CHAPTER 2

Estimates of Chinese Nuclear Forces

The Chinese government has not disclosed the size of its nuclear stockpile, nor does it normally provide information about the composition of its nuclear forces. The Chinese nuclear stockpile is composed primarily of warheads for ballistic missiles of different ranges and some bombs for aircraft, and estimates of the stockpile and operational warheads vary considerably depending upon the source (see Appendix A for our estimate). Past predictions by the U.S. intelligence community of the growth of the Chinese nuclear arsenal have proven to be highly inaccurate and even contradictory. Many of the forecasts have overestimated the future size of the force, the timing of when certain weapons systems will become operational, and the pace of their deployment. This trend began decades ago and appears to continue today.

In the 1960s, U.S. Pacific Command (PACOM) estimated that China could have 435 nuclear warheads by 1973, or more than three times as many as China is thought to have produced by that time. By 1972, the DIA's assessment of the capability of China's fissile material production facilities resulted in the estimate that "the Chinese could have as many as 120 thermonuclear warheads and 260 fission nuclear weapons in the stockpile...."[82] Yet at about that time China probably only had about 130 weapons, and the *New China News Agency* carried an official statement by the Chinese government that claimed that China was "not yet a nuclear power" because its "nuclear weapons are still in the experimental stage...."[83]

By 1981, the Joint Chiefs of Staff reported that China had more than 100 DF-2 and DF-3 missile launchers with a possible missile reload capability. Newspaper columnist Jack Anderson reported in 1984 that Pentagon reports stated that China had 137 to 199 ballistic missiles.[84] In April of that year, the DIA repeated its 1972 estimate by stating in a paper that China had 360 nuclear warheads. In

the paper the DIA also provided its "best estimate" for the future number of Chinese nuclear warheads at 586 in 1989 and 818 in 1994.[85] (Table 1)

Table 1:
DIA Estimates of Chinese Nuclear Forces (1984)[86]

Type	1984	1989	1994
CSS-1	25	5	0
CSS-2	110	120	120
CSS-3	8	31	32
CSS-4	2	9	16
SLBM	0	24	48
Solid-fuel ICBM	0	0	2
MR/IRBM follow-on	0	17	28
Bombs	165	200	230
ADMs	50	50	50
SRBM	0	0	12
ASM	0	130	250
Follow-on Systems	0	0	30
TOTAL	**360**	**586**	**818**

DIA cautioned that its estimates were based on projections for delivery systems and that "[n]o direct evidence exists on the actual size of China's present nuclear stockpile." Instead, the DIA explained, its assignment of nuclear warheads for Chinese delivery systems was based on a correlation of information from three main categories:

1. The nuclear testing sequence;
2. Analysis of the nuclear test device characteristics; and
3. The technical characteristics and deployment of delivery systems.

Also included, but not listed, must have been an estimate of the amount of fissile material produced by China over the years. Combined, this methodology lead to a highly inflated estimate, and it is noteworthy that the DIA in the same paper contradicted the 360 warheads estimate by stating in the summary that "[b]etween 150 and 160 warheads are estimated to be in the PRC nuclear stockpile."[87] Why the same agency in the same paper made two such different and contradictory estimates of the size of the Chinese nuclear stockpile is unclear.

Later in 1984, the DIA published the *Handbook of the Chinese People's Liberation Army*, which provided yet another estimate by stating that "China now has between 225 and 300 nuclear warheads." This arsenal was said to include "fission warheads ranging from 20 to 40 kilotons and thermonuclear warheads ranging from 3 to 5 megatons." DIA also suggested that China had managed to build a nuclear Triad where the "warheads can be delivered by both land- and sea-based missiles, as well as by conventional bomber aircraft."[88]

In hindsight, the 150 to 160 warhead estimate may have been the more accurate, and public U.S. intelligence estimates made since have put the size of the Chinese *deployed* nuclear arsenal in the 100-plus warhead range. Indeed, sometime between the mid-1980s and mid-1990s, the U.S. intelligence community appears to have obtained new information about China's nuclear stockpile that resulted in a very different estimate. China's "inventory of nuclear weapon systems," the Pentagon stated in 1996, "now includes over a hundred warheads *deployed operationally* on medium range ballistic missiles (MRBMs), intermediate range ballistic missiles (IRBMs), and intercontinental ballistic missiles (ICBMs)."[90] The following year, the DOD clarified that "China has over 100 nuclear warheads *deployed* on ballistic missiles," and that "*additional* warheads are in storage." DOD also said that China had "a stockpile of fissile material sufficient to increase or improve its weapon inventory."[91] This assertion was repeated in February 2006, when the DIA director told Congress:

Table 2:
China's Nuclear Status

Country	Stockpile
Russia	16,000
United States	10,000
France	350
United Kingdom	200
China	**200**
Israel	100
Pakistan	60
India	50

China has declared that it possesses "the smallest nuclear arsenal" among the (five original) nuclear weapon states.[89]

> One of China's top military priorities is to strengthen and modernize its strategic nuclear deterrent force by *increasing its size, accuracy* and survivability. It is likely the number of deployed Chinese nuclear-armed theater and strategic *systems* will increase in the next several years. China currently has *more than 100 nuclear warheads*. We believe China has sufficient fissile material to support this growth.[92] (Emphasis added.)

Estimating the size of the Chinese nuclear arsenal has always relied almost exclusively on U.S. intelligence estimates, while Chinese government information about the size or composition of its nuclear forces has been almost non-existent. In the Chinese view, secrecy increases the potential adversaries' uncertainty about Chinese capabilities and therefore increases the deterrent effect, although it may also – as in the case of the United States – cause that adversary to assume the worst. Perhaps in recognition of this dilemma, the Chinese Foreign Ministry in April 2004 published a fact sheet that included the statement: "Among the nuclear-weapon states, China ... possesses the smallest nuclear arsenal."[93] Since Britain has declared that it has less than 200 operationally available warheads, and the United States, Russia and France have more, the Chinese statement could be interpreted to mean that China's nuclear arsenal is smaller than Britain's.[94]

Not surprisingly, the devil is in the details. When the Chinese statement uses the word "arsenal," does that mean the entire stockpile or just the portion of it

Table 3:
Pentagon Overview of China's Missile Forces 2006 [95]

China's Missile Inventory	Launchers	Missiles	Estimated Range
DF-5/CSS-4 ICBM	20	20	8,460+ km
DF-4/CSS-3 ICBM	10-14	20-24	5,470+ km
DF-3/CSS-2 IRBM	6-10	14-18	2,790+ km
DF-21/CSS-5 MRBM Mod 1/2	34-38	19-50	1,770+ km
JL-1 SLBM	10-14	10-14	1,770+ km
DF-15/CSS-6 SRBM	70-80	275-315	600 km
DF-11/CSS-7 SRBM	100-120	435-475	300 km
JL-2 SLBM	DEVELOPMENTAL		8,000+ km
DF-31 ICBM*	DEVELOPMENTAL		7,250+ km
DF-31A ICBM	DEVELOPMENTAL		11,270+ km
TOTAL	**250-296**	**793-916**	

* China defines the DF-31 as a long-range ballistic missile, not an intercontinental ballistic missile (see Figure 13).

DF stands for Dong Feng which means "east wave." The U.S. designation CSS stands for Chinese Surface-to-Surface. Color codes: Red (nuclear), Blue (possibly nuclear), Black (not nuclear).

that is operationally deployed? To add to the confusion, Britain has not disclosed the size of its *stockpile* but only declared that "less than 200 warheads" are " operationally available." This strongly suggests that there may be additional British warheads in storage.

The Chinese statement was followed in July 2005 by the DOD report on Chinese military capabilities that for the first time provided a breakdown of China's ballistic missile forces. The breakdown, which was updated in the 2006 report, showed that the DOD believes that China has some 793 to 916 ballistic missiles of various types (see Table 3). Of these, some 83 to 126 are thought to be nuclear-capable.

As for the future development of China's nuclear forces, the DIA told Congress in 2005 that it anticipates that China's overall nuclear weapons inventory will increase.[96] DIA provided no specific numbers in the unclassified testimony, but a leaked DIA estimate from 1999 shows the agency then believed that China's total nuclear inventory would increase to some 358 to 464 warheads by 2020. This projection included a quadrupling of the number of ICBM warheads to 180 to 220 and nearly a doubling of SRBM warheads.[97] Some of the ICBM warheads would primarily be targeted at the United States, and the U.S. intelligence community has predicted that this portion of the arsenal might increase from 20 today to 75 to 100 warheads in 2015.[98]

This warhead forecast, which was first made in the 2001 National Intelligence Estimate *Foreign Missile Developments and the Ballistic Missile Threat Through 2015* shortly after the DIA estimate, has been repeated many times since by several agencies and appears to be the most consistent U.S. estimate. It appears to depend upon the expectation that the number of Chinese ICBMs primarily targeted against the United States will increase from 20 today to 60 in 2010.[99] Past inflated and inaccurate estimates by official sources should be kept in mind when considering this prediction. Its most controversial element is that it assumed China will be able to produce and deploy 40 DF-31A missiles by 2010 – only four years from now – and possibly another 15 missiles by 2015 if the DF-5As remain with single warhead. The DF-31A has not yet been flight tested.

True to form, the U.S. projection has already slipped, as the number of ICBMs primarily targeted against the United States did not reach 30 in 2005 (or 2006) as predicted but has remained at about 20. And it seems very unlikely that China will be able to field enough DF-31A missiles in only four years to meet

the high projection set by the U.S. intelligence community. Perhaps in reflection of these realities, this projection was not included in the DOD's 2005 and 2006 reports on Chinese military capabilities.[101]

Table 4:
Estimates For Chinese Warheads Primarily Targeted Against the United States in 2015

Missile Type	Without DF-5A MRV	With DF-5A MRV
DF-5A	20	60
DF-31A	55	40
TOTAL	**75**	**100**

Estimates based on CIA/DOD prediction of "about 75 to 100 warheads deployed primarily against the United States" by 2015, with 75 being more DF-31A missiles with no DF-5A MRVs, and 100 being fewer DF-31A missiles with MRV on DF-5A.[100]

Not surprisingly, some private analysts have made even bigger projections for the development of China's ballistic missile forces. "By 2010," Richard Fischer of the International Assessment and Strategy Center recently wrote in the *Wall Street Journal*, "China is also likely to add up to 100 land-based and 24 submarine-based missiles armed with nuclear warheads, more than enough to overwhelm planned U.S. missile defenses."[102] Such a development would exceed the Pentagon's worst-case scenario and also require China to build and deploy two SSBNs. The U.S. intelligence community estimates that only one may become operational by then.

Beyond estimating the number of missiles is the question of whether China will deploy multiple warheads on some of its ICBMs. Unlike claims made by many private organizations and news media, the U.S. projection does *not* envision multiple warheads on the new DF-31, its longer-range DF-31A modification, or the submarine-based JL-2. The official U.S. estimate has low and high numbers. The lower number envisions single warheads on the DF-5A and a larger number of DF-31A missiles. If three warheads were placed on each DF-5A, fewer single warhead DF-31As would be required (see Table 4).[103]

To reach the 1999 DIA projection of 180 to 220 ICBM warheads by 2020 (assuming the same number of DF-5A and DF-31A missiles as in Table 4 above, and using the U.S. range definition for an ICBM, Figure 13), China would have to deploy *an additional* 80 to 140 single-warhead DF-31s (see Table 5), or more than double its entire current land-based ballistic missile force. The alternative would be to develop a much smaller warhead that would allow the DF-31 and

DF-31A to carry multiple warheads, but that would probably require additional nuclear weapons testing.

To the best of our knowledge, there is no evidence that China has embarked upon such an aggressive ICBM build-up. We think the number of DF-31s required to meet the DIA estimate is much too high and more realistically will

Table 5:
Possible Missile Composition With DIA Projection For Chinese ICBM Warheads by 2020[104]

Missile Type	Warheads (Low)		Warheads (High)	
	Without DF-5A MRV	With DF-5A MRV	Without DF-5A MRV	With DF-5A MRV
DF-5A	20	60	20	60
DF-31*	105	80	145	120
DF-31A	55	40	55	40
Total	**180**	**180**	**220**	**220**

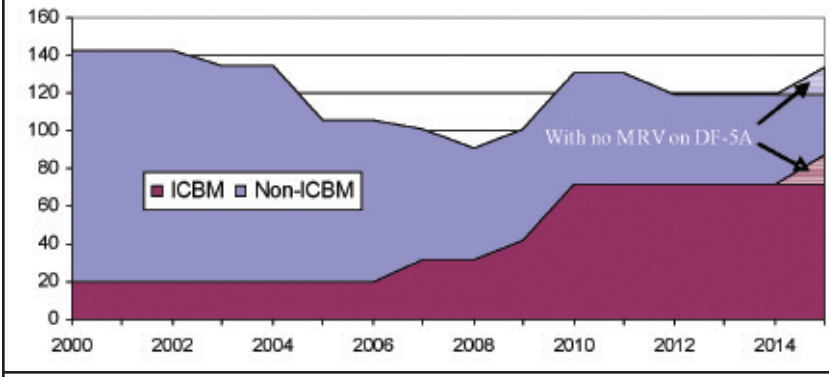
* Although an ICBM by U.S. definitions, the 4,500+ miles (7,250+ km) range of the DF-31 means that it can not be used to "primarily" target the United States but will likely be used for regional targeting. China defines the DF-31 as a LRBM, not an ICBM (see Figure 13).

The estimate is based on CIA/DOD prediction of "about 75 to 100 warheads deployed primarily against the United States" by 2015, with 75 being more DF-31A missiles with no MRVs on DF-5A, and 100 being fewer DF-31A missiles with MRV on DF-5A (see Table 4).[105]

include only a couple of dozen missiles. Instead, based on the above information and using the U.S. range definition for ICBMs, we cautiously estimate that the number may reach 70 to 85 ICBMs by 2015 and 85 to 100 ICBMs by 2020 from 20 ICBMs today. This increase appears larger than it is because it includes replacement of the DF-3 and DF-4 with the longer-range DF-31, a weapon that, like its predecessors, will not be primarily targeted against the United States but is nonetheless counted as an ICBM. Combined with the other elements of the missile force, using assumptions from the 2001 National Intelligence Estimate, the result is a missile force that overall is about the same size as today but includes more ICBMs (Figure 4).

Under the U.S. intelligence community's "worst-case" scenario, with as many as 100 warheads primarily targeted against the United States, China's total nuclear weapons arsenal would increase from approximately 145 warheads today to 220

Figure 4:
Chinese Nuclear Ballistic Missile Force Composition 2000-2015

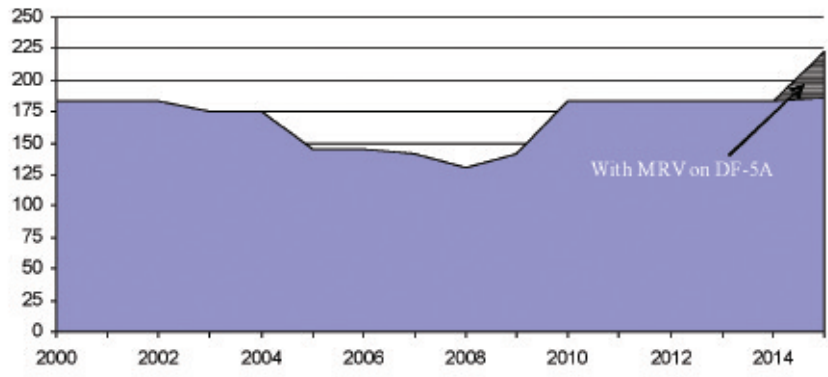


As China replaces older medium- and intermediate-range ballistic missiles with longer-range types, ICBMs (using U.S. ICBM range definition, Figure 12) will make up a comparatively greater portion of the total force. Assumes multiple warheads (MRV) on the DF-5A. Without MRV on DF-5A, the U.S. intelligence community believes, an additional 15 DF-31A ICBMs would be added (see Table 4). For a breakdown of China's nuclear arsenal, see Appendix A.

warheads by 2015. If the DF-5A is not uploaded and the number of ICBM warheads primarily targeted against the United States only reaches 75, the total arsenal would level out at almost 190 warheads (Figure 5). These projections assume that China will be able to deploy a sizeable number of DF-31A, an assumption we believe may be overblown.

Because the deployment of the DF-31A (and DF-31/JL-2) will coincide with the retirement of the antiquated DF-3A and DF-4, the overall size of the Chinese arsenal can be expected to remain at about the same level it has been for the past decade (140 to 180 warheads). To that end there is a certain irony in the fact that the central factor that could lead to an increase in the size of the Chinese nuclear arsenal is the impact that China believes a U.S. ballistic missile defense system will have on the effectiveness of its ballistic missile force. This could lead to an increase of the Chinese arsenal to nearly 225 warheads (Figure 5).

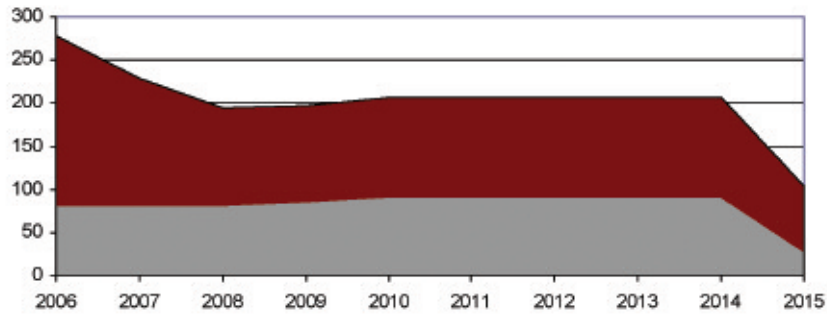
Figure 5:
Chinese Deployed Nuclear Warhead Estimates 2000-2015



If the projections made by the U.S. intelligence community about the future deployment of Chinese ballistic missiles are correct, the total size of the Chinese arsenal may increase from 145 warheads today to 186 to 223 warheads by 2015. The total primarily depends on how many new ICBMs China will deploy and how many of the existing DF-5As will be equipped with multiple warheads. See Appendix A for a breakdown of the arsenal.

These developments would significantly *decrease* the overall explosive power of the Chinese arsenal. Depending on the precise mix of missiles and warheads under the Pentagon's projections, we estimate that the overall megatonnage of the arsenal will decrease by 37 percent to 60 percent over the next 10 years (Figure 6).

Figure 6:
Estimated Megatonnage Of China's Nuclear Arsenal 2006-2015



Assumes China will deploy 250 kiloton (kt) single-warheads on DF-31, DF-31A, JL-2, and three 250 kt multiple-warheads (MRV) on DF-5A ICBMs by 2015.

The primary reason for this dramatic development is that the new DF-31 and DF-31A missiles carry much smaller warheads that the DF-3As and DF-4s they are expected to replace. In addition to this replacement, the question of whether China will deploy multiple warheads on its DF-5As will, not surprisingly, have a significant impact on how powerful China's deterrent against the United States will be.

The multiple-warhead force that some lawmakers and private analysts most frequently warn against would result in a significantly less powerful deterrent than if China kept the current warheads on the DF-5As. The reason is that multiple warheads will need to be much smaller than the current 4 Megaton (Mt) warhead, probably in the range of 250 kiloton (kt) each. The difference in megatonnage is dramatic.

If China decides *not* to deploy multiple warheads on its DF-5A missiles, but retains the single 4 Mt warhead currently carried on each missile, and complement this force with DF-31As (as many as 55 missiles under the DOD scenario), the total megatonnage aimed against the United States could increase by 14 Mt (nearly 18 percent) from 80 Mt today to 94 Mt in 2015 (Table 6).

Table 6:
Estimates for Chinese Megatonnage On Missiles Primarily Targeted Against the United States in 2015

Missile Type	Currently (2006)			2015 (Without DF-5A MRV)			2015 (With DF-5A MRV)		
	Missiles	Warheads	Mt	Missiles	Warheads	Mt	Missiles	Warheads	Mt
DF-5A	20	20	80	20	20	80	20	60	15
DF-31A	0	0	0	55	55	13.8	40	40	10
TOTAL	**20**	**20**	**80**	**75**	**75**	**93.8**	**60**	**100**	**25**

Estimates based on CIA/DOD prediction of "about 75 to 100 warheads deployed primarily against the United States" by 2015, with 75 being more DF-31A missiles with no DF-5A MRVs, and 100 being fewer DF-31A missiles with MRV on DF-5A.[106] Megatonnage (Mt) assumes 250 kt warhead on DF-31A and multiple-warhead DF-5A.

