jiaolong*, laying a solid foundation for practical application of scientific research and greater depth of testing—as well as resource surveys" (*Beijing Review* No. 38, September 23).

PROGRAM BACKGROUND

China has made relatively quick progress on the development of the *Jiaolong* submersible since starting the project as part of its ocean exploration program about eight years ago. China started to develop the submersible in 2002 and work on the submersible and its mother ship was completed after about six years. According to one report, "In order to promote the development of China's deep-sea delivery technology...the Ministry of Science and Technology launched the *Jiaolong* Project as part of the State Hi-Tech Development Program (863 Program). This project was designed to provide important hi-tech equipment for China's seabed ocean resources surveys and scientific research, as well as develop generic technology for deep-sea exploration and sea floor operations" (*Beijing Review* No. 38, September 23).

The chief engineering unit responsible for the program is the China Ship Scientific Research Center (CSSRC), also known as the 702nd Research Institute of China Shipbuilding Industry Corporation (CSIC). CSSRC is part of a consortium of more than 100 research institutes and enterprises across China that have been involved in various aspects of the development of the *Jiaolong* submersible and its mother ship. The CSSRC website indicates that the institute's role as chief engineering unit for the project includes responsibility for development of 10 of the 12 major sub-systems as well as the assembly and integration work [7].

Some U.S. media reports indicate that China's rapid progress was enabled by access to foreign technology and expertise. According to one report, "China went on a global shopping spree to gather sophisticated gear for its submersible" (*New York Times*, September 11). Indeed, according to an official from CSSRC, about 40 percent of the *Jiaolong's* equipment was imported (*New York Times*, September 11). The *Jiaolong's* hull was ordered from Russia and its advanced lights, cameras and manipulator arms were purchased from the United States. Foreign training was also critical to the program's success. In

2005, Chinese trainee pilots and a Chinese scientist participated in a series of dives on Alvin. Among the Chinese trainees was Ye Cong, who served as a pilot during *Jiaolong's* sea trials.

CHINA'S FUTURE PLANS FOR *JIAOLONG*

China appears to have ambitious plans for further development of its deep submergence capabilities. Next year the *Jiaolong* is expected to dive to 5,000 meters. In 2012, the submersible is to reach its maximum operating depth of about 7,000 meters, according to Chinese media reports (*Global Times*, September 17). The submersible will perform a variety of missions. According to one Chinese media report, "In the future, *Jiaolong* will take on various complex missions, such as carrying scientists and engineers into deep sea to carry out scientific investigation and exploration of oceanic ridges, basins and submarine hydrothermal vents. It will also conduct submarine prospecting and high-precision topographic surveys, detect and capture suspicious objects, lay fixed underwater equipment, detect submarine cables and pipelines, as well as undertake general deep-sea inquiries and salvage operations" (*Beijing Review* No. 38, September 23). China is also planning to build up the infrastructure required to support these ambitious plans. A study under way calls for construction of a "national deep-sea base in the coastal area of Qingdao in Shandong Province to provide ground services for manned submersibles" (*Beijing Review* No. 38, September 23).

POSSIBLE STRATEGIC IMPLICATIONS

Chinese scientists and officials state that the *Jiaolong* submersible is intended mainly to conduct resource exploration and scientific research activities. "The main mission of the submersible is to carry scientists, engineers and their various instruments to the rugged deep sea topography to perform tasks of oceanic geology, geophysics, biology and chemistry," according to the article by Liu, Cui, and Li. Similarly, according to Peng Xiaotong, a research fellow with the National Marine Geological Laboratory at Shanghai-based Tongji University, "A manned submersible provides a powerful tool for scientists to carry out all kinds of research unavailable in laboratories by taking them directly to deep seas" (*Beijing Review* No. 38, September 23). Wang Pinxian, an academic with the Chinese Academy of Sciences and Chairman of China Marine Research Commission, has also emphasized its scientific research applications. "For deep-sea scientific research, a manned submersible is like a car in daily traffic," Wang said. "Its practical significance is in enabling scientists to carry out research activities freely between 2,000 and 3,000

meters below sea level. A submersible can be seen as the lonely pioneer in deep-sea exploration" (*Beijing Review* No. 38, September 23).

Chinese officials have responded to international media reports highlighting the potential military applications of the *Jiaolong* by reiterating that its main missions are scientific. Some have downplayed its potential strategic implications. In September, sea test commander Liu Feng, also one of the authors of the journal article cited above, emphasized that the submersible's missions are resource exploration and scientific research. Liu also stated that *Jiaolong* was developed by China's Ministry of Science and Technology, not the military, and Chinese sources dismiss international media reports highlighting the submersible's potential military applications as attempts to play up the "China threat theory" (*Global Times*, September 17).

It is certainly true that the *Jiaolong* provides China with scientific research and resource exploration capabilities. Deep submersibles play an important role in various types of undersea scientific research because of their ability to operate deep in the ocean and on the sea floor. As for resource exploration, as one U.S. media report pointed out, "the global seabed is littered with what experts say is trillions of dollars' worth of mineral nodules" (*New York Times*, September 11). The *Jiaolong* enhances China's ability to explore for these resources [8].

Yet, China's successful development of the *Jiaolong* submersible also has potential strategic implications. This is in large part because of the importance of the undersea battle space in contemporary military affairs. As one article in the Chinese publication *Modern Ships* points out, "how to use the deep sea to gain superiority in the undersea military competition is a question that all countries must closely inquire into" [9]. As the same article notes, in addition to their utility for resource exploration and scientific research, submersibles like the *Jiaolong* also have potential military applications, such as supporting China's submarine force as it becomes more active in the "far seas." For example, the author of this article suggests that if there is an accident in which a PLAN submarine sinks to the bottom in an area far from China's coast, a submersible like the *Jiaolong* could be used for tasks such as rescue, investigation, and salvaging important components of the submarine. Consequently, the *Jiaolong* will remain of interest to foreign observers not only because of its implications for scientific research and undersea resource exploration, but also as a result of its potential strategic applications.

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