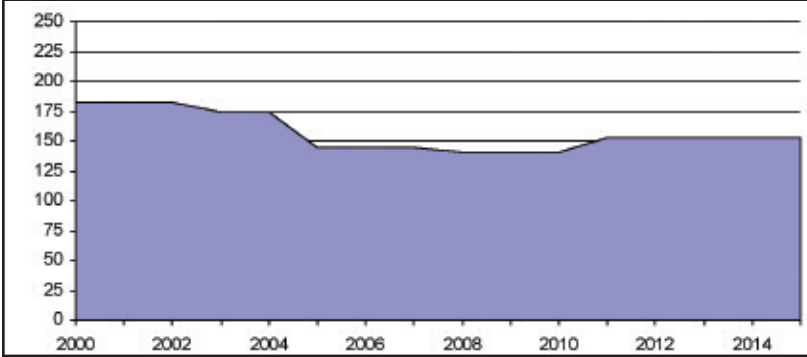
On the other hand, if China decides to deploy multiple warheads on the DF-5A missiles, the total megatonnage primarily targeted against the United States would be reduced by nearly 70 percent from 80 Mt today to some 25 Mt in 2015 (Table 6). If the number of casualties and fatalities that can be inflicted upon the United States in a war is any measure, then it would clearly be in the national security interest of the United States that China deployed multiple warheads on its DF-5As.[107]

As mentioned, these projections obviously are fraught with many uncertainties and unknowns. Not only is the precise size of the current Chinese nuclear arsenal still a mystery, but we have no idea how many DF-31A missiles China plans to deploy (and perhaps the Chinese do not know yet either). The U.S. intelligence community assumes that China plans to deploy a considerable number of the still-untested DF-31As. The projections also assume that China will be able to deploy at least two Jin-class SSBNs, something that remains to be seen given the difficulties in operating the Xia-class SSBN. Nor is it known whether China will deploy multiple warheads on its DF-5A missiles and how many; in fact, China could decide to retire the old missile instead once the more survivable DF-31A comes online and continue with an all single-warhead missile force of roughly the same size as today.

Given the shaky record of past U.S. intelligence community projections for Chinese nuclear force developments, we must of course also consider the possibly that China will not deploy 75 to 100 warheads primarily targeted against the United States in 2015, but significantly less. This core projection for China's nuclear future dates back to the 1990s, well before the 2003 Iraq invasion and the subsequent lessons learned about inaccurate intelligence assessments about weapons of mass destruction.

China may decide instead that the increased survivability of the DF-31 (and DF-31A) over the existing DF-3, DF-4 and DF-5As means that fewer warheads will be needed overall. If we assume that the DF-3A and DF-4 are replaced with the DF-31 and the DF-5A replaced with the DF-31A on a one-for-one basis, the size of the Chinese arsenal will remain largely unchanged (Figure 7). But in such

Figure 7:
Low Estimate For Chinese Nuclear Arsenal 2000-2015



Assumes DF-31 will replace DF-3A and DF-4 and the DF-31A will replace the DF-5A on a one-for-one basis with single warhead loading.

an estimate – as in the larger estimate presented by the U.S. intelligence community – China's perception of the lethality of U.S. nuclear forces and the effectiveness of the ballistic missile defense system likely will be prominent factors in determining the size of its arsenal.

Nuclear Ballistic Missiles

China currently deploys approximately 105 nuclear ballistic missiles of five different types (Table 7). This force includes four land-based missiles (DF-3A, DF-4, DF-5A, and DF-21 (Mods 1/2) and a single sea-based missile (JL-1). Whereas the land-based missiles are considered operational, the JL-1 is not thought to have achieved full operational capability due to persistent technical difficulties on its launch platform, the Xia-class submarine.

Table 7:
Chinese Nuclear Ballistic Missiles 2006

China Name	U.S. Name	Year deployed	Range	Warheads	Yield	Missiles	Warheads
Land-based							
DF-3A	CSS-2	1971	3,100	1	3.3 Mt	16	16
DF-4	CSS-3	1980	5,500	1	3.3 Mt	22	22
DF-5A	CSS-4	1981	13,000	1	4-5 Mt	20	20
DF-21A	CSS-5	1991	2,150	1	200-300 kt	35	35
DF-31	CSS-X-10	2006?	7,250+	1	? kt	0	0
DF-31A	?	2007-2009?	11,270+	1	? kt	0	0
Subtotal					93	93	
Sea-based							
JL-1	CSS-NX-3	1986	1,770+	1	200-300 kt	12	12
JL-2	CSS-NX-4?	2008-2010?	8,000+	1	? kt	0	0
TOTAL						**105**	**105**

[a] In kilometers.
See Appendix A for a breakdown of China's entire estimated nuclear weapons arsenal.

How many nuclear missile China will produce and deploy in the future is hard to predict. The Pentagon predicted in 1997 that "China probably will have the industrial capacity, though not necessarily the intent, to produce a large number, perhaps as many as a thousand, new missiles within the next decade."[108] This has partially come true, but mainly in the form of production of short-range ballistic missiles deployed off Taiwan.

As for longer-range missiles, three are in various stages of development (DF-31, DF-31A, and JL-2). The DF-31A and JL-2 are variations of the DF-31, which the DOD for the last several years has predicted was about to be deployed. Development of the DF-31 began in the early 1980s, and this new generation of mobile ballistic missiles forms the core of the Pentagon's warnings about China's strategic modernization.

The Issue of Mobility

The 2006 DIA threat assessment warns that "China continues to expand and modernize its ballistic missile forces to increase their survivability and warfighting capabilities, enhance their coercion and deterrence value and overcome ballistic missile defenses."[109] Notwithstanding this warning, it is important to keep in mind that China's ballistic missile force has been predominantly mobile since the 1960s, and that more than half of China's long-range missile force is mobile today. This includes the land-based DF-3A, the DF-4, the DF-21, and the sea-based JL-1. The new DF-31, its longer-range modification DF-31A, and the sea-based JL-2 will continue this mobile tradition. Because the DF-31 and DF-31A are solid-fueled missiles, they will be simpler to operate and take less time to ready for launch than the liquid-fueled DF-3A and DF-4 missiles they will replace, but mobility and the concealment capability have been factors that U.S. targeteers have had to deal with for decades. Back in 1976, when China was deploying the then new DF-3, for example, the CIA warned in a National Intelligence Estimate:

> The Chinese have enhanced the deterrent value of their IRBMs and MRBMs by means of concealment and field site deployment. Such measures have not only increased the likelihood of post-strike survival but also have decreased the potential attacker's confidence that he has detected and targeted the entire force.[110]

Figure 8:
DF-21 Missile Launcher On Narrow Road

The Second Artillery Corps conducts "Red vs. Blue confrontation exercises" where missile launchers disperse from their bases to predesignated launch points hundreds of miles away. This image shows a TEL (Transporter Erector Launcher) for the DF-21 medium-range ballistic missile passing cars on a narrow road. *Image: China-Defense.com*

Figure 9:
Mobile Missile Communication

Deployment of Chinese mobile missile units requires extensive logistical support, including communication with other units and central command authorities, which is vulnerable to technical problems and jamming.

Image: PLA Daily

Little is known in public about how Chinese mobile missile regiments deploy and what their tactics are for concealment and launching. Descriptions of exercises are rare and vague when they happen. The *PLA Daily* of the People's Liberation Army occasionally publishes news reports about Second Artillery Corps exercises. Although the reports are unspecific, and highly glorifying, they do provide some insight. One example includes a Second Artillery Corps "Red vs. Blue confrontation exercise" held in January 2005, which was said to have covered nearly 620 miles (1,000 kilometers). The scenario envisioned deployment under frequent Blue attack, in response to which the brigade "employed flexible tactics, such as cross-attacks, to swiftly develop its attack into the defensive depth of the Blue Army." While this may sound impressive, the exercise was held online, according to the battalion commander, partly because "the special characteristics of the Second Artillery Force make it very difficult to conduct actual-troop training."[111]

The Second Artillery Corps held another exercise in March 2005 that involved several launching units of a missile brigade that after the "firing of three red signal flares" deployed to their "battling positions hundreds of kilometers away."[112] The deployment to positions hundreds of kilometers away suggests that the Second Artillery Corps, at least in this case, believed it would receive advanced warning of an attack. The use of red flares suggests that concealment and surprise was not a high priority.

Deployment of mobile missile units comes with considerable operational and logistical challenges. The Pentagon is well aware of the Chinese military's difficulties in conducting realistic exercises, and also of the special

Communication and Command and Control (C3) complications that come with operating mobile forces. The Second Artillery Corps acknowledged such complications in October 2004 in a blunt description of a signal regiment that had conducted a "field mobility communication support and survival exercise under complex weather conditions in deep mountains." Once the missile launchers deploy into the field, the signal regiment is responsible for providing emergency communication support to troops posted along the large deployment area. Although the exercise was said to have improved the signal regiment's " all-weather mobility communication support capabilities," including the establishment of field operation command posts and jamming systems, the report bluntly admitted that signal regiments "often [sic] always [run] into various difficulties in [their] mobile communication support."[113]

Whether involvement of all support elements is typical for Second Artillery Corps missile launch exercises is not known, but a *PLA Daily* description of an exercise conducted on July 18, 2006, suggests that it may not be typical. The "operational combined missiles exercise" was said to have involved "over 20 operational elements and over 100 specialties." In addition to the missile launchers themselves, this included a communication element, the meteorological element, a survey element, and others. The exercise was portrayed by the *PLA Daily* as a unique event that upgraded the overall combat effectiveness "by making all elements take part in training," as if such "combined" training is not a normal part of Second Artillery Corps exercises.[114]

Figure 10:
Chinese Missiles On the Move

China has operated mobile ballistic missiles (like this DF-2) for four decades. Most of China's current missile force is mobile, and most of the future force will be mobile.

Image: China.Military.com

Mobile missile launchers, according to the Second Artillery Corps, are known as the "three extras": extra height, extra width and extra length. This means that personnel training takes longer and that support vehicles are essential. Missile bases have built training

grounds for large-scale vehicles where the drivers practice driving on narrow roads, bridges, in tunnels, and on steep mountains. This further increases the visibility of mobile missiles.

Ensuring that equipment vehicles are capable of driving and keeping in touch with each other "is an important condition for the troops to accomplish their missile launch tasks." During an exercise in July 2005, for example, "several vehicles mounted with special equipment [probably missile launchers] broke down after encountering the enemy's air or surprise attack. Then three military transport vehicles arrived at the accident site. The maintenance personnel immediately changed tires and check[ed] the oil circuit. Several minutes later, the malfunctions were removed and the three damaged vehicles were back on the journey again."[115]

Now, increased mobility of a modernized Chinese missile force is once again a central theme in the threat briefings from the Pentagon and various think tanks that see it as a worrisome new development. When the United States increases the survivability of its highly offensive nuclear forces, these institutions say it enhances stability. But when China improves the survivability of its minimum nuclear deterrent, it causes great concern.

Yet mobility also can enhance stability in two ways. Most important, mobile missiles are less likely to be destroyed in a first strike and therefore are less likely to be launched first or early in an impending crisis. For the Chinese, increased mobility increases the survivability of their deterrent and strengthens their adherents of a no-first-use policy. Some in the Pentagon, however, see increased mobility as a sign that China is moving away from a no-first-use policy toward a more threatening doctrine of nuclear war fighting.

The motivation for increasing mobility can be interpreted in opposite ways and in certain instances both explanations can be true. While the primary reason for China's current nuclear modernization seems to be to safeguard the survivability of a continued minimum nuclear deterrent – in response to enhanced U.S. forces including Trident and a future ballistic missile system – it is also true the missiles will have improved capabilities in accuracy and readiness.

The U.S. intelligence community occasionally acknowledges that deployment of more capable U.S. offensive forces and development of an anti-ballistic missile defense system may have helped provoke a Chinese response we now see emerging as a new generation of mobile missiles. One has to look long and hard

to find such an acknowledgement, but they do exist. One acknowledgement – and a very clear one – was provided by Robert Walpole of the CIA during a Senate hearing in 2002:

> *Sen. Cochran.* The estimate that you have described to us today says that China is modernizing its strategic missile forces. Can you tell us how long this modernization effort has been underway?
>
> *Mr. Walpole.* Yes, since the mid-1980s. *China became concerned about the survivability of its silos when the U.S. deployed the Trident II-D5 because you could hit those silos.*
>
> *Sen. Cochran.* What do you think are the factors that are behind China's desire to modernize its military forces, and strategic military forces?
>
> *Mr. Walpole.* Largely to move to mobile, more survivable systems.[116] (Emphasis added.)

How China plans to base the road-mobile DF-31 and DF-31A is not known. One possibility may be that China chooses to base the road-mobile missiles in caves like some of the current DF-3As and DF-4s. Several Chinese airbases that we examined with satellite images also have large underground facilities that may be used to hide aircraft and weapons, but could potentially also serve as shelters for mobile missile launchers. Another possibility is that the quicker launch capability of solid-fueled missiles over the current liquid-fueled missiles makes Chinese planners confident enough to deploy the launchers in garages inside missile garrisons. China's northern neighbor, Russia, deploys road-mobile SS-25 missile launchers in groups of nine on easily identifiable bases that are highly vulnerable to attack (Figure 11). However, since China does not have an effective early warning system or a robust command and control system that can detect and respond to attacks, underground facilities may be the most likely deployment option.

As noted, a mobile Chinese missile force is far from a new phenomenon and one that U.S. targeteers are familiar with from several decades of targeting Chinese (and Soviet/Russian) mobile missiles. In fact, U.S. nuclear strike plans have formally targeted mobile missile forces for two decades. Until the mid-1980s, Single Integrated Operational Plan (SIOP) targeting was directed against only stationary, point targets, but after the Soviet mobile SS-25 ICBM became operational and China first began deployment of the mobile DF-21 in 1985, new U.S. national guidance directed in 1986 that Relocatable Targets (RTs) be placed at risk and established a requirement to develop a flexible and responsible

targeting system to do so.[117] At that point all legs of the Triad were tasked to strike various categories of "predictable" relocatable targets, but a Strategic Air Command (SAC) working group produced an implementation plan that "holds a limited number of [unpredictable] relocatable targets (RTs) at risk in SIOP-6C." At first only SAC forces were involved but with the SIOP-6D plan in October 1987, the Navy's strategic nuclear submarines also began holding "unpredictable Relocatable Targets" at risk. The plan for holding mobile targets at risk was called the Strategic Relocatable Target Attack (SRTA) tactic.[118]

Figure 11:
Russian SS-25 Road-Mobile Missile Base at Novosibirsk

This SS-25 missile garrison near Novosibirsk some 340 miles (550 km) from China's northern border includes nine garages for SS-25 road-mobile launchers. The image shows all nine launchers parked outside their garages in what may have been a START verification display. The base is highly vulnerable to attack, a design China will probably not mimic for deployment of its DF-31 and DF-31A mobile ICBMs without an early warning system. *Image: GoogleEarth/DigitalGlobe*

The Navy developed a new retargeting system to allow Trident SLBMs to quickly be aimed at mobile or emerging targets. After more than a decade in development, deployment of the Strategic Retargeting System (SRS) began in October 2003 to "provide the increased flexibility and capability required by the [1994] Nuclear

Posture Review for our offensive strike platform." Specifically, the new targeting system enables SSBNs "to quickly, accurately, and reliably retarget missiles to targets" to "allow timely and reliable processing of an increased number of targets," ... "reduce overall SIOP processing" time and "support adaptive planning."[119]

Whether Chinese planners were aware of these programs is not known, but the capability of the Trident SLBM, according to the CIA, convinced China that its strategic missile force was too vulnerable. As China takes its next step in the nuclear arms race by deploying the DF-31 and DF-31A mobile missiles, U.S. planners will respond by trying to overcome the ploy through additional flexibility and responsiveness of their nuclear forces and intelligence assets. Some of the next steps were described in the 2001 Nuclear Posture Review:

> One of the greatest challenges today is accounting for the location and uncertainty of mobile and relocatable targets.... To respond to this challenge, collection systems and techniques that defeat adversary relocation capabilities must be developed. Sensors must also be capable of defeating camouflage and concealment efforts and detecting and exploiting new command and control systems....
>
> To locate successfully and maintain track on mobile targets until a weapon can be planned and executed, several enhancements need to be made to the current collection capability. Today's satellite constellation is not optimized for the current and developing mobile target challenge. Planned improvements to this constellation would provide the capability to rapidly and accurately locate and track mobile targets from the time they deploy from garrison until they return. Sensors with rapid revisit or dwell capability over deployment areas combined with automated exploitation sides are required to provide this capability.[120]

This qualitative and operational arms race will continue as long as both sides decide that it must respond to the other to shore up nuclear battle plans.

The Issue of Multiple Warhead Payloads

Unclassified U.S. government publications do not credit current Chinese nuclear missiles with multiple warheads,[121] yet media reports and publications by non-governmental analysts and organizations frequently claim that China

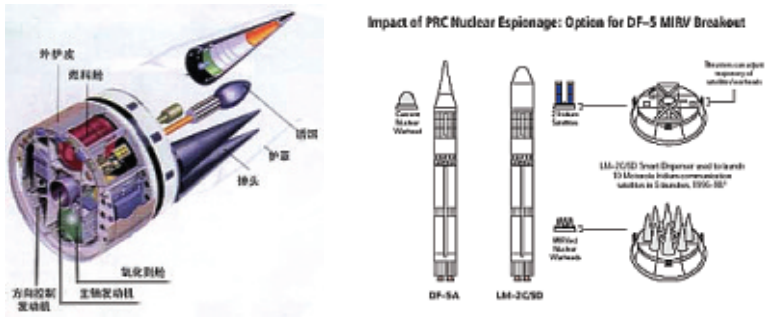
already has multiple warhead payloads deployed on some of its ballistic missiles, or will soon deploy multiple warheads on the DF-31 and its two derivative versions, the DF-31A and the JL-2.

A prominent source for this claim appears to be the 1999 Cox report. Although the report cautioned that the "Select Committee has no information on whether the PRC currently intends to develop and deploy multiple independently targetable reentry vehicle systems," it nonetheless stated that "[e]xperts also agree that the PRC could have this capability for its new mobile intercontinental ballistic missiles within a reasonable period of years that is consistent with its plans to deploy these new mobile missiles." Moreover, if China decided to pursue an "aggressive development of a MIRV system," the report predicted, such a program "could permit the deployment of upwards of 1,000 thermonuclear warheads on ICBMs by 2015."[122]

Some experts and journalists used these exaggerated claims to portray a worst-case example of Chinese missile developments.[123] The Heritage Foundation, for example, published a "backgrounder" shortly after the Cox report came out, claiming that the DF-5 could be equipped with as many as eight warheads each, and that "[b]oth the DF–31 and DF–41 [DF-31A] ICBMs are expected to incorporate multiple independently targeted reentry vehicle (MIRV) warheads."[124] These claims were echoed by the Institute for Foreign Policy Analysis in a study in 2000: "In fact, it is generally understood that China is equipping its future missile systems with MIRVed warheads." The DF-31 might carry as many as three warheads, the Julang-2 three (perhaps even six), and the DF-31A as many as 10 warheads, the institute speculated.[125]

In stark contrast to such claims, the U.S. intelligence community has consistently stated that it does not believe China has deployed multiple warheads on any of its ballistic missiles and that the three versions of the DF-31 are not likely to be so equipped either. "China has had the capability to develop and deploy a multiple reentry vehicle system for many years, including a MIRV system,"[127] but has not done so, the CIA stated in December 2001. The U.S. anti-ballistic missile system, however, may prompt China to change its mind, according to the Pentagon.[128]

Figure 12:
Speculations About Chinese Multiple Warhead Capabilities



Private institutions frequently speculate that China has or intends to deploy multiple warheads on its ballistic missiles. These two illustrations propose a potential MIRV capability on the DF-31(left) and the DF-5A (right). The U.S. intelligence community, in contrast, does not believe the DF-31 will carry multiple warheads and that the DF-5A could, if China decided so, potentially carry up to three warheads. [126]

"Chinese MIRVing of a future mobile missile would be many years off," the CIA told Congress in 2000. If China wanted to deploy multiple warheads on a missile, rather than deploying multiple warheads on the DF-31 and DF-31A, it "*could* use a DF-31 type RV for a multiple-RV payload for the CSS-4 in a few years," the CIA explained.[129] (Emphasis added.) The DOD echoed this conclusion in 2002, when it stated that any Chinese multiple warhead capability will "most likely [be] for the CSS-4."[130] The CIA's Robert Walpole also addressed this issue in testimony before Congress in 2002:

> *Sen. Cochran.* How many missiles will China be able to place multiple reentry vehicles on?
>
> *Mr. Walpole.* In the near term, it would be about 20 CSS-4s that they have, the big, large ICBMs. The mobile ICBMs are smaller and it would require a very small warhead for them to put multiple RVs on them.
>
> *Sen. Cochran.* … [D]o you think that China will attempt to develop a multiple warhead capability for its new missiles?
>
> *Mr. Walpole.* Over time they may look at that. *That would probably require nuclear testing to get something that small, but I do not think it is something that you would see them focused on for the near term.*[131] (Emphasis added.)

So even if the Cox report's allegations of Chinese theft of U.S. warhead design were true, the CIA believes that China would still have to conduct additional nuclear tests to be able to build warheads sufficiently small to be able to deploy multiple warheads on the DF-31, DF-31A, and JL-2. The primary reason the intelligence community believes a potential multiple warhead capability would be deployed on the DF-5 and not on any of the new missiles is that deployment on the mobile systems "would encounter significant technical hurdles and would be costly," according to the CIA.[132] It is important to note that this conclusion was made in December 2001, *after* the intelligence community determined in April 1999 that "U.S. information acquired by the Chinese could help them develop a MIRV for a future mobile missile."[133] Apparently, they are still a long way away – if developing such a capability is their intention at all.

Beyond the technical constraints and opportunities, however, China may not be interested anyway in equipping too many of its new missiles with multiple warheads because placing "too many eggs in one basket" would increase the vulnerability of its ICBMs to a first strike. Reducing the vulnerability of the force is thought to be the main objective of the transition to solid-fueled mobile missiles, but MIRVing would contradict that objective. Keeping most of the mobile missiles with single-warheads (although likely with penetration aids), in contrast, would give China's force maximum security, flexibility and range.

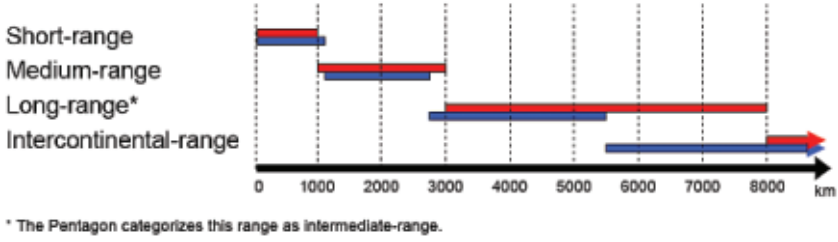
The Issue of Missile Ranges

In addition to mobility, increased missile range is another capability that is used to paint a grim picture of a more threatening China. It is the expectation that China will be able to reach the United States with more warheads in the future that has reinstated China at the center of U.S. nuclear planning. When the DOD report on Chinese military forces was published in 2005, the *Washington Times* reported that the report "stated that China *now* can reach almost all of the United States with its small arsenal of nuclear missiles."[134] (Emphasis added.) The word "now" suggested a new development, but the DOD report did not say that China had acquired a *new* capability to target almost all of the United States. On the contrary, the report showed that China has had such a capability for more than two decades.

Adding to the confusion about China's missile force is that China and the United States use different definitions for the ranges of the various missiles. For

example, the new DF-31 is reported by the DOD to have a range of 4,500+ miles (7,250+ km), which would make it an ICBM according to U.S. definitions.[135] But according to Chinese definitions, a range of 4,500+ miles (7,250+ km) does not make it an ICBM, but a long-range missile. The U.S. definitions appear to be determined largely by the increased range of newer missiles: The DF-3A is medium-range, the DF-4 is intermediate-range (or long-range by Chinese standards), whereas anything above the range the DF-4 (3,418 miles (5,500 km) is an ICBM. See Figure 13 for comparison of Chinese and U.S. missile range definitions.

Figure 13:
Chinese and U.S. Definitions for Ballistic Missile Ranges

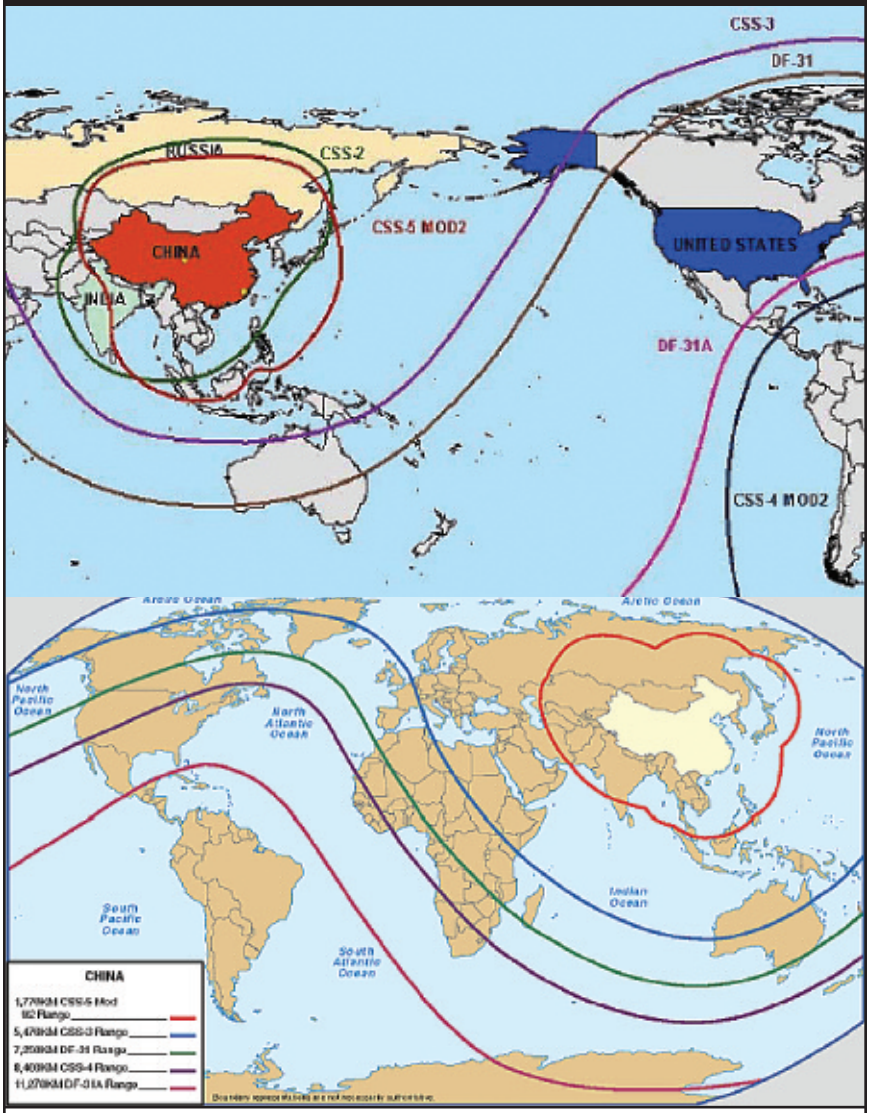


China (red) and the United States (blue) categorize ballistic missile ranges differently. The discrepancy is most significant for missiles with ranges between 5,500 km (3,418 miles) and 8,000 km (4,970 miles), which China categorizes as long-range missiles but which the Pentagon categorizes as intercontinental ballistic missiles (ICBM).

To add to greater confusion, the Pentagon has used different ranges for China's long-range missiles. The 2005 DOD report on China's military forces contains a map showing the ranges of, among other missiles, the DF-5A (CSS-4 Mod 2) and the DF-31A. These are the two missiles that are most central to the Pentagon's warnings about China's future offensive nuclear capabilities. The map shows the DF-5A with a range reaching beyond Florida, whereas the range of the future DF-31A is shown as a little less, reaching to the northern parts of Florida. The DOD's report from 2006, however, shows the range of the DF-31A extending beyond Florida while the DF-5A is shown to have a range that doesn't even allow it to hit Washington, D.C. (Figure 14).

This range-confusion led to a front-page report in the widely read *Defense News* in 2006 that claimed that the DF-31A will have a longer range than China's current ICBM, "making it the first Chinese ICBM that could hit Washington, D.C., Paris or Madrid."[136]

Figure 14:
Inconsistent DOD Range Estimates For DF-5A



Recent DOD range estimates for the DF-5A (CSS-4) are inconsistent. Whereas the 2005 map (top) shows a range (dark green) beyond Florida, the 2006 map (bottom) shows a range (purple) that falls short of New York and Washington, D.C.

Land-based Ballistic Missiles

Currently, China is estimated to deploy approximately 90 nuclear-armed land-based ballistic missiles of four types: DF-3A, DF-4, DF-5A, and DF-21 (Mods 1 and 2).[137] All carry single nuclear warheads. Two land-based missiles, the DF-31 and its extended-range modification the DF-31A, are under development (Table 8). Operational deployment of DF-31 has slipped repeatedly over the past few years, compared with Pentagon predictions.

Table 8:
Chinese Land-Based Nuclear Ballistic Missiles 2006

China Name	U.S. Name	Year deployed	Range	Warheads	Yield	Missiles	Warheads
DF-3A	CSS-2	1971	3,100	1	3.3 Mt	16	16
DF-4	CSS-3	1980	5,500	1	3.3 Mt	22	22
DF-5A	CSS-4	1981	13,000	1	4-5 Mt	20	20
DF-21A	CSS-5	1991	2,150	1	200-300 kt	35	35
DF-31	CSS-X-10	2006?	7,250+	1	? kt	0	0
DF-31A	?	2007-2009?	11,270+	1	? kt	0	0
TOTAL						**93**	**93**

[a] In kilometers.

There are many rumors about where China's ballistic missiles are deployed, but very little is known about the actual locations. China does not provide such information and U.S. intelligence doesn't say much about what it knows. The better unofficial sources identify more than a dozen locations in nine provinces (see Table 9) and leaked documents provide some additional information. Satellite images of three of those locations are included in this report, but only one (Delingha) has enough features to be positively identified as an operational launch site. Images of other areas as well as higher resolution would undoubtedly make it possible to identify additional sites.

Reports about China's nuclear forces published by the Pentagon and private research institutions such as the International Institute for Strategic Studies indicate that China over the past five years has decreased its land-based nuclear missile force by more than 20 percent. The decline may not have happened and may have to do with differences in counting launchers and missiles. But if correct,

Table 9:
Rumored Nuclear Missile Bases and Brigades[138]

Missile	Location	Province	Base Number	Unit
DF-3A	Datong	Qinghai	56 Base	?
	Dengshahe[139]	Liaoning	51 Base	810 Brigade
	Jianshui[140]	Yunnan	53 Base	802 Brigade
	Lianxiwang[141]	Anhui	52 Base	807/811 Brigade
	Liujihou	Qinghai	56 Base	?
	Quaotou	Qinghai	56 Base	809 Brigade
	Tonghua[142]	Jilin	51 Base	818 Brigade
	Yidu[143]	Shandong	?	?
DF-4	Delingha[144]	Qinghai	56 Base	812 Brigade
	Da Qaidam	Qinghai	56 Base	?
	Sundian	Henan	54 Base	804 Brigade
	Tongdao	Hunan	55 Base	805 Brigade
DF-5A	Luoning	Hunan	54 Base	801 Brigade
DF-21	Chuxiong	Yunnan	53 Base	808 Brigade
	Jianshui[140]	Yunnan	53 Base	
	Tonghua	Jilin	51 Base	818 Brigade
DF-31	n.a.	n.a.	n.a.	n.a.
DF-31A	n.a.	n.a.	n.a.	n.a.

it appears to have been caused by the retirement of approximately 20 DF-3A (CSS-2) IRBMs and the conversion of part of the DF-21 (CSS-5) force from nuclear to conventional missions. This reduction has affected the portion of the missile force that has theater range and resulted in a decreased nuclear posture against countries on China's periphery. The fact that part of this reduction may come from converting some of China's most modern medium-range, solid-fuel, mobile DF-21 to conventional capability suggests an important new focus on non-nuclear missions. The DOD acknowledges such a Chinese interest:

> Beijing's growing conventional missile force provides a strategic capability without the political and practical constraints associated with nuclear-armed missiles. The PLA's short-range ballistic missiles (SRBMs) provide a survivable and effective conventional strike force, as will future procurement of conventionally armed ballistic missiles and land-attack cruise missiles.[145]

Medium-Range Ballistic Missiles

Most of China's land-based nuclear ballistic missiles (55 percent) are medium-range missiles. This includes the old DF-3A and the more recent DF-21. These weapons are likely used to target India and Russia and U.S. military bases in the region.

DF-3A (CSS-2) MRBM

Figure 15:
DF-3A (CSS-2) Medium-Range Ballistic Missile

A DF-3 medium-range ballistic missile being prepared for elevation as part of a launch exercise. The white-painted warhead section is clearly visible.

Images: Military.China.com

The DF-3A is "China's primary regional missile system," the DOD stated in 2000. Today however, more than half of the missiles have been withdrawn from service and the weapon system is undergoing retirement. The DF-3A is a road-mobile, liquid-fueled IRBM that can be launched from either a permanent launch pad or portable launch stand.[146] It carries a 3.3 Mt warhead and has a range of up to 1,925 miles (3,100 km).[147] The weapon is most likely used to target Russia, India, and U.S. bases in Japan.

Deployment began in 1971 and reached a peak of 110 missiles by 1984[148] before declining to about 50 in 1993[149] and some 16 missiles on eight launchers today.[150] The Air Force's National Intelligence Center predicted in 1996 that China would remove the DF-3 completely from service in 2002,[151] but as with so many other predictions from the intelligence community, that did not happen. Instead, presumably due to the delay of the DF-31, the "Second Artillery is continuing to supplement its aging inventory of liquid-propellant [DF-3]

Figure 16:
DF-3A (CSS-2) Twin Launch Exercise

Recent image of a double DF-3A launch exercise at an unknown location. The white-painted warhead section of the DF-3A is clearly visible. The image gives a vivid impression of the large number of service trucks that are needed to support the weapon in the field. Apart from fuel trucks, this includes command and control vehicles, cranes, emergency vehicles, personnel carriers, etc. This makes the weapon more visible to detection by foreign intelligence assets.

Images: China.Defense.com

intermediate-range ballistic missiles with the solid-propellant, road-mobile [DF-21A] MRBM," according to the DOD.[152] Once the DF-31 enters service, however, the cumbersome DF-3A is likely to disappear quickly from operational service and its warheads probably scrapped. Today the DF-3A is rumored to be deployed at eight locations in six provinces (Table 9). China may have converted several of these sites to the newer DF-21 missile.

One of the rumored locations for the DF-3A is Yidu in the Shandong district in eastern China. The precise locations are unknown but approximately five miles (eight km) south of Yidu are two sites that might be launch facilities. One site

Figure 17:
Possible Yidu DF-3 Launch Facility

This facility south of Yidu in the Shandong province (36°36'09.29"N 118°28'48.63"E) might be a DF-3 launch site. The site is adjacent to another facility with a smaller potential launch pad. The site may have been converted to DF-21. It should be emphasized that there is no official confirmation that this facility is a launch site.

Image: GoogleEarth/DigitalGlobe

(Figure 17) has a 265-foot (80-meter) wide concrete pad adjacent to a 131 x 40 feet (40 x 12 meters) building large enough to house two DF-3A missiles. The second site (not shown) has a smaller 131-foot (40-meter) pad adjacent to a 115 x 56 feet (35 x 17 meters) building. It should be emphasized that it is not known whether these two sites are indeed launch facilities, but their layout suggest that they might serve such a role.

DF-21 (CSS-5) MRBM

The DF-21 is China's first land-based solid-fuel missile and similar to the JL-1 sea-launched ballistic missile. The missile was completed between 1985 and 1986, but deployment apparently did not get underway until 1991 and then at a modest pace. Today, the Pentagon says that 19 to 50 missiles are deployed.

The DF-21 is a road-mobile missile carried in and launched from a launch canister mounted on a towed transporter-erector-launcher (TEL). The DOD says that China deploys two versions (Mod 1 and Mod 2), designated as DF-21 and DF-21A, respectively. The weapon system continues to supplement the aging inventory of liquid-fueled DF-3As.[153] The missile's range is normally listed as 1,100+ miles (1,770+ km), but the classified range for DF-21 Mod 1 appears to be 1,340 miles (2,150 km).[154] A variant of the DF-21 is the submarine-based JL-1 developed for the Xia-class submarine.

Figure 18:
DF-21 (CSS-5) Launchers

The DF-21 is China's first solid-fueled ballistic missile. Some have been converted to non-nuclear missions.
Image: U.S. Air Force

U.S. Air Force intelligence predicted in 1996 that once DF-21 deployment was adequately underway, the DF-3A "will likely be removed completed from service, perhaps by 2002,"[155] but this did not happen. Yet there is considerable confusion about the number of DF-21 missiles deployed. The 2006 DOD report lists 19 to 50 missiles of both modifications on 34 to 38 launchers.[156] The 2005 report, however, listed only 19 to 23 missiles on 34 to 38 launchers,[157] while Air Force intelligence in 2006 listed "fewer than 50" DF-21 (CSS-5 Mod 1) launchers as *well* as "fewer than 50 DF-21 (CSS-5 Mod 2) launchers.[158]

Figure 19:
DF-21 (CSS-5) Missile Calibration

This image of a calibration of a DF-21 missile clearly shows the stump warhead section with access hatches opened. The missile appears to be marked DF-21M.

Image: Military.China.com

Part of the confusion may come from sources citing launchers instead of missiles. Another explanation may have to do with the conversion of a number of the DF-21s to conventional missions. The conventional version, apparently known as DF-21C, raises important questions about China's regional targeting priorities as well as about crisis stability. Launch (or preparation for launch) of several DF-21Cs in a crisis or war might be misinterpreted as an impending nuclear strike and trigger U.S. preemptive nuclear action which in turn could result in Chinese nuclear retaliation.

The DF-21 is rumored to be deployed in at least three locations in three provinces (see Table 9), but nothing is known for sure and other locations may be used as well. If so, one potential other location may the Suixi (Liancheng) airbase in southern China. A satellite image from 2005 (Figure 20) shows a large rectangular area with an assembly of dozens of vehicles. Although the relatively poor resolution of the image makes identification of the vehicles difficult, 22 of the vehicles appear to be approximately 34 to 46 feet (13 to 14 meters) long and consist of a truck with a 33 to 36 feet (10 to 11 meters) long trailer. The DF-21

Figure 20:
DF-21s or SAMs at Suixi Airbase

This image of Suixi Airbase (21°23'45.54"N 110°11'58.83"E) taken in 2005 shows a large concentration of long vehicles in a rectangular area (insert left). The largest vehicles are similar in size to DF-21 launchers, although it should be emphasized that it is unknown whether the vehicles are indeed DF-21 launchers. At the southern end appears to be a SAM site, which may be a temporary setup while a more permanent site is completed in what appears to be a SAM construction area next to the northern part of the area with the trucks. Rather than DF-21 launchers, the large vehicles may be used to transport surface-to-air missiles. Note that the tilted insert (right) makes the vehicles appear flatter than they actually are.

Image: GoogleEarth/DigitalGlobe

reportedly is 35 feet (10.7 meters) long.[159] The surface of the launch canister that contains the DF-21 missile is not smooth but has several large protrusions and other features that might account for the uneven appearance of the large vehicles in the image. But it should be emphasized that it is by no means certain that the vehicles identified on the satellite image are indeed DF-21 launchers; they may simply be trucks transporting surface-to-air missiles for a SAM site at the base.

Deployment of DF-21s at Suixi Airbase would, if true, raise some interesting questions. First, since the Pentagon estimates that China has only 34 to 38 DF-21 launchers, the relatively large number of possible DF-21 launchers visible in the satellite image would make Suixi one of the major deployment areas. Second, with a range of approximate 1,330 miles (2,100 km), DF-21s would not be able to target India from Suixi. They would, however, be in striking range of the Philippines and the Taiwan area.

Long-Range Ballistic Missiles

The long-range ballistic missile category is one area where different Chinese and U.S. range definitions create confusion. China categorizes missiles with a range of 1,860 to 4,970 miles (3,000 to 8,000km) as long-range, which includes the DF-4 and the new DF-31. The U.S. government categorizes the DF-4 as an intermediate-range missile (1,700 to 3,420 miles (2,750 to 5,500 km) but counts the DF-31 as an ICBM. For consistency, we have included the DF-31 in the ICBM section below.

DF-4 (CSS-3) LRBM

Initially deployed in 1980, the DF-4 was the first Chinese ballistic missile capable of hitting Guam, a base used for forward deployment of U.S. nuclear bombers and submarines since the early 1960s. The decision to develop the missile was made in May 1965,[160] shortly after the U.S. Navy began strategic deterrent patrols in the Pacific with ballistic missile submarines from Guam.

Figure 21:
DF-4 (CSS-3) Missile

DF-4 rollout-to-launch version in launch exercise. The missile garage is visible to the right. The DF-4 will likely be replaced by the DF-31.

Image: U.S. Air Force

The DF-4 is rumored to be deployed at three, possibly four, locations in three provinces (see Table 9). One location (Dalingha, Qinghai) has been identified via satellite images for the report (see Figures 22 and 23).

The DF-4 was built in two configurations: a rollout-to-launch version housed in garages or caves; and an elevate-to-launch version based in silos.[161] Only the rollout-to-launch version is thought to be operational today. With a range of more than 3,420 miles (5,500 km), the DF-4 is probably used to target Russia, India and Guam. The DF-4 is estimated to carry a single 3.3 Mt warhead.

The CIA predicted in 1976 that the DF-4 force would level out at less than five launchers by 1978,[162] but more than double the number apparently were deployed.[163] The 2001 National Intelligence Estimate stated that about a dozen DF-4 would probably remain in service through 2015,[164] and the DOD has stated since that the weapon likely will remain in service through 2009 for regional deterrence missions until they can be replaced by the DF-31.[165] Today there are thought to be 10 to 14 launchers with 20 to 24 missiles.[166]

Figure 22:
Delingha DF-4 Launch Facility

This DF-4 launch site (37°22'33.56"N, 97°03'21.17"E) is located in central China near Delingha (see map insert). The site includes a 263 x 59 feet (80 x 18 meters) missile garage, barracks, fuel and service trucks, an office building, and a garage situated around a 230-foot (70-meters) wide launch pad. The site is at an elevation of 9.833 feet (2,977 meters) above sea-level and the DF-4s are within reach of almost all of Russia, India and Guam.

Image: GoogleEarth/DigitalGlobe

One of the rumored deployment areas for the DF-4 is the Delingha area in the Qinghai province in central China where the 414th Brigade is believed to be based. At least two launch sites appear to be operational approximately 17 miles (27 km) (Figure 22) and 19 miles (30 km) (Figure 23), respectively, west of the town of Delingha. Both launch sites have the same basic layout: A 230-foot (70-meter) wide concrete circle, a large garage that is large enough to

contain two or more DF-4 missiles mounted on their erect launchers, half a dozen fuel trucks, one to two dozen cabins and a couple of office buildings.

Figure 23:
Delingha DF-4 Launch Facility

This DF-4 launch site (37°24'27.47"N, 97° 1'40.70"E) is located in central China near Delingha (see map insert). The site includes a 194 x 30 feet (59 x 9 meters) missile garage, barracks, fuel and service trucks, and an underground garage next to a 230-foot (70-meter) wide launch pad. The site is at an elevation of 10,050 feet (3,064 meters) above sea-level. The DF-4s are within reach of almost all of Russia, India and Guam.

Image: GoogleEarth/DigitalGlobe

Approximately 10 miles (17 km) further to the west are what may be five additional, but apparently abandoned, launch sites. They may have been operational in the 1980s when China's nuclear deterrent was principally focused against the Soviet Union, but were abandoned either because the targets shifted and/or the missile force was reduced. A possible location for the 414th Brigade Headquarters is Delingha Nongchang, approximately halfway between Delingha and the launch sites. The site includes what might be a launch site, including three missile garages, a launch pad, and a number of service vehicles (Figure 24).

For all of the (possibly) identified DF-4 launch sites, it is striking how vulnerable they are to attack. Their small size and the apparent storage of the missiles in garages on the surface makes it unnecessary to even resort to nuclear weapons use in a counterforce attack on these facilities. A single successful bomber sortie with a precision bomb (even a Special Operations Forces unit on the ground) would be sufficient to put a launch site out of operation.

Figure 24:
Possible Delingha DF-4 Launch Facility Headquarters

This possible but unconfirmed DF-4 launch site headquarters (37°18'37.94"N, 97°12'27.71"E) is located in Delingha Nongchang approximately 10 miles (15 km) southwest of the town of Delingha in central China (see map insert). The site includes what might be three missile garages in front of a launch pad inside a fenced enclosure with service trucks. It must be emphasized that the site has not been confirmed as a missile related facility.

Image: GoogleEarth/DigitalGlobe

Approximately 115 miles (185 km) further to the west from Delingha is another rumored DF-4 site: Da Qaidam. The town is said to be the location of the 412 Missile Brigade, and a satellite image taken in 2005 (not shown) shows a busy town with what appears to be industry and military facilities. Two sites immediately south of Da Qaidam may be dismantled launch pads, but the available satellite images do not reveal possible launch sites, although a small fenced facility approximately 22 miles (36 km) south of Da Qaidam near Xiao Qaidam have some interesting features but no visible launch pad.

Intercontinental Ballistic Missiles

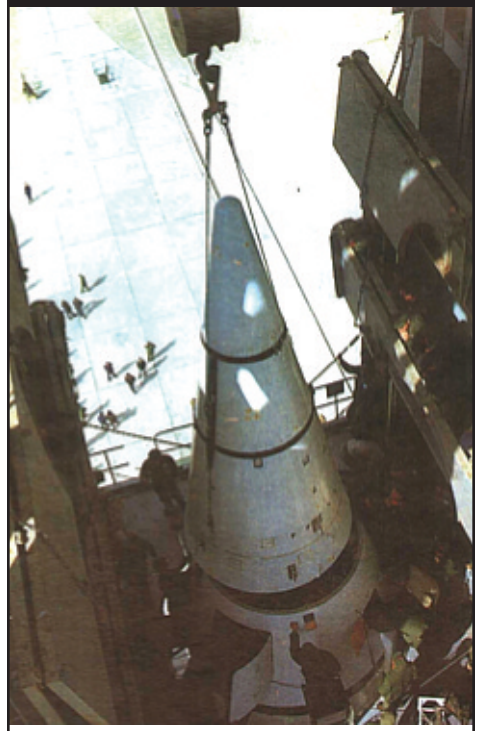
China's ICBM force includes the modified DF-5, which is the only missile capable of targeting all of the United States. The DF-31 and DF-31A are under development and expected to supplement or replace the DF-3/DF-4 and eventually the DF-5, respectively.

DF-5A (CSS-4 Mod 2) ICBM

Approximately 20 silo-based DF-5A (CSS-4 Mod 2) make up China's "primary nuclear deterrent," according to the DOD,[167] a statement that reflects that this is the only Chinese missile that can reach targets in all of the continental United States. First deployed in August 1981, the DF-5 has a throw-weight of approximately 7,000 lbs (3,100 kg) and is capable of delivering a 4-5 Mt warhead more than 8,100 miles (13,000 km).

While the DF-5's role is normally described in a China-U.S. deterrence relationship, the DIA concluded in 1985 that although the missile was "originally envisioned by Beijing as providing a deterrent against the United States, [it] now has a primary role for use against Soviet targets, especially Moscow." DIA derived this conclusion from the DF-5 "flight test program and other information we have on this missile [that] suggests that it is intended to be used against targets defended by an unsophisticated, first generation anti-ballistic missile defense. Moscow remains the only city with an ABM system." DIA also

Figure 25:
DF-5A (CSS-4) Reentry Vehicle?



A possible reentry vehicle is loaded atop a DF-5A prior to a test launch from the Jiuquan Space Launch Center. The missile is normally deployed in silos with the warhead stored separately. A modified version of the DF-5 has also been used for space launches.

Image: Military.China.com

concluded that "some CSS-4s might have secondary targets in the United States," but added that U.S. plans to build a missile defense system would likely lead to additional improvements to the DF-5.[168]

China is in the last phase of replacing all original DF-5s with a modified and longer-range version (DF-5A), a replacement that is frequently misrepresented. One of the few "experts" that the House Armed Services committee in 2005 invited to brief it on the Chinese military mistakenly told the committee that the 1999 Cox report "for the first time revealed that the PLA was replacing its 13,000-km-range, liquid-fueled DF-5 Mod 1 ICBMs with a longer range DF-5 Mod 2."[169]

On the contrary, the replacement program had been reported on for more than a decade. The decision to extend the range reportedly was made in November 1983,[170] shortly after the so-called "Star Wars" speech by President Ronald Reagan. The DOD predicted in 2002 that all DF-5s would be replaced by DF-5A by mid-decade,[171] but the 2005 report states that the upgrade is still in progress.[172] The modification appears to have been minor,[173] increasing the range by about 620 miles (1,000 km) to approximately 8,100 miles (13,000 km).[174]

Figure 26:
DF-5 (CSS-4) Silo Launch

A DF-5 is launched from a silo. China is thought to have about 20 operational DF-5A silos and also some decoy silos.

Image: Military.China.com

While normally credited with a range of approximately 8,100 miles (13,000 km), DIA reported in 1984 that two flight tests of the DF-5 took place "from central China to the vicinity of the Fiji Islands about 15,000 kilometers [9,320 miles] away."[175] The 2006 DOD report adds further confusion to the capability of the DF-5A by listing its range as 8,460+ km (5,257+ miles) and showing a map with a range only reaching halfway across the United States, significantly shorter than the DF-31A.[176] The 2005 DOD report, in

contrast, included a map that showed the range to reach beyond Florida and further than the DF-31A.[177] (See Figure 14)

The Cox report claimed that the DF-5 is "based in significant part on U.S. technologies illegally obtained by the PRC in the 1950s" for the Titan missile and that this "information formed the basis for the [DF-5s] that are currently targeted on the United States."[178] This claim was discredited by the CISAC assessment of the Cox report.[179]

The U.S. intelligence community anticipates that China may begin to deploy multiple warheads on part of its ballistic missiles in response to the U.S. deployment of ballistic missiles defense systems, and that the DF-5A in that case would be the weapon of choice. Private "experts" invited to testify before Congress have speculated that the DF-5A could carry five to eight multiple warheads,[180] but the 70 to 100 range for warheads primarily targeted against the United States that has been projected by the CIA and repeated by other agencies since only envisions three warheads.[181]

DF-31 (CSS-X-10) ICBM

The DF-31 forms the core of China's long-range ballistic missile modernization program. Deployment of the new missile has been expected for many years but DOD's predictions have continued to slip. The DF-31 was first displayed publicly at the National Day parade in 1999, and has been photographed at several places including on airport runways. The DOD predicted in 2002 that deployment would "begin before mid-decade,"[182] but this did not happen, and although the Internet is full of pictures and claims that the DF-31 has already been deployed, the 2006 DOD report says it may happen in 2006.[183]

Figure 27:
DF-31 (CSS-X-10) Launchers

The DF-31 launcher is similar to the launcher used for the DF-21, except longer and with fewer protrusions on the canister. The missile itself has three stages and carries a single nuclear warhead.

Images: U.S. Air Force

The range of the DF-31 has been the subject of much speculation. Most sources claim a range of around 4,934 miles

(8,000 km). In 1987, the Pentagon stated that the range would be "at least" 4,970 miles (8,000km),[184] but after monitoring additional flight tests, the Pentagon in its 2006 report reduced the range estimate to 4,500 miles (7,250+ km), or less than the 4,970+ miles (8,000+ km) estimate for the JL-2.[185] Adding to the confusion is that China and the United States define the DF-31 differently as a long-range missiles and an ICBM, respectively. We include the missile in the ICBM section for consistency.

With a range of more than 4,500 miles (7,250+ km), but apparently less than 4,970 miles (8,000km), the DF-31 will be China's first solid-fueled ICBM. The three-stage missile is carried by an eight-axle transporter-erector-launcher (TEL) (Figure 27). Once deployed, it will be able to reach targets throughout Asia and Europe, but not the U.S. mainland except for Alaska and the most northwestern states. The missile will probably replace the DF-3 and DF-4 entirely, although the U.S. intelligence community expects some DF-4s may be retained through 2009 and possibly until 2015. At that time, the 2001 National Intelligence Estimate predicted, China may have about two dozen DF-31s and DF-4s.[186]

Unlike certain private analysts and reporters who speculate that the DF-31 will be equipped with multiple warheads, the U.S. intelligence community believes the missile will carry a new small warhead tested in the 1990s as well as an advanced package of penetration aids against U.S. and Russian ballistic missile defense systems. Chinese television in 2004 carried pictures of what allegedly was said to be the warhead section for the DF-31 being rolled out on a dolly (Figure 28).

Figure 28:
Alleged DF-31 (CSS-X-10) Warhead Section

This 2004 image from Chinese television allegedly shows the warhead section for the DF-31 being rolled out. The authenticity of the image has not been confirmed. The U.S. intelligence community consistently has predicted that the missile will carry a single warhead with an advanced penetration aids package.

Images: Military.China.com

Figure 29:
DF-31 Missile On Fixed Launch Pad

An image allegedly showing the DF-31 missile positioned on a fixed launch pad. The missile, which has been under development since the 1980s, is expected to replace the DF-3A and DF-4 in regional targeting.

Image: SinoDefence.com

DF-31A ICBM

The DF-31A is a modified version of the DF-31 with a longer range of more than 7,000 miles (11,270+ km). With such a range the missile will be able to reach targets throughout the United States, Europe and Russia. The DOD expects the DF-31A will be primarily targeted against the United States, and together with the DF-5A the DF-31A form the basis for the U.S. intelligence community's projection of 75 to 100 Chinese warheads "primarily targeted against the United States" by 2015.

This warhead estimate assumes that China will be able to produce and deploy 40 to 55 DF-31As by 2015, a questionable assumption given that the missile has yet to be flight tested. DOD projections for initial deployment have continued to slip over the years, and the DOD now believes the missile will be deployed in

2007.[187] A more likely date is toward the end of the decade. The DF-31A may previously have been confused with the DF-41, an earlier attempt to design a solid-fueled ICBM which has now been abandoned (Figure 30).

Figure 30:
Alleged DF-41 (Abandoned) ICBM

This image is said to show the DF-41, China's earlier attempt to develop a solid-fueled ICBM capable of targeting all of the United States. The authenticity of the image has not been confirmed and the design appears more Russian than Chinese.

Image:bbs.news.163.com

Despite frequent claims by media and private organizations that the DF-31A will carry multiple warheads, the U.S. intelligence community does not believe the missile will be so equipped. The DF-31A will likely carry a single warhead, perhaps in the 200 to 300 kiloton range, plus an advanced package of penetration aids.

Other Nuclear Ballistic Missiles

The 2006 DOD report provides the new information that "China will deploy several new conventional and nuclear variants of MRBMs and IRBMs for regional contingencies and to augment its long-range missile forces."[188] According to the report, China currently has one MRBM (DF-21) and one IRBM (DF-3). Of these, it is known that a conventional variant of the DF-21 (DF-21C) is deployed, but it is

Figure 31:
Alleged "New" Missile Launcher

This image of an alleged new five-axle missile launcher was recently posted on the Web site Military.China.com.

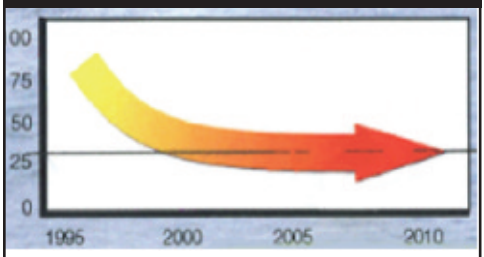
Image:Military.China.com

unclear what the new nuclear variant is. A photograph of a new five-axle mobile launcher was recently posted on the Internet (see Figure 31).

The Chinese Submarine Force

As of early 2006, the Chinese submarine force consisted of approximately 56 operational submarines, including 50 diesel-powered submarines, five nuclear-powered Han-class attack submarines, and a single Xia-class ballistic missile submarine.[189] This force is less than half of what China had in the mid-1980s, a dramatic reduction caused mainly by the retirement of older Whiskey-class and Romeo-class diesel attack submarines. New classes of submarines are under construction but production is unlikely to offset the decline as the remaining Romeo-class submarines are retired. The DOD predicts that all Romeo-class submarines will have been withdrawn from service by 2010, and that China's non-nuclear powered (i.e., diesel) submarine inventory by 2020 will consist of Ming-, Song-, and Kilo-class submarines.[190] The size of the submarine force is expected to stabilize around 40 boats (Figure 32).

Figure 32:
U.S. Navy Projection For Chinese Submarine Force



Unlike unofficial speculations that China's submarine force will increase, U.S. Naval Intelligence states that "Chinese diesel submarine force levels are stabilizing as quality replaces quantity."

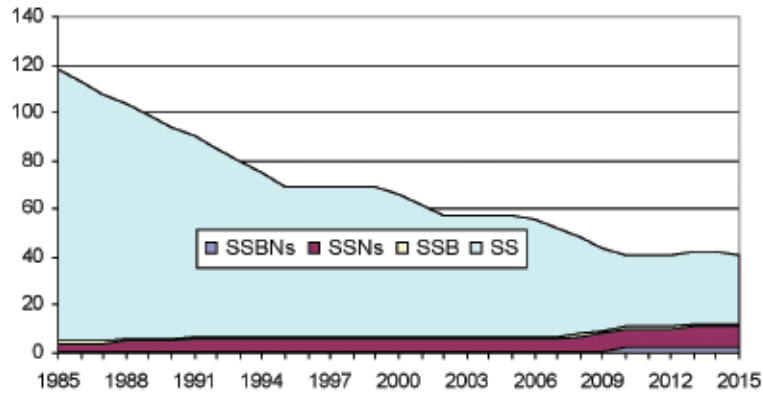
Source: U.S. Naval Intelligence

As with many other aspects of China's military modernization, the future development of the submarine force is frequently misreported or exaggerated in the news media and in publications by private organizations. An article in the *Wall Street Journal* in April 2006, for example, quoted "military analysts" speculating that "China could have as many as 85 submarines in the Pacific by 2010," and that "Beijing's fleet of attack subs could outnumber the U.S. fleet by five to one by 2025."[191] A Heritage Foundation article published only two days before the *Wall Street Journal* article claimed that the Chinese submarine fleet is "growing prodigiously,"[192] and another article in March 2006 described "China's rapidly expanding submarine force."[193] The shipbuilding industry is also prone to exaggerate the Chinese submarine force, with the American Shipbuilding Association claiming in 2005

that China's submarine force by 2010 "will be nearly double the size of the U.S. submarine fleet."[194]

Such claims are well in excess of the projections made by the U.S. intelligence community, however, which anticipates a much smaller Chinese submarine fleet. Like other maritime nations in the Pacific region, China is modernizing its submarine force by retiring older models and replacing them with newer submarines, but in smaller numbers. Production of Song-class and Yuan-class diesel submarines, purchases of Russian Kilo-class diesel submarines, and production of Type 093-class nuclear-powered attack submarines and Type 094-class nuclear-powered ballistic missile submarines will likely result in a fleet of approximately 40 submarines by 2015 (Figure 33). If China wanted to, it could obviously easily increase its submarine force beyond that level. "One of the top priorities" for the Chinese Navy during the 10th Five-Year Plan, according to the DOD, is manufacturing submarines.[195] Yet the unclassified intelligence estimates we have seen do not anticipate an increase at this point.

Figure 33:
Chinese Submarine Force 1985-2015



The Chinese submarine fleet has been cut in half since 1985 and likely will continue to drop to roughly 40 submarines by 2015, according to U.S. Naval Intelligence.

The development and operations of the submarine force are important because they form a central component of the Pentagon's claim that China is expanding its military reach in the region. According to the DOD, the Chinese Navy's maritime mission in recent years "has evolved from a static coastal defense into

an 'active offshore defense,'" resulting in newer, more modern warships and submarines capable of operating at greater distances from China's coast for longer periods.[196] If equipped with land-attack missiles in the future, the submarine mission will evolve further.

Unlike U.S. submarines, however, Chinese submarine officers have very limited experience in offensive submarine operations far from the Chinese coast. Each U.S. attack submarine sails on an extended patrol once or twice each year and six to 16 submarines are constantly forward-deployed lurking off foreign coasts – no doubt including China's. The entire Chinese submarine force, by contrast, conducted no patrols at all in 2005.

Nuclear-Powered Ballistic Missile Submarines

The expectation that China will be able to develop a credible sea-based nuclear deterrent is another key component of the warnings that are made about China's military modernization. If (and *if* is the operative word here) Chinese ballistic missile submarines were equipped with a long-range missile that could reach the United States, the 1999 Cox report warned, this "would allow a significant change in the operation and tactics of the PRC's nuclear-powered ballistic missile submarines. Instead of venturing into the open ocean to attack the United States [something the Chinese probably have never envisioned for their single Xia-class SSBN], the Type 094-class submarines could remain near PRC waters, protected by the PLA Navy and Air Force."[197] The Type 094 class SSBN, the latest 2006 DOD report states, "will provide China with an additional, survivable nuclear option."[198] By 2025, the Heritage Foundation prognosticated that "several Chinese nuclear ballistic missile submarines will be capable of patrolling America's West Coast,"[199] apparently imagining how the Soviet's operated their SSBNs during the Cold War.

But before the Chinese get to that stage, if they ever do, they must first demonstrate that they can build a reliable SSBN force and operate it successfully. In the past, China has experienced considerable technical difficulties in developing and deploying a sea-based nuclear ballistic missile force. According to information obtained from the Office of Naval Intelligence, moreover, China's single Xia-class SSBN has never conducted a deterrent patrol. This fact may be a result of technical problems that have prevented the submarine from becoming fully operational, or less likely it may reflect the Chinese government's policy that "China…

never deploys any nuclear weapons beyond its borders."[200] An operational SSBN force, and certainly one that would patrol America's West Coast, would require a dramatic change of policy, capability, and operations.

The Xia-class (Type 092), or Daqingyu-class, was launched from the Bohai shipyard in April 1981 after more than 25 years of design and development work. The nuclear propulsion design was based on the reactor developed for the Han-class (Type 091) nuclear-powered attack submarine first launched in 1971. The Xia hull appears to be a modified Han hull, with the ballistic missile compartment added to the mid-section with a characteristic hump to cover the top of the missile tubes, an approach also used by the United States and the Soviet Union in designing their first SSBNs back in the 1960s.

Table 10:
Chinese Sea-Based Nuclear Ballistic Missiles

Type	Name	Year deployed	Range*	Warheads	Yield	Missiles	Warheads
JL-1	CSS-NX-3	1986	1,770+	1	200-300 kt	12	12
JL-2	CSS-NX-4?	2008-2010?	8,000+	1	? kt	0	0
TOTAL						**12**	**12**

* Range in kilometers.

Past projections by the U.S. intelligence community about the Chinese SSBN force have proven to be highly inaccurate and inflated. The DIA projected in 1984 that four Xia-class SSBNs would be operational by 1994.[201] This never happened indicating either that DIA's prediction was wrong or that something was wrong with the design. Whatever the reason, it seems unlikely that China would have gone to the great expense and the mobilization of its resources to just build one submarine. Up until late-1999, U.S. media reports continued to say that a second Xia-class submarine was under construction. The *Washington Times* even reported that the submarine was being modified to carry the new JL-2.[202]

Again in 2002, after the Xia underwent an overhaul from 1995 to 1998, the DOD predicted that "China is expected to deploy a medium-range SLBM aboard the XIA SSBN before the end of the year," and that the service life of Xia "most likely will be extended through at least 2011."[203] The medium-range SLBM was the JL-1 but the 2002 deployment did not materialize and it remains to be seen if Xia will continue to operate as an SSBN or be used as a SLBM test

platform to replace the old Golf-class SSB if and when the Type-094 becomes fully operational. The Xia appears to continue to be hampered by technical issues as it moved into dry dock again in 2005 for what appears to have been either a refueling overhaul or repairs to the reactor compartment (Figures 34 and 35).

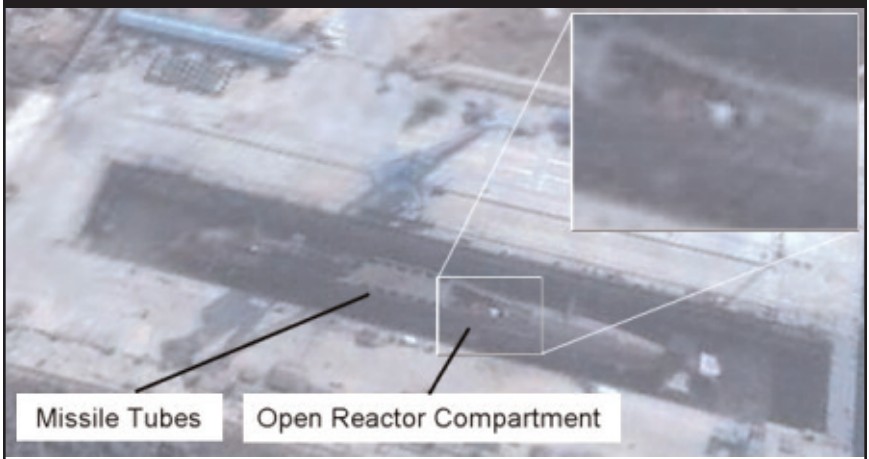
Figure 34:
Xia-class SSBN in Dry Dock 2005

This satellite image from 2005 of the submarine base at Jianggezhuang shows the Xia-Class SSBN and two Han-Class SSNs. A third Han-Class SSN is berthed outside the frame. The image of the Xia in dry dock is a significant change compared with 2003, when the boat was docked in the bottom of the frame where one of the Han-Class SSNs is located (see insert). The Xia completed a major overhaul in 1998.

Images:GoogleEarth/DigitalGlobe

The Xia was designed to carry 12 Julang-1 (JL-1, or CSS-N-3) missiles, a two-stage solid-fueled missile equipped with a single 200 to 300 kt warhead to a range of 1,100+ miles (1,770+ km). The JL-1, which is similar to the DF-21, was completed in 1986 but is not thought to have been fully operational and may be stored on land in the underground submarine cave at Jianggezhuang approximately 15 miles (24 km) east of Qingdao on the Yellow Sea. Another possibly is that the warheads may be stored further inland at a central storage location.

Figure 35:
Xia-class SSBN In Dry Dock 2005



This satellite image from 2005 shows the Xia-Class SSBN in dry dock at the Jianggezhuang naval base. The hull appears to be open above the reactor compartment, suggesting that this was either a refueling overhaul (only seven years after Xia completed a major three-year overhaul in 1998), or repairs to the reactor compartment itself or the hull above it.

Images: GoogleEarth/DigitalGlobe

The 2006 DOD report lists 10 to 14 JL-1 missiles for 10 to 14 launchers, a curious number because the Xia is known to have 12 launch tubes (see also Figure 36 below). Yet the DOD report indicates that China only produced one load of JL-1 missiles, insufficient to arm any additional boats that were once rumored.

One reason the JL-1 is often listed as CSS-NX-3 is that China may be working on upgrading the missile. According to U.S. Naval Intelligence, in order to "give the XIA more capability, the Chinese may elect to develop, test, and equip it with an improved version of the JL-1 SLBM." Initial operational capability of the improved version might be 2004, Naval Intelligence predicted,[204] but no such deployment has been announced.

Several media reported in 2004 that the first Type 094 SSBN, known as the Jin-class, had been launched in late July 2004,[205] but this may have been the lead hull of the Type 093 SSN.[206] How many Jin-class SSBNs will be built is unknown, but two or three is often suggested (as was the case with the Xia).[207] Only the future will tell how many will actually be built. The Jin-class submarine will carry 12 Julang-2 SLBMs (Figure 36), a modification of the land-based DF-31. The JL-2 will be solid-fueled like the JL-1 but with three stages.

Figure 36:
Type 094 Class SSBN Missile Configurations

Earlier descriptions (left) of the Type 094 showed 16 launch tubes for ballistic missiles, but a 2004 outline published by U.S. Naval Intelligence shows 12 tubes arranged in two groups (right).

Images: DefenceTalk.com/U.S. Naval Intelligence

The JL-2 has already been the subject of much speculation with the 1999 Cox report claiming the missile will have a range of 7,200 miles (11,590 km) that would "allow it to be launched from the PRC's territorial waters and to strike targets throughout the United States." Confusingly, the reports main missile chart listed a much shorter range of 4,900 miles (7,880 km), a little more than the DF-31.[208] Some news media only reported the longer estimate, however, and the *Washington Times* quoted "one official" saying that the JL-2 and the DF-31 "will be able to hit any place in the United States, not just the Western states. It is a significant new capability."[209] This mistake was repeated by *Air Force Magazine* in 2005 when it reported that the 2005 DOD report on China's military forces stated that the DF-31 and Julang-2 "can strike anywhere in the United States except southern Florida."[210]

Figure 37:
Julang-1 SLBM

The 1,100-plus mile range Julang-1 is China's only sea-launched ballistic missile. First deployed in 1986, the weapon has never been on a strategic deterrent patrol. U.S. Naval Intelligence says China may be upgrading the missile.

Source: U.S. Air Force

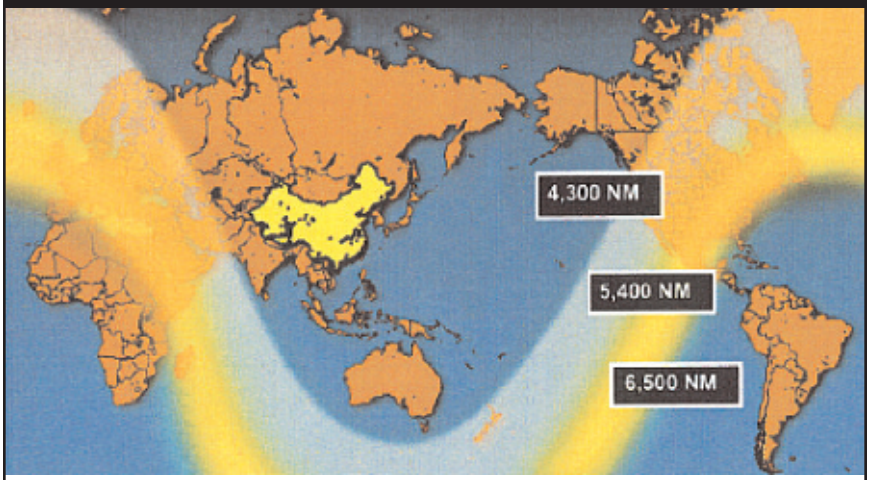
What the DOD report stated, however, was that the DF-31 has a range of 4,500+ miles (7,250+ km) and that a future version (DF-31A) will have an extended range of

more than 7,000 miles (11,270 km). The range of JL-2 was not identified in the report but was described in the 2006 report as more than 4,970 miles (8,000+ km).[211] This estimate roughly matches the estimate most commonly used by the intelligence community, but some confusion remains.

In a publication titled *Worldwide Maritime Challenges* published in 2004, U.S. Naval Intelligence set the JL-2 range at "over 5,000 nautical miles" (over 5,750 miles or 9,260 km). This estimate apparently was from a range of different assessments of launch close to China (not on distant patrol) "potentially putting all of the continental United States at risk," according to the Navy. The statement accompanied a map (Figure 38) showing three range estimates: 4,300 nautical miles (4,950 miles or 7,960 km), 5,400 nautical miles (6,210 miles or 10,000 km), and 6,500 nautical miles (7,480 miles or 12,040 km).[212] Only the shortest of these ranges match the estimate in the 2005 DOD report whereas the longest range matches the 1999 Cox report.

Of course, any long-range submarine ballistic missile can target all of the United States if the submarine just sails close enough, but at best the inconsistent estimates indicate that the U.S. intelligence community just does not know what the JL-2

Figure 38:
U.S. Navy Range Estimates For Julang-2 SLBM



The Office of Naval Intelligence stated in 2004 that "JL-2 range assessments extend to over 5,000 nautical miles (over 5,00 miles or 9,260 km), potentially putting all of the continental United States at risk." Only the shortest of those assessments, however, match statements made by CIA and DOD.

Image: U.S. Naval Intelligence

range will be. Even with a possible range of 5,095 miles (8,200 km), the JL-2 would not be able to target the continental United States from the Bo Hai Bay, which sometimes is described as a protected sanctuary for China's future SSBN fleet. The North Korean Bay would also be too far away, and the SSBNs would have to sail through the narrow straits between South Korea and Japan and into the Sea of Japan for its JL-2 missiles to reach targets in the continental United States. For Bo Hai Bay to be used as launch area, the range of the JL-2 will need to be well over 5,130 miles (8,260 km). Since China is only 2,800 miles (4,500 km) wide and the JL-2 has not been test launched into the Pacific Ocean, it is difficult to accurately estimate the range.

Another confusing issue surrounding the JL-2 is whether the missile will carry multiple warheads, even MIRVs as some experts claim. An article in *U.S. Naval Institute Proceedings* in 2003 titled "China's Subs Lead the Way," for example, claimed that the JL-2 will be equipped with "three to six warheads."[213] Similarly, after China in June 2005 successfully test launched a JL-2 (after a previous failed attempt in 2004), an article in the Naval Submarine League magazine, *The Submarine Review*, stated:

> With the *successful implementation* of the JL-2 onboard the Type-094, China now possesses a weapon capable of reaching *any target in the world*. When loaded to capacity with JL-2 missiles, the Type-094 would contain *48 separate 90-kiloton warheads*.
>
> It is not currently known whether the JL-2 is ready for full-scale deployment, but according to a report issued by the Pentagon regarding China's nuclear forces in May 2004, *the number of SLBMs could increase to 30 by next year and 60 by 2010*.[214] (Emphasis added.)

In contrast to such claims, the U.S. intelligence community has consistently stated that the JL-2 "is expected to carry a single warhead" with "a sophisticated penetration aids suite"[215] to overcome U.S. and Russian anti-ballistic missile systems. The JL-2 is not yet deployed because the weapon is not finished and the Type 094 class SSBN that is supposed to carry it has yet to be commissioned. In fact, the DOD expects that the JL-2 may be last of the three DF-31 versions to become operational "by the end of the decade."[216] Finally, the JL-2 will not be capable of "reaching any target in the world" even with a range of 7,450 miles (12,000 km), unless it went on patrol far from Chinese waters.

Nuclear-Powered Attack Submarines

Chinese attack submarines do not carry nuclear weapons, but the submarines are central to the Pentagon's warnings of China's increasing military reach. Moreover, the U.S. intelligence community asserts that at least one of the land-attack cruise missiles under development by China may be or could be equipped with a nuclear capability.[217] The Chinese Navy currently has approximately 55 operational attack submarines, of which all but five old nuclear-powered Han-class submarines (Figure 39) are diesel-powered. A new class of nuclear-powered attack submarines (Type 093) is under construction.

Figure 39:
Han-class (Type-091) Nuclear-Powered Attack Submarine

A Han-class nuclear-powered attack submarine with outlines of tiles covered by snow. All five units were commissioned between 1974 and 1991 and are based at Jianggezhuang approximately 15 miles (24 km) east of Qingdao on the Yellow Sea.

Image: DefenceTalk.com

The first Han-class (Type 091) unit became operational in 1974 after years of construction, and it took 20 years to build four more boats for a total of five. The Han boats are often showcased as examples of China's naval might, but their capability is limited and the boats are thought to be extremely noisy compared with U.S. nuclear-powered attack submarines. U.S. Naval Intelligence anticipates that China will overhaul the Han submarines.[218]

As with most other Chinese weapon systems, DOD's projection for when the new Type 093 (Shang-class) nuclear-powered attack submarine (Figure 40) will enter service has slipped. In 2003, the expectation was that it would happen in late 2004 or early 2005,[219] but in 2005 the date had slipped to sometime in 2005.[220] Finally, in May 2006, the DOD finally reported that the first boat "is now entering the fleet."[221]

Figure 40:
Shang-class (Type-093) Nuclear-Powered Attack Submarine

A model of the new Shang-class (Type 093) nuclear-powered attack submarine that is expected to replace the Han-class submarines.

Image: DefenceTalk.com

Two more units may be under construction, and by 2010, the DOD predicts, the Shang-class will form the "backbone" of China's future forward anti-carrier warfare capability and eventually replace the Han-class. The DOD says that the Shang-class compares to the technology of the Russian Victor III SSN,[222] a capability U.S. attack submarines have considerable experience in operating against.

The Shang-class "is intended primarily for anti-surface warfare at greater ranges from the Chinese coast than the current diesel force," according to U.S. Naval Intelligence. "China looks at SSNs as a primary weapon against aircraft carrier battle groups and their associated logistics support."[223]

Submarine Operations

Like other naval powers, China cloaks its submarine operations in great secrecy, and other navies generally do not want to say very much about what they know the Chinese might be doing. As a result, it is difficult to have a substantial debate based upon facts – but easy to make exaggerated claims – about the capabilities and implications of the Chinese submarine fleet.

While the DOD currently warns about China's submarine modernization and operations, the tone was more cautious in 1997. Back then, the DOD said that the Chinese nuclear submarine "operations have been limited and they have never sailed beyond their regional waters." The DOD also cautioned that although the nuclear submarines "have a potential for operations in the Pacific Ocean, their capabilities would be very limited against modern Western or Russian ASW [Anti-Submarine Warfare] capabilities."[224] Even back in 1972, the DIA noted China's desire for a "blue water" capability, but 30 years later it still has not happened:

> The augmentation of the fleet with guided missile destroyers and destroyer escorts and with an increasing number of new attack submarines provides the Chinese with a blue water operational potential and the capability of seeking our and attacking enemy strategic naval at increasing distances from the Chinese mainland.[225]

Figure 41: Chinese Maritime Reach?

The Pentagon claimed in 2006 that the Chinese Navy is working on a "first" or "second island chain" strategy that reaches as far into the Pacific as Guam.

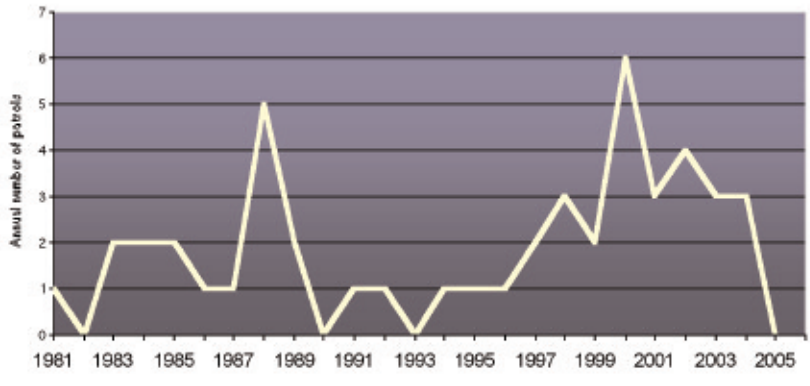
With the arrival of the Bush administration in 2001, the assessments of Chinese submarine operations changed significantly. The 2002 DOD report warned that the Chinese navy "is making efforts to improve its force-projection options by improving the capability to deploy submarines on extended patrols."[226] The 2006 DOD report claimed that China was trying to establish a "first" or "second island chain" strategy for its naval forces (Figure 41), and that "Chinese forces have increased operations beyond China's borders and coastal waters, most notably the highly publicized 2004 intrusion of a HAN-class nuclear submarine in Japanese territorial waters during operations far into the western Pacific Ocean.[227]

Using the 2004 Han-class incident as an example of such a development appears to be cherry-picking. Indeed, information recently obtained under the Freedom of Information Act from U.S. Naval Intelligence reveals that Chinese attack submarines–a primary capability if such a Chinese expansion into the Pacific is

to be successful–conduct very few patrols. The data does show a slight increase between 1999 and 2002, but the patrols have since declined and stopped completely in 2005 (Figure 42). Over the full period for which data is available (1981 through 2005), the trend is that patrols have only increased from one per year to 2.8 patrols per year for the entire Chinese submarine fleet. The data also reveals that China's single SSBN has never conducted a deterrent patrol. The DOD reports from 2005 and 2006 do not mention this important development, only the intrusion.

The implications to be drawn from the data are significant. Basically, it means that the Chinese submarine force has very little operational experience in conducting extended submarine operations away from its coastal waters. As a result, for example, the crews of the new Jin-class ballistic missile submarines currently under construction will need to start almost from scratch to develop the operational and tactical skills and procedures that are essential if a sea-based deterrent is to be militarily effective. By comparison, U.S. SSBNs have conducted over 3,600 deterrent patrols over the past 55 years. In 2005 alone, the U.S. SSBN force conducted 44 patrols (21 patrols in the Pacific), or more than four times the number of SSBN patrols conducted by all other nuclear weapon states combined.

Figure 42:
Chinese Submarine Patrols 1981-2005



Chinese attack submarine (SSN/SS) patrols. China's single SSBN has never conducted a patrol. Data is not available from prior to 1981.[228]

The patrol data shows a total absence of Chinese general purpose submarine patrols in 2005, and a very low number of patrols (an average of less than two per year) conducted by this force since 1981. In the most recent period (2000

through 2005) less than six percent of China's submarine fleet has gone on patrol in any given year. In 2000, with an all time high of six patrols, operational experience was limited to 10 percent of the submarine fleet.[229]

Given the concern over China's intentions and capabilities in the Taiwan Strait, this operational history is important. Any cross-strait naval assault with surface ships and subsequent supplies would be impossible to protect or sustain without significant submarine forces well-versed in sustained operations far from home. Even if the mission was only defense against U.S. aircraft carrier battle groups operating in the Taiwan Strait, the limited Chinese submarine patrol experience may limit Chinese capabilities.

If China's intentions were to project a credible military influence in the Sea of Japan and South China Sea, one would expect to see a much higher degree and more consistent pattern of submarine operations in those areas than appears to be the case. Overall, the data suggests thus far that the Chinese submarine force's mission is not force projection but coastal defense and sea denial near China and Taiwan.

How to interpret this information obviously depends on what U.S. Naval Intelligence means by the term "patrol." In response to a follow-up question about the declassified submarine patrol data, U.S. Naval Intelligence refused to define what constitutes a "patrol," arguing that it "cannot release specific criteria for determining what a 'patrol' is as it would divulge methods and sources."[230] The Defense Department's unclassified Dictionary of Military Terms (JP 1-02) provides some help by making the following five definitions available:[231]

> **antisubmarine patrol:** The systematic and continuing investigation of an area or along a line to detect or hamper submarines, used when the direction of submarine movement can be established.
>
> **inshore patrol:** A naval defense patrol operating generally within a naval defense coastal area and comprising all elements of harbor defenses, the coastal lookout system, patrol craft supporting bases, aircraft, and Coast Guard stations.
>
> **offshore patrol:** A naval defense patrol operating in the outer areas of navigable coastal waters. It is a part of the naval local defense forces consisting of naval ships and aircraft and operates outside those areas assigned to the inshore patrol.

> **patrol:** A detachment of ground, sea, or air forces sent out for the purpose of gathering information or carrying out a destructive, harassing, mopping-up, or security mission.
>
> **submarine patrol area:** A restricted area established to allow submarine operations: a. unimpeded by the operation of, or possible attack from, friendly forces in wartime; b. without submerged mutual interference in peacetime.

Assuming that U.S. Naval Intelligence's use of the term "patrol" follows the DOD's definitions, the declassified patrol data suggests that Chinese strategic and general purpose submarines in 2005 did not conduct investigations to detect other submarines, did not participate in naval defense operations in coastal or outside coastal areas, and were not deployed for the purpose of gathering information or harassing.

Reports of Chinese submarine patrols are scattered and vague, probably because they are so few. Historically, Chinese submarines first began to undertake extended patrols in the mid-1970s by sailing away from China's shoreline.[232] During those patrols, when Han-class submarines entered the fleet, the submarines would sail beyond the first island chain (the line from the Philippine Islands through Taiwan to the Ryukus), and even the second island chain (Indonesia, the Marianas Archipelago, and the main islands of Japan).[233]

Sometime between 1985 and 1986, according to articles in *Ta Kung Pao*, a Chinese SSBN (the Xia) was rumored to have navigated more than 37,000 km and "broke the 84-day record of continuous underwater navigation set by an American submarine." Also, in the spring of 1988, a Chinese nuclear submarine reportedly navigated the Taiwan Strait into the South China Sea and conducted "a successful test voyage at extreme depths."[234] The report that the Xia conducted such an operation between 1985 and 1986 appears to be incorrect since the Xia has never conducted a patrol. Instead, these two operations may have involved Han-class submarines. The 1988 voyage coincided with the fourth Han boat (hull no. 404) becoming operational.[235] Five patrols were conducted in 1988.

During the Taiwan Strait crisis in 1994, an S-3 anti-submarine aircraft from the USS Kitty Hawk (CV-63) reportedly detected and trailed a Chinese Han-class submarine while operating in the Sea of Japan. The submarine was said to have operated near, and even shadowed, the carrier over a period of three days within a distance of 18 to 24 miles.[236] This may have been the single patrol conducted by Chinese general purpose submarines in 1994.

In June 2001, the *Washington Times* quoted unnamed U.S. military officials saying that a Chinese submarine had departed the Quingdao Naval Base without being detected by U.S. intelligence agencies. The submarine was said to have sailed underwater for more than a month in what was described as an "undetected SSN deployment," possibly to trail the U.S. Oceanographic Survey Ship USS Bowditch (T-AGS-62) operating in the Yellow Sea.[237] This may have been one of the three Chinese general purpose submarine patrols conducted in 2001.

Figure 43:
Ming-class SS Off Japan

A Japanese P-3C anti-submarine aircraft trails a Chinese Ming-class diesel submarine about nine miles outside Japanese territorial waters in November 2003.

Image: Japanese Defense Force

Two years later, in November 2003, a Japanese P-3C anti-submarine aircraft detected a Chinese Ming-class diesel submarine on the surface in the Osumi Strait some nine miles outside Japanese territorial waters approximately 25 miles from the Japan's coastline (Figure 43). A Chinese Foreign Ministry spokesperson said the submarine was on a "routine maritime training,"[238] one of only three patrols conducted by general purpose submarines that year.

Again, on November 10, 2004, Japanese forces detected and chased what was said to be a Chinese Han-class nuclear powered attack submarine after it allegedly entered Japanese territorial waters some 250 miles southwest of Okinawa where it sailed submerged between Miyako and Ishigaki islands near Taiwan. The Japanese government complained to China and said Beijing subsequently admitted it was their submarine, apologized, and explained that it had been on a training mission and for "technical reasons" had entered Japanese waters.[239]

The Pentagon said the submarine had conducted "operations far into the western Pacific Ocean," and used the incident to warn that the "Chinese forces have increased operations beyond China's borders and home waters."[240] In reality, however, the Chinese submarine force had not increased such operations but remained at the same patrol level as the previous year and with only half as many patrols as during the peak in 2000.

In May 2005, various private Web sites carried reports and pictures of a Chinese Han-class submarine allegedly conducting a visit to a naval base on the Hainan Island on the South China Sea (Figure 44). This cruise apparently was not considered a patrol by U.S. Naval Intelligence, which reported zero Chinese submarine patrols in 2005 – the fourth time since 1981 that the Chinese submarine fleet has not conducted any patrols consistent with it not falling under any of the five definitions of "patrol" given above.

Figure 44:
Han-Class SSN On Hainan Island?

In May 2005, various private Web sites carried reports about a Han-class SSN that reportedly had been spotted at a naval base on Hainan Island on the South China Sea.

Image: DefenceTalk.com

Medium-Range Bombers

China operates a force of about 120 aging H-6 intermediate-range bombers of which a couple of dozen may have a secondary nuclear strike mission. Although seen increasingly obsolescent as a modern strike bomber, the H-6 is not as old as the U.S. B-52 and may gain new life as a platform for China's emerging cruise missile capability. China is thought to be close to introducing the YJ-63 first-generation land-attack cruise missile for delivery by the H-6. We estimate that China maintains a small inventory of nuclear bombs for these aircraft.

Bombers were China's first nuclear strike platform. Only three years after China's first nuclear test, the CIA concluded in 1967 that "China probably now has a few fission weapons in stockpile deliverable by bomber." [241] Prior to that, three nuclear tests had been carried out at Lop Nur using the Soviet-produced Tu-16 Badger medium-range bomber.

The first Chinese produced H-6 was completed in 1968, and CIA estimated in 1969 that the "Chinese initially will probably look to the Tu-16 primarily as a

means for carrying nuclear weapons," but would probably also have other roles.[242] The first confirmation of H-6 bombing training was provided by U.S. satellite photography on August 13, 1971, when an H-6 was photographed leaving the Hsingjenpao bombing range. By March 1972, DIA estimated that China had 32 H-6 with an additional 19 awaiting completion.[243]

Figure 45:
Hong-6 Intermediate-Range Bombers

The Hong-6 bomber has dropped several nuclear devices in Chinese nuclear tests and a small number of aircraft may still have a nuclear strike mission. Like the U.S. B-52, the H-6 was produced in the 1960s.

Image: Military.China.com

The National Security Council concluded in January 1972 that the Chinese "probably now have the capability to respond to a bomber attack by launching their bombers on receipt of warning."[244] This included "a few" H-6 bombers with nuclear capability, according to the DIA,[245] which at this point began to include thermonuclear bombs. Until November 1976, H-6 aircraft were used to drop a total of nine nuclear devices in Chinese nuclear tests at Lop Nur. Five of these tests were very-high yield weapons in the 2 to 4 Megaton range. Two had yields in the hundreds of kilotons, and two with yields from 15 to 35 kilotons.[246]

Due to the limited penetration capability of the H-6 and lack of a low-level capability, however, DIA concluded that the aircraft was not intended for strategic use. "Rather, these aircraft appear intended for an essentially tactical role, directed at an invader's rear areas or supply routes," DIA estimated and concluded that it was "improbable that China's air forces have a strategic nuclear delivery mission."[247]

This conclusion contradicted somewhat an earlier DIA report from 1972, which states that "recent intensification of [H-6 bombing training] coupled with the highest noted altitude for BADGER activity – 41,000 feet – confirms China's serious intent to develop a strategic strike capability."[248]

As production of ballistic missiles progressed, however, the importance of the H-6 as a nuclear strike platform probably decreased, and the CIA concluded in 1976 that China's intermediate range bombers "probably do not have a primary mission of strategic attack." Instead, the "organization, deployment, and training" of the bomber force "suggests that it has a dual role of conventional and nuclear bombing."[249] This situation has probably continued until today, with a couple of dozen of the approximately 120 H-6 bombers probably having a secondary nuclear mission.

China is in the process of introducing several land-attack cruise missiles, a development that may boost the importance of the H-6. One example is the YJ-63 (Figure 44), a first-generation cruise missile that can deliver a 500 kg warhead to a range of 249 to 310 miles (400 to 500 km). Another example is the DH-10, a second generation cruise missile which reportedly has a range of more than 930 miles (1,500 km). The Pentagon says there are "no technological bars to placing on these systems a nuclear payload, once developed," [250] and Air Force Intelligence says the DH-10 will carry "conventional or nuclear" warhead.[251]

Figure 46:
YJ-63 Land-Attack Cruise Missile

The YJ-63 is a first-generation land-attack cruise missile for delivery by the Hong-6 bomber (background). The subsonic weapon, which can carry a 500 kg warhead to a range of 249-310 miles (400-500 km), is may be deployed within a few years.[252] The second-generation land-attack cruise missiles, the Pentagon says, may be nuclear armed.

Image: Military˜.China.com

Using satellite images purchased from DigitalGlobe or freely available via GoogleEarth, we studied Chinese bases and detected 124 H-6 bombers at six bases (Anqing, Dangyang, Leiyang, Nanjing. Wugong, and Xian). Five of the bases had 18 to 34 H-6 bombers present, while Leiyang only had five H-6s.

A satellite image taken on May 7, 2005 (Figure 47), showed 23 H-6s present at the Anqing Airbase in eastern China, sufficient for one or two squadrons. The bombers are lined up on the tarmac at both ends of the 1.74 miles (2.8 km) runway. The western end of the runway is connected to a loop 0.6 miles away that may be a service area for the bombers. At the eastern end of the loop is a tunnel entrance that appears to connect to an underground facility inside the adjacent mountain. The tunnel is not wide enough (only 16 meters) for a bomber to enter, but might instead be used to store weapons for the bombers. Anqing Airbase does not appear to have an external weapons storage area.

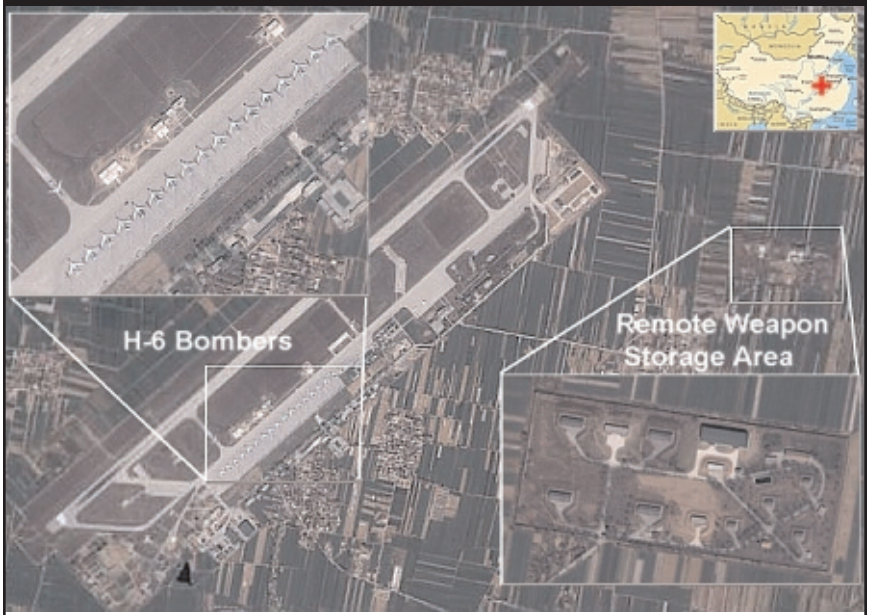
Figure 47:
Anqing H-6 Bomber Airbase

Anqing Airbase (30°34'N 117°02'E) is located north of Anqing in the Nanjing military region (see map insert). This satellite image, which was taken on May 7, 2005, shows 23 H-6 bombers and a tunnel entrance to an underground facility (see enlarged insert).

Image: GoogleEarth/DigitalGlobe

The Xian Airbase, photographed in April 2005, was found to have 18 H-6 bombers. The image showed 17 bombers lined up on the tarmac and one bomber taxiing. Unlike Anqing, Xian does not have underground facilities and instead included what appears to be an external weapon storage facility with about a dozen buildings located approximately one mile to the east of the base. Most of the buildings appear to be surrounded by soil barriers (Figure 48).

Figure 48:
Xian H-6 Bomber Airbase

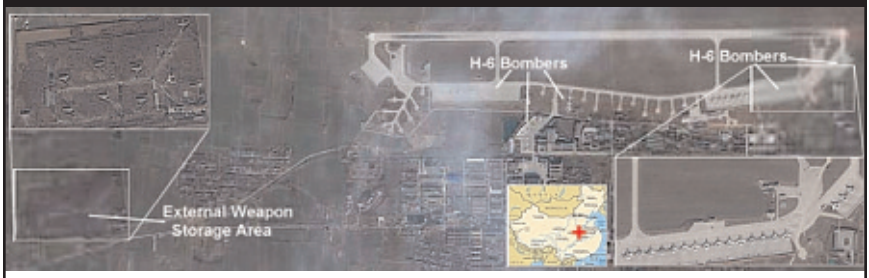


Xian Airbase (34°21'53"N 109°06'55"E) is located approximate 15 miles (24 km) northeast of Xian in the eastern-most part of the Lanzhou military region in the Shaanxi province (see map insert). This satellite image, which was taken on April 3, 2005, shows H-6 bombers and remote Weapon Storage Area.

Image: GoogleEarth/DigitalGlobe

A similar layout was found at the Wugong Airbase located approximately 35 miles west of Xian. A satellite image taken on February 2, 2003, shows 34 H-6 bombers, half of which appear to be in some form of maintenance. A remote weapon storage area appears to be located approximately 1.3 miles south-west of the base (Figure 49).

Figure 49:
Wugong H-6 Bomber Airbase



Wugong Airbase (34°16'33"N 108°15'57"E) is located in central eastern China (see map insert). This satellite image, which was taken on February 2, 2003, shows H-6 bombers a remote weapon storage area.

Image: GoogleEarth/DigitalGlobe

Tactical Nuclear Weapons

As a measure of how effectively the Chinese keep even the most basic facts about their nuclear stockpile secret, we have been unable to determine from Chinese and U.S. statements or unclassified sources whether China has tactical nuclear weapons or not. Without hard evidence, though, we estimate that China maintains a small inventory of tactical bombs for a couple of dozen fighter-bomber aircraft. Several reports and certain events strongly suggest that China may have developed a modest tactical nuclear weapons capability, but exactly what it is or was or when it was extant is uncertain. The U.S. intelligence community also has indicated, although dubiously, that China may have developed warheads for short-range ballistic missiles and possibly nuclear land mines.

In the early 1970s, the production of plutonium by the Jiuquan (or Yumen) reactor triggered speculations that China was developing tactical nuclear weapons.[253] According to a RAND study, "plutonium offered the Chinese the technologically feasible option of shifting to ADMs [(atomic demolition munitions) and] tactical nuclear weapons" and "tactical nuclear weapons might make up for weakness in conventional arms, especially artillery."[254] Plutonium, of course, also can be used in strategic nuclear weapons, but the DIA stated in March 1972 that the "Chinese appear to be on the brink of establishing a tactical nuclear capability."[255]

Tactical use of nuclear missiles and bombers was seen by the Chinese as a means of responding – short of the strategic level – to an invader's use of tactical nuclear weapons, according to 1976 CIA analysis. Aircraft delivered bombs

were more accurate than ballistic missiles at the time, although the aircraft were susceptible to air defense systems.[256] By 1984, the DIA concluded that such use of strategic assets in tactical scenarios was "unlikely."[257] Yet there was "circumstantial evidence," the CIA concluded in 1976, "that China seeks to develop a tactical nuclear force as well."[258]

Part of this circumstantial evidence was several military exercises that China held in the early 1980s that simulated the use of tactical nuclear weapons. In June 1982, a joint service exercise was held in the Ningxia Hui Autonomous Region that "included a simulated tactical nuclear detonation," according to the DIA.[259] In the exercise, both sides simulated the use of tactical nuclear weapons, and the defender's counterattack was described as follows: "Our troops' nuclear strike capability zeroed in on the targets, took the enemy by surprise and dealt his artillery positions and reserve forces a crushing blow." The local newspaper carried a photo with the caption "An 'atomic bomb' exploding deep in the ranks of the 'enemy.'"[260]

Defending against a nuclear-armed invader was a serious challenge to Chinese military planning and several exercises conducted during the 1980s seemed to be intended to train Chinese troops to fight under nuclear battlefield conditions.[261] Earlier the CIA had concluded that Chinese forces were not organized, equipped or trained to conduct operations successfully in a nuclear war environment.[262]

The simulation of tactical nuclear weapons employment, of course, did not prove that China had developed or intended to develop tactical nuclear weapons. Strategic weapons also can be used in a tactical manner. Yet the CIA said at the time that although the Chinese "have not deployed a tactical nuclear force per se," their "fissile material production capabilities [deleted][are in] excess of what they appear to need for their strategic programs" so "design and production of tactical nuclear weapons is not constrained." Based on its analysis of Chinese nuclear capabilities, the CIA said it "would not be surprised" if the following weapons were begun or were deployed by the early 1980s:

- Small tactical bombs and warheads;
- A nuclear-armed cruise missile;
- A nuclear depth charge; and
- Atomic demolition munitions.[263]

At the same time, based on its knowledge of warhead designs, the CIA judged that China would be unlikely to develop certain tactical weapons, "such as a nuclear artillery round, nuclear-armed [anti-air missiles] for fighters, and possibly nuclear torpedoes for submarines."[264] These three types did not materialize, but the DIA concluded in 1984 that "a small number of the nuclear-capable aircraft probably have nuclear bombs, even though we are unable to identify airfield storage sites" at the air bases. The DIA also concluded that "the Chinese maintain ADMs [atomic demolition munitions] in their inventory, although there is no evidence confirming their production or deployment."[265] While it is puzzling how DIA could reach such a conclusion without any evidence, the agency described its predicament:

> We know very little… about the extent of tactical or theater nuclear weapons for use by the Chinese People's Liberation Army (CPLA). A lack of basic doctrine or training may indicate that the Chinese only recently considered integrating nuclear weapons into ground force operations. The Chinese nuclear weapons technological capability would limit the current ground force nuclear support to atomic demolition munitions (ADMs), bombs, and missiles such as the CSS-1; it would not include artillery-fired nuclear projectiles.[266]

Nevertheless, the DIA predicted, China in the following decade would produce a sizeable non-strategic nuclear force consisting of bombs, ADMs, short-range ballistic missiles, and air-to-surface missiles (Table 11). In hindsight, as with many of DIA's projections, those about Chinese tactical nuclear weapons turned out to be inaccurate, exaggerated and contradictory.

Table 11:
DIA Projection For Chinese Non-Strategic Nuclear Weapons 1984-1995[267]

Weapon	1984	1989	1995
Bombs	165	200	230
ADMs	50	50	50
SRBMs	0	0	12
ASMs	0	130	250
Follow-on Systems	0	0	30
TOTAL	**215**	**380**	**572**

Yet in November 1984, only seven months after it made this prediction, the DIA published another projection of Chinese military capabilities: *Handbook of the Chinese People's Liberation Army*. This publication, which was said to be "based on known Chinese practice and publications up to 1 August 1984," reached a completely different conclusion about China's tactical nuclear weapons:[268]

> There is no evidence that China possesses a tactical nuclear weapons stockpile or that the CPLA has developed any coherent doctrine for tactical nuclear fire support of ground forces…. Although China is assessed as having the capability to produce tactical nuclear weapons and has successfully tested nuclear devices in the 20-kiloton range, there is no evidence that it has yet produced or deployed such weapons.[269]

The *Handbook* described that China's lack of a non-strategic nuclear arsenal may have resulted from Chairman Mao Zedong's conviction that tactical nuclear warfare would quickly escalate to the strategic level. Yet the DIA also remarked that Chinese defense literature "has reflected a more receptive attitude toward the advantages of tactical nuclear weapons since the death of Mao." Despite this development, the *Handbook* reemphasized, "China is not now assessed as having any stockpile of tactical nuclear rockets, guided missiles, or atomic munitions."[270]

It is unclear (and certainly confusing) why the same agency came to two so contradictory conclusions within a time span of just seven months. One answer may be that handbooks are not highly classified and appear to rely to a large extent on publicly available information.[271] Another answer may depend upon definitions. Whereas the *Handbook* contained an overall rejection of Chinese tactical nuclear weapons, the section ends with a description of what is meant by tactical: "rockets, guided missiles, or atomic munitions." The April 1984 estimate (Table 11) also did not list rockets or guided missiles, but it did include ADMs albeit with the caveat that "there is no evidence confirming their production or deployment."[272] The existence of tactical bombs was not explicitly excluded.

Likewise, although the *Handbook* dismissed the existence of tactical nuclear weapons, it did conclude: "There are indications that China *may develop* tactical nuclear delivery systems."[273] (Emphasize added.) As mentioned above, several of China's nuclear tests were low-yield, possibly indicative of an effort to develop tactical nuclear weapons. For example, the 12th Chinese nuclear test was conducted on November 18, 1971, and involved a relatively low-yield (15 kt) device. Debris analysis indicated that the device used a boosted plutonium primary (2 kg Pu) which contained no more than 0.5 kg of oralloy. The DIA concluded that this "may be indicative of PRC interest in developing all plutonium primaries or pure fission weapons for tactical uses."[274]

Two months later, on January 7, 1972, a modified A-5 fighter-bomber (Q-5A) dropped a low-yield (8 kt) nuclear bomb in a nuclear test at Lop Nur. The

employment reportedly used the loft bombing technique.[275] The test was the first – and apparently only – time a Chinese fighter-bomber has been used to deliver a live nuclear weapon and, according to the DIA, "may have been a proof test of a tactical weapon."[276] A few months after the test, the DIA estimated that China possessed "0-25 tactical bombs for delivery by F-9 [Q-5] or IL-28" aircraft.[277] By 1984, the DIA estimated that China had a total inventory of 165 nuclear bombs.[278]

Figure 50:
Qian-5 With Hydrogen Bomb?

The Qian-5A delivered the nuclear bomb in China's 13th nuclear test on January 7, 1972. These two unofficial images claim to show the "Qian-5 airplane with hydrogen bomb" (left) and a hydrogen bomb with the inscription "strong bomb no. 1" (right). The claims have not been verified.

Images: DefenseTalk.com

Since then, the Q-5A may have been retired, and there have been no reports that other Q-5s were modified to deliver nuclear weapons. Given its age and short range of only 400 km,[279] any reason to keep the Q-5 with a nuclear strike capability is questionable. If China had wanted to retain a tactical nuclear air strike capability, one option could have been to convert a limited number of modern aircraft such as the Russian-supplied Su-27 or Su-30. The DOD says that Chinese aircraft's land-attack capabilities are improving in general due to development and acquisition of guided munitions, and specifically highlights anti-radiation missiles and laser- and TV-guided Air-to-Surface Missiles and bombs for the Su-30MKK. With its greater range, this aircraft might be a logical choice for a regional tactical nuclear strike capability, although it should be emphasized that no known source credits the Su-30KK with a nuclear capability.

It is also possible that one or more of China's short-range ballistic missiles may have nuclear capability. The DIA stated in 1987 that the DF-15 (CSS-6) (Figure 51) had a nuclear capability,[280] and the National Security Council told Congress in July 1993 that "work is underway on warheads for… tactical missiles." [281] Air Force Intelligence in 1996 described that the DF-15 was taking over regional targeting of the old nuclear DF-3,[282] which might suggest a nuclear capability. Furthermore, the 1999 Cox report stated that the DF-15 "may be fitted with nuclear warheads or with an enhanced radiation weapon (neutron bomb)."[283]

Figure 51:
DF-15 Nuclear-Capable?

The DF-15 (CSS-6) has been assessed by the U.S. intelligence community to be nuclear-capable. The missile appears to exist in at least two configurations with a narrow extended warhead section (left) and a traditional cone-shaped warhead section (right).

Images: DefenceTalk.com/U.S. Air Force

In addition, a DIA report from 1999 stated that China had roughly 100 nuclear short-range ballistic missiles,[284] with a range of less than 621 miles (1000 km).[285] This estimate is suspicious because the report did not include medium-range 621 to 1,864 miles (1000 to 3000 km) or long-range 1,864 to 4,971 miles (3000 to 8000 km) ballistic missiles, which China are known to have. It is possible, therefore, that the report may incorrectly have used "SRBM" to refer to all missiles other than ICBMs and SLBMs.[286]

Since the early 1990s, however, DOD and CIA publications have focused on the conventional capabilities of Chinese short-range ballistic missiles, and the question of a potential nuclear capability for these weapons has faded. The DOD described in 2000 that the DF-15 has the capability to deliver "a 500-kg conventional payload to a maximum range of 600 km [373 miles]." The report explicitly stated that the "PLA's 2nd Artillery has incorporated a new conventional mission with the addition of CSS-6 and CSS-7 SRBMs to its inventory."[287] As of March 2006, Air Force Intelligence estimated that "fewer than 150" DF-15 launchers were deployed, doubling of the estimate from 2003,[288] and the May 2006 DOD report listed some 70-80 launchers with 275-315 missiles.[289]

Although the DIA in the 1980s speculated that China had Atomic Demolition Munitions (ADM) and might develop other tactical nuclear weapons systems, none of this appears to have materialized and few today mention Chinese tactical nuclear weapons. One exception, however, is the Congressional Research Service (CRS), which in a 2006 report speculates that China "could put nuclear warheads on weapons such as ... ASCMs, torpedoes, and naval mines." [290] Another exception is the Lexington Institute, a private think-tank that advocates larger U.S. military forces, which stated in a 2004 report that:

> there is some evidence the PLA considers nuclear weapons to be a useful element of an anti-access strategy. In addition to the nuclear-capable [ballistic] missiles ... China has nuclear bombs and aircraft to carry them, and is reported to have nuclear mines for use at sea and nuclear anti-ship missiles. At the very least, China would expect the presence of these weapons and the threat to use them to be a significant deterrent to American action.[291]

The Lexington report was cited by the CRS, but neither provided any evidence to back up these claims.

Nuclear Cruise Missiles

China does not now have nuclear cruise missiles, but the Pentagon speculates that such a capability may be on the horizon. This assessment has evolved over the last five years. In 2001, the DOD stated that China "produces several types of land-, sea-, and air-launched cruise missiles, which are potential means of delivery for NBC [Nuclear, Biological and Chemical] weapons."[292] The 2005 DOD report portrayed the "first- and second-generation" land-attack cruise missiles under development as "conventionally-armed," but added that there are "no technological bars to placing on these systems a nuclear payload, once developed."[293]

The 2006 report brings the assessment one step further by concluding that "China is ... developing air- and ground-launched cruise missiles [such as the DF-10] that *could have* a nuclear capability."[294] (Emphasis added.) The DH-10 land-attack cruise missiles (Figures 52 and 53) reportedly will have a range over 932 miles (1,500 km),[295] and Air Force Intelligence stated in March 2006 that a new cruise missile under development will have a "conventional or nuclear" warhead.[296]

Figure 52:
Chinese Cruise Missile Under Development

China is developing two land-attack cruise missiles, which the DOD could says "could have" nuclear capability. This unofficial picture may be the DH-10 which reportedly will have a range of over 932 miles (1,500 km).

Image: SinoDefense.com

Taipei Times reported in April 2005 that an unidentified Taiwanese intelligence source expected the first Chinese land-attack cruise missile would become operational in 2005 and that as many as 200 missiles could be deployed by late 2006.[297] Some private analysts were quick to jump on the bandwagon and make the worst-case scenario even worse. One analyst speculated that as many as 1,000 land-attack cruise missiles could be deployed by 2010 with "pin-point strike accuracy comparable to the U.S. Tomahawk." Some of the missiles, this source explained, "can be expected to be armed with ... tactical nuclear warheads," have a range of 621 to 2,485 miles (1,000 to 4,000 kilometers), and "eventually be carried to distant operating areas by Type 093 nuclear attack submarines," where they will threaten Japan, India, Guam, Hawaii and the U.S. West Coast. Indeed, Chinese submarines armed with nuclear cruise missiles might even threaten the U.S. East Coast, the analyst speculated, if "PLA Navy supply ships gain access to Cuban ports – as did former Soviet Navy ships – or even to other South American ports."[298]

Figure 53:
Chinese Ground-Launched Cruise Missile

China is developing air- and ground-launched land-attack cruise missiles, which the DOD says "could have" nuclear capability. These images, which may show the 932+ miles (1,500 + km) range DH-10, shows a missile in flight (left) that strongly resembles the U.S. Tomahawk cruise missile, and a missile with similar features displayed on what appears to be a mobile launcher (right).

Images: ChineseMilitaryForum/DefenceTalk

The prediction by the DIA in 2005 was considerably more tempered, saying that China by 2015 "will have hundreds of highly accurate air- and ground-launched" land-attack cruise missiles.[299] Regardless of what number might be deployed or when, the Pentagon believes that the land-attack cruise missiles have a high priority and are being developed "for theater and *strategic* missions."[300] (Emphasis added.) The new weapons "probably will also be used to bolster the viability of Chinese military deterrence," according to DOD.[301]

Ballistic Missile Test Launch Facilities

Reports about Chinese ballistic missile tests are sketchy and normally limited to what U.S. intelligence officials leak to the media, occasional announcements by Chinese authorities, and rumors. As a result, it is difficult to make a reliable overview of what China has launched over the years. Based on what scholars and private researchers have assembled from various official and unofficial sources over the years, Table 12 lists 48 Chinese ballistic missile tests conducted between 1960 and 2006. The United States and Russia, by comparison, have conducted several hundred ballistic missile tests collectively.

Table 12: Reported Chinese Ballistic Missile Tests[302]

Date	Missile	Comments
September 1960	R-2	Launch of Soviet supplied missile.
November 5, 1960	DF-1	First successful launch of short-range ballistic missile, copied from Soviet design R-2/SS-2).
December 1960	DF-1	Two launches from Jiuquan.
March 21, 1962	DF-2	First DF-2 test ends in failure. Possibly from Jiuquan.
June 29, 1964	DF-2	First successful DF-2 launch; from Jiuquan.
July 9, 1964	DF-2	From Jiuquan.
Jul 11, 1964	DF-2	From Jiuquan.
November 1965	DF-2A	First successful launch of DF-2A; from Jiuquan.
October 27, 1966	DF-2A	Fully armed missile launched from Jiuquan. The 20-30 kt warhead detonates over the Lop Nur nuclear test site 800 km away.
December 26, 1966	DF-3	First successful DF-3 launch. From Jiuquan.
1969	DF-3	Launch from Harbin.
January 30, 1970	(DF-3)	First successful launch of a "China-made long-distance missile." Possibly DF-3 or DF-4. From Jiuquan.
October 1970	(DF-3)	A ballistic missile traveling 2,000 miles (3,219 km) within China's borders.
September 10, 1971	DF-5	Experimental from Jiuquan.
June 1, 1976	DF-4	First test of DF-4. From Jiuquan.
January 7, 1979	DF-5	Partial-range test launched from Wuzhai or Jiuquan.
July 15, 1979	DF-5	Partial-range test. From Wuzhai or Jiuquan.
August 21, 1979	DF-5	Partial-range test. From Wuzhai or Jiuquan.
September 4, 1979	DF-5	Partial-range test. From Wuzhai or Jiuquan.
October 15, 1979	DF-5	Possible partial-range test. From Wuzhai or Jiuquan. Some say November 26.
February 15, 1980	DF-5	Partial-range test. From Wuzhai or Jiuquan.
May 18, 1980	DF-5	First full-range test from Jiuquan to impact site some 6,000 miles (9,656 km) away in the Pacific Ocean.
May 21, 1980	DF-5	Second long-range test. Fell about 800 miles (1,287 km) short of observation vessels. Launched from Jiuquan.
August 15, 1980	DF-4	From Jinhyu center.
October 15, 1980	DF-4	From Jinhyu center.
December 7, 1981	DF-5	From Wuzhai center. Some say Jiuquan.
April 30, 1982	JL-1	Rumored launch from Yellow Sea. Uncertain.
October 12, 1982	JL-1	First underwater launch. From Golf-class sub.
May 1985	DF-21	Launch from Wuzhai.
September 28, 1985	JL-1	Rumored test. Uncertain.
October 15, 1985	JL-1	First launch from the Xia-class SSBN. May have been partial failure.
September 27, 1988	JL-1	First successful launch from Xia-class SSBN.
April 29, 1992	DF-21	Test from Wuzhai. Failure.
May 1992	DF-21	Test from Wuzhai. Failure.
1993?	DF-21	Test from Wuzhai. Failure.
July 1995	DF-21	Launch from Wuzhai.
November 10, 1995	DF-21	Launch from Wuzhai.
January 10, 1996	DF-21	Launch from Wuzhai.
December 28, 1996	DF-21	Launch from Wuzhai.
August 2, 1999	DF-31	First successful DF-31 test. From Wuzhai. Decoys possibly used.
Spring 2000	DF-31	Rumored.
November 4, 2000	DF-31	Partial-range test with decoys from Wuzhai.
December 16, 2000	DF-31	Launch from Wuzhai.
August 21, 2002	DF-4	Launched from site in southern China. Some say August 21.
(August 16, 2004)	(DF-31)	A new guided missile test rumored to have been launched "a few days ago." Said to be a complete success that hit its target "with extreme precision."
(June 12, 2005)	JL-2	Launched from Gulf-class submarine near Qingdao with an impact point in western China several thousand miles away.
September 5, 2006	DF-31	Launched from Wuzhai. Flew about 2,500 km into the Takla Makan Desert.

The Chinese test launches have been carried out from a small number of facilities. The two primary ones are the Wuzhai Missile and Space Test Center and the Jiuquan Space Launch Center, which are used to test-launch the majority of China's long-range ballistic missiles.[303] The chronology above indicates that ballistic missile flight testing increasingly has shifted from Jiuquan to Wuzhai.

The Wuzhai Missile and Space Test Center is located approximately 12 miles (20 km) west of the city of Wuzhai in the northwestern part of the Shanxi province some 267 miles (430 km) southwest of Beijing. Although sometime also confusingly referred to as the Taiyuan Space Facility, the Wuzhai Missile and Space Test Center is 83 miles (134 km) northwest from Taiyuan.

Figure 54:
Wuzhai Missile and Space Test Center

The Wuzhai Missile and Space Test Center (38°50'31"N, 111°36'22"E) is located approximately 12 miles (20 km) west of the city of Wuzhai in the northwestern part of the Shanxi province. This satellite image from 2005 clearly shows the two main launch pads. Other smaller potential launch pads are located outside the frame.

Images: GoogleEarth/DigitalGlobe

Wuzhai includes two primary launch pads, a rail storage area, and what appear to be several smaller remote launch platforms. The satellite image shown above (Figure 54) clearly shows details of each major pad. The northern pad has a high launch tower and an exhaust duct. The southern pad has what appears to be a crane on rail possibly used to lift the missile off the transport. The southern pad also includes what appears to be a launch pad for use by mobile missile launchers.

Figure 55:
DF-5A Test Launch Site At Jiuquan Space Launch Center

The Jiuquan Space Launch Center complex includes this twin-tower launch facility (41°18'26.55"N, 100°18'54.29"E) near Lao-lu-wu-lo which appears to have been used to test launch the DF-5A. An undated and unidentified image (top insert) shows a film crew filming a DF-5 on a launch pad, but the image features (road and light towers) match the southern launch pad of the facility at Lao-lu-wu-lo (bottom insert). The DF-5A is transported in sections and two 33-foot (10-meter) vehicles are visible in the satellite image taken in 2005. The facility also includes railheads connecting to each launch pad area.

Images: GoogleEarth/DigitalGlobe and China.defense.com

Ballistic missiles are also test-launched from the Jiuquan Space Launch Center in the western part of the Nei Mongol district (Figure 55). This is China's main space port that is primarily used for space launches such as the Long March rockets, but it is also where the majority of the DF-5 launches took place.

The center includes several launch sites that are used to test launch military ballistic missiles. The primary one appears to be a twin-launch pad facility with rail access located approximately 24 miles (39 km) north of the main Long March launch center. A satellite image from 2005 shows that the facility has two launch towers located some 430 meters apart on 50x60-meter launch pads, and connected by a rail system for a mobile tower that may be used to assemble the missile and move it to the launch towers. Exhaust ducts are clearly visible behind each tower. Railheads end next to each launch pad, and two 10-meter vehicles appear to be making their way to the western launch tower.

Underground Facilities

China has a large number of underground facilities. Neither the Chinese nor the U.S. intelligence community will say how many, but during examination of many dozens of satellite images in preparation for this report we found that many military bases indeed have underground facilities. They may not all be "hard and deeply buried," but placing important assets underground in some form seems to be a common element of China's military planning.

Underground facilities suggest an intention to protect vulnerable assets or hide them from view. Whereas Chinese airbases typically include one or more underground facilities, U.S. airbases generally do not have underground facilities for aircraft. Conversely, whereas the United States deploys its entire land-based ballistic missiles force in hardened silos, China only has 20 of its longer-range missiles in silos. In the future, it is possible that none of China's missile force will be silo-based. Other missiles may be hidden in caves, a type of deployment not used by the United States. One of the Chinese long-range missiles rumored to be deployed in caves is the DF-4, and while that may be true for some, we found at least two surface launch sites near Delingha that appear to be operational. A new feature of Chinese airbases also appears to be climate shelters on the tarmac to protect aircraft against rain and sun and from spy satellites.

To effectively target and destroy underground facilities is a central part of the Pentagon's justification for new types of weapons. The 2001 Nuclear Posture Review described the problem and proposed a solution:

> More than 70 countries now use underground facilities (UGFs) for military purposes. In June 1998, the Defense Science Board Task Force on Underground Facilities stated that there are over 10,000 UGFs

> worldwide. Approximately 1,100 UGFS were known or suspected strategic (WMD, ballistic missile basing, leadership or top echelon command and control) sites. Updated estimates from DIA reveal this number has now grown to over 1,400. A majority of the strategic facilities are deep underground facilities. These facilities are generally the most difficult to defeat because of the depth of the facility and the uncertainty of the exact location. At present the United States lacks adequate means to deal with these strategic facilities….
>
> > In general, current conventional weapons can only "deny" or "disrupt" the functioning of HDBTs and require highly accurate intelligence and precise weapon delivery – a degree of accuracy and precision frequently missing under actual combat conditions. Similarly, current conventional weapons are not effective for the long term physical destruction of deep, underground facilities…. One effort to improve the U.S. capability against HBDTs is a joint DoD/DOE phase 6.2/6.2A study to be started in April 2002. This effort will identify whether an existing warhead in a 5,000 pound class penetrator would provide significantly enhanced earth penetration capabilities compared to the B61 Mod 11.[304]

Between 1964 and the mid- to late-1970s, China carried out a massive construction program, in effect building a duplicate industrial base in the remote regions of China to serve as a strategic reserve in the event of war, initially foreseen with the United States and later with the Soviet Union.[305] This project, called the "Third Line," encompassed mining, energy production, railways, hydroelectric power, steel factories, and machine building. Many of the new sites were concentrated in the western and southwestern provinces of Sichuan, Yunnan, Guizhou, Gansu, Ningxia and Qinghai, as well as parts of Shaanxi, Henan, Hubei and Hunan, away from the more vulnerable coastal cities and provinces. In general, the Chinese tried to use topography for protection, building in narrow valleys or near mountains. The scale of the undertaking was enormous, much larger than Roosevelt's New Deal or Stalin's Five-Year Plan, and probably had a negative impact on China's economic development.[306] The Third Line was accomplished in great secrecy and even today it is not well known or discussed.

The overall effort had a strong military bias and was aimed at shielding airplanes, and at least since 1963, China has built underground facilities at naval bases. By March 1972, according to the DIA, at least 16 bases had underground facilities in various stages of completion that could be used by boats or

submarines. DIA estimates that the facilities have two purposes: storage of missiles, ammunition and logistics; and protection against a preemptive nuclear strike.[307]

One of these underground facilities is located at the Jianggezhuang base approximately 15 miles (24 km) east of Qingdao on the Yellow Sea (Figure 56). The base, which appears to be the homeport for China's single Xia-class ballistic missile submarine, spans an entire bay 1.2 miles (1.9 km) across, and includes six piers, a dry dock, numerous service facilities, and the underground submarine facility. The base is also used by Han-class nuclear-powered attack submarines.

Figure 56:
Underground Submarine Facility at Jianggezhuang

Underground submarine facility at the Jianggezhuang Naval Base near Qingdao. The facility is used by the Xia-class ballistic missile submarine.

Image: GoogleEarth/DigitalGlobe

The underground facility consists of a large submarine entrance from the harbor, a pier side entrance to the south, and a land entrance to the east (see Figure 57). The sea entrance is approximately 43 feet (13 meters) wide and appears to be arched by a large concrete structure. Both of the land entrances are approximate 33 feet (10 meters) wide and have what appears to be a railway system connected to the interior of the facility. Construction of the underground facility at

Jianggezhuang, which began in 1968 and was completed in the mid-1970s,[308] is described in *China's Strategic Seapower*:

> In February 1966, Mao, ever concerned to protect the country's defenses from air raids, urged the navy to "build more shelters" for its ships in man-made caves. "In building [such] shelters you do not have to adopt underwater operations," he wrote. "You can begin by digging a vertical shaft just like the miners do. Then dig through the rock horizontally to let seawater in. After that, add a hardened cover over the shaft." At this, the navy embarked on a search for a place where the nation might "shelter its submarines."
>
> About two years later, Mao approved the navy's choice of an inlet near Qingdao and ordered the building to commence. The navy immediately transferred several engineering regiments to work on the project's first phase, and they proceeded to remove 810,000 cubic meters of rock and to pour 200,000 cubic meters of concrete. The gigantic sea cave completed, construction crews then installed 17,000 pieces of equipment and laid 220 km of pipeline, much of it related to maintaining nuclear power plants. By the mid-1970s, the concealed base was camouflaged and hardened against attack and made ready to receive the first nuclear boat, nuclear boat No. 401. In 1975, the navy authorized the North China Sea Fleet to form the Nuclear Submarine Flotilla.
>
> The base comprises multiple shelters, each of which has a number of facilities to load and unload nuclear fuel roads, move supplies, monitor the performance of various subsystems, repair breakdowns, and conduct demagnetization. The cavernous shelter where the boats are docked is as high as a 12-story building. Large-sized cranes in this shelter can load or off-load the JL-1 missiles. Partially protected against nuclear or chemical attack as well as conventional air raids, the shelters can maintain communication and independent operations under combat conditions. The base commander can conduct effective command and control of his submarines for extended periods even when cut off from all outside support.[309]

The size and layout of the Jianggezhuang cave is not known, but the location and angle of the entrances give some idea of a possible outline (Figure 57). The sea entrance likely extends at least a full Xia-class submarine length plus some more into the mountain. The two land-entrances located at the northeast and southwest corners have what appears to be a rail system connecting to outside buildings.

Various private Web sites occasionally post unique images from Chinese military facilities. The original source of the images is not always identified, but may be Chinese news papers, television stations, the Chinese military itself, or individuals using their digital camera during a vacation. The following unique image originally posted on *DefenceTalk.com* shows a Han-class nuclear-powered attack submarine inside a large unidentified underground facility (Figure 58).

The Chinese Air Force also uses underground facilities extensively to protect aircraft, ammunition and personnel. One example of this is the Feidong Air Base which includes a long taxiway that connects the main base and runway with a large underground facility inside a nearby mountain (Figure 59).

Although hiding military equipment such as aircraft in tunnels may seem logical for protection, it also makes it much easier for a capable adversary to neutralize significant portions of the Chinese military with relatively limited effort. Instead of requiring several dozen bombs to destroy a squadron of aircraft, only a couple of precision weapons are needed to seal the entrances or exits to a tunnel trapping all the aircraft inside.

Regardless, we found underground facilities at many of China's bomber and fighter bases. A rule of thumb seems to be that if the base is near a mountain, then there likely will be some form of underground facility. There are too many examples to include in this report, so here we will just mention a few.

One example is the Urimqi Airbase in the northern part of the Xinjiang province. Approximately two miles from the base is what appears to be a remote weapon storage area, but the runway is also connected with a taxiway to an underground facility two miles south of the base. A satellite image clearly shows two entrances into the mountain (Figure 60).

Figure 57:
Possible Outline of Underground Submarine Facility at Jianggezhuang

Based on the location and angle of the entrances, the probably size of the underground submarine facility at the Jianggezhuang Submarine Base is marked with red lines. In addition to a large submarine pool, the facility may house storage and loading facilities for ballistic missiles and nuclear warheads for the Xia-class submarine.

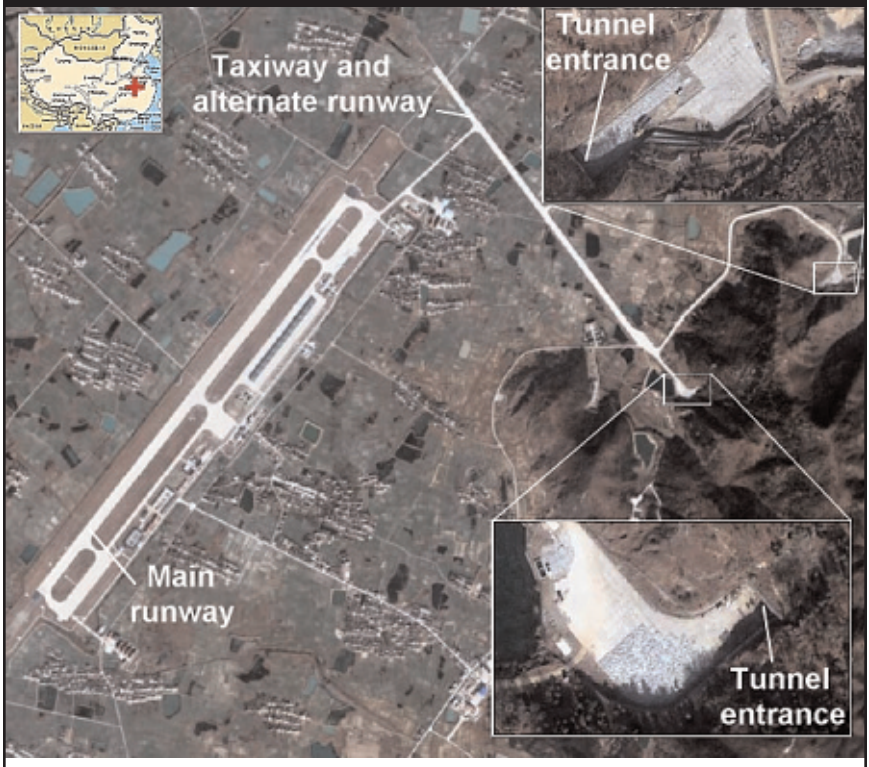
Source: GoogleEarth/DigitalGlobe

Figure 58:
Han-Class Submarine Inside Underground Facility

A nuclear-powered Han-class attack submarine inside underground facility at undisclosed Chinese naval base. Such as cave is known to exist at Jianggezhuang northeast of Qingdao, although it is unknown if this image shows the inside of Jianggezhuang. By 1972, at least 16 naval bases had underground facilities in various stages of completion.

Image: DefenceTalk.com

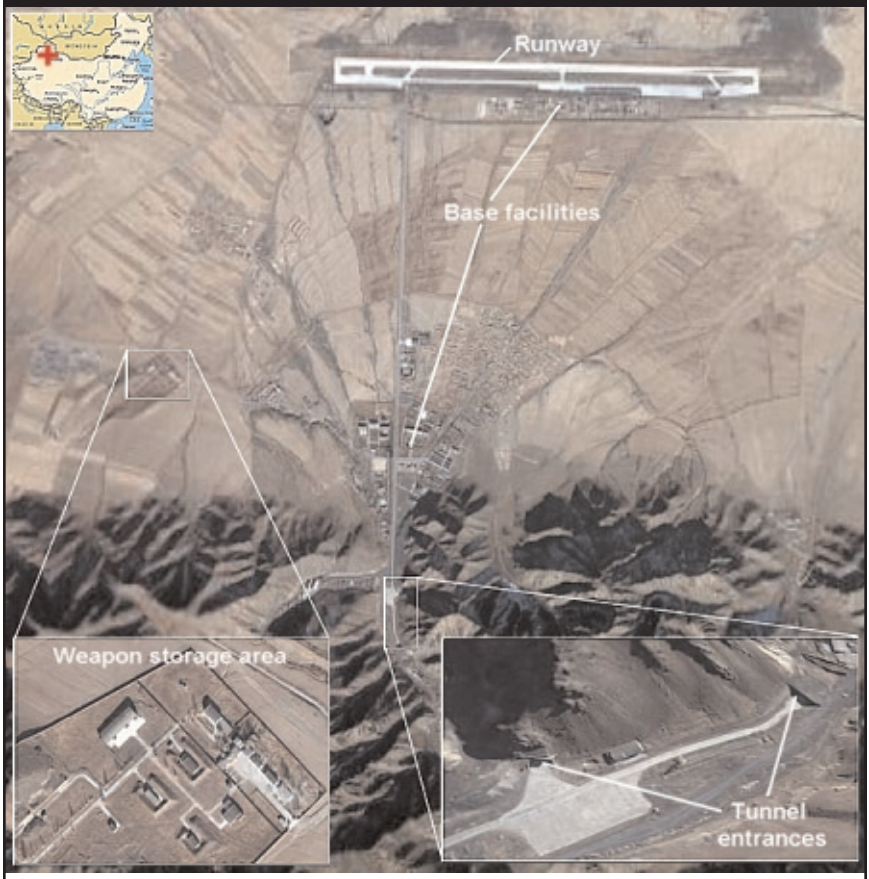
Figure 59:
Underground Facility at Feidong Air Base



The Feidong Air Base (31°54'35.61"N, 117°39'29.99"E) near Dianbu in the Anhui province includes a large underground facility at the end of what appears to be an alternate runway that connects to the main base. Two entrances to the underground facility are clearly visible in this satellite image. Road maintenance appears to be in progress.

Image: GoogleEarth/DigitalGlobe

Figure 60:
Urumqi Airbase With Remote Underground Facility



Urumqi Airbase (43°27'59.45"N 87°31'49.58"E), which is located in the north-central part of the Xinjiang province, has a 2-mile (3.2 km) connection to a remote underground storage facility in a nearby mountain. This satellite image clearly shows two entrances (right insert) to an underground facility as well as a remove weapons storage area (left insert).

Image: GoogleEarth/DigitalGlobe

Below follows a selection of images of various underground facilities:

Figure 61:
President Jiang Zemin Inspects Underground Aircraft Facility

Chinese President Jiang Zemin inspects an aircraft cave in the Ningxia region on June 19, 1991. The name of the base is not known, but it may have been Helanshan west of Yinchuan.

Image:China-Military.org

Figure 62:
J-8 Aircraft Moved Into Underground Facility

Chinese J-8 fighters are rolled into an underground facility at an unknown air base.

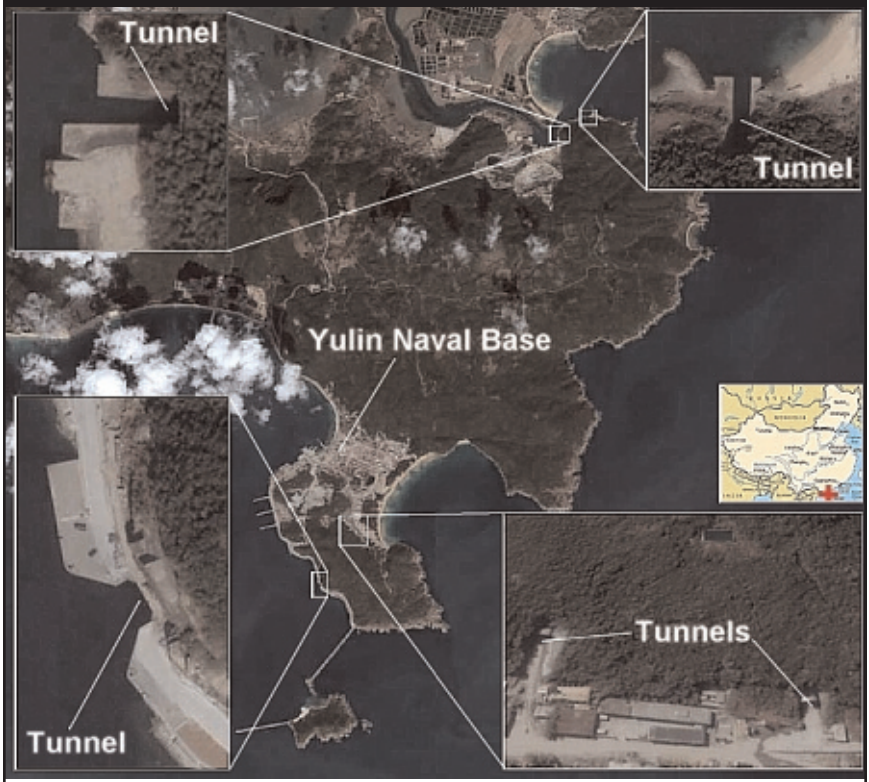
Image:Chinese Military Forum

Figure 63:
Underground Facility at Guangzhou Shadi Air Base

A squadron of Chinese MIG fighters lined up inside an underground tunnel allegedly at the Guangzhou Shadi airbase.

Image:China-Military.org

Figure 64:
Underground Facilities at Yulin Naval Base



Yulin naval base (18°12'30.06"N, 109°40'48.62"E) on Hainan Island has several underground facilities. This satellite image shows what appear to be tunnels to underground facilities. In the main base area (bottom left), a tunnel (18°12'9.75"N, 109°41'40.54"E) in the harbor may lead to an underground facility for submarines or ships. Two tunnels appear to lead to an underground facility (18°12'36.26"N, 109°41'51.18"N) on land (bottom right) near other potential tunnels not shown here. Outside the main base, a remote underground facility has been dug into the mountain (18°15'34.82"N, 109°43'36.98"N) with two tunnels providing access from the sea. With a width of 33 feet (10 meters), the entrances would be a tight fit for Han-class submarines, but diesel submarines and small surface combatants could potentially enter.

Image:GoogleEarth/DigitalGlobe

Figure 65:
Underground Aircraft Facility at Yangcun Airbase

The Yangcun Airbase (39°22'27.70"N, 117° 5'34.05"E) in the Tianjin province includes a small underground aircraft facility near the southern end of the runway. This satellite image clearly shows the two entrances, 406 feet (124 meters) apart. Several other Chinese airbases have similar underground facilities.

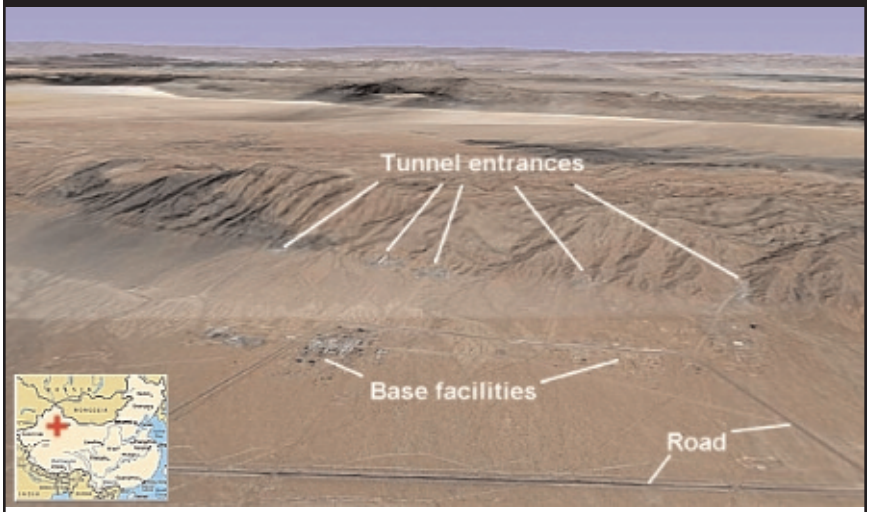
Image: GoogleEarth/DigitalGlobe

Nuclear Weapons Testing

Since China conducted its first nuclear test explosion on October 16, 1964, it has carried out a total of 45 known nuclear test explosions to develop and refine its stockpile of nuclear bombs and warheads. The tests had explosive yields between "low" kt (1 to 10 kt) and 4 Mt. The last atmospheric test took place on October 16, 1980, and the two last underground test were conducted in 1996.

As part of the research for this report, we examined satellite images from the Chinese nuclear test site at Lop Nur, where several different locations for vertical and horizontal tests have been reported. We discovered at least one area that appears to be active approximately five miles (eight kilometers) north of Po-cheng-tzu in the Xinjiang providence (Figure 66).

Figure 66:
Horizontal Tunnels at Lop Nur Nuclear Test Site



Satellite image of five horizontal tunnels and base facilities at the Lop Nur test site in the Xinjiang province. The image is centered (41°42'01"N, 88°21'58"E) on an area that spans approximately 3 miles (5 km) at an elevation of approximately 4,900 feet (1,500 m) above sea level.

Image: GoogleEarth/DigitalGlobe

The site includes a large number of facilities along a side road and has five access roads that lead north to the base of the mountain ridge and what appear to be five horizontal tunnels dug into the mountain (Figure 67).

Figure 67:
Details of Horizontal Tunnels at Lop Nur Nuclear Test Site

Close-ups of entrances to five horizontal tunnels at the Lop Nur test site in the Xinjiang province. Centered at 41º42'01"N, 88º21'58"E, the satellite image reveals various levels of activities at all five entrances. Trucks are visible at four of the five tunnel entrances, particularly the eastern (bottom; see Figure 68 for more details), and one entrance is covered with a roof.

Image:GoogleEarth/DigitalGlobe

Various buildings are located outside each tunnel entrance and one of the entrances appears to be covered with a roof. Each site also clearly shows an area where rock excavated from the mountain has been dumped. Trucks are visible at all entrances except one. One site appears to be more active than the others, with several trucks operating near the tunnel entrance (Figure 68).

It is not possible to determine from the available satellite image if the tunnels are associated with underground nuclear weapons testing, but it is a possibility given their location in the Lop Nur area. Nor is it possible to determine from the

Figure 68:
Activity at Horizontal Tunnel at Lop Nur Nuclear Test Site

This satellite image taken in 2005 shows what appears to be the most active horizontal tunnel (41°42'15.66"N, 88°23'24.15"E) at the Lop Nur test site. Several 20-foot (6-meter) trucks are visible amongst the buildings. What appears to be the dumping area for rock excavated from the tunnel is visible in the left side of the image.

Image: GoogleEarth/DigitalGlobe

available satellite image whether the tunnels are new or were constructed years ago. If the tunnels are indeed horizontal tunnels used in the underground nuclear testing program, the activity may indicate that China is conducting hydrodynamic tests or maintaining the site in a state of readiness – much like the the United States does with the Nevada Test Site – in case of a decision to resume nuclear testing.