CHAPTER - 7
PROLIFERATORS AND CAPABILITIES

Previous chapters have noted the main actors in proliferation activity. In this is apparent that while a variety of countries like South Africa, Israel, and Ukraine have sometimes played a crucial role in diverting critical technology, in recent years it is China, Russia and North Korea who appear to have had a considerable role to play – a role which is undoubtedly highlighted by a western dominated media eager to inquire into the new threats. On the face of evidence (not reports) it is apparent that China and North Korea acting perhaps as a subsidiary, have had a critical role in the missile programmes of both Pakistan and Iran. Previous chapters have brought out that neither of these would have had any conceivably effective missile programme without outside assistance. With North Korea itself perhaps simply a conduit of Chinese technology. However China, while no doubt a country with a creditable R&D, herself has benefited considerably from Russian and American technology to keep her on the upwardly mobile line of technology. Some of this (as noted in chapter -4) is available from open sources. However, when not available in such sources, China has apparently been able to get the technology through covert means, though this has certain curious overtones which appears to hint at the fact that the US government may well have turned a blind eye to these covert efforts.
Similarly, Russia is also alleged to have a covert "proliferation strategy", towards countries like Iran, and perhaps Iraq. In a sense, this is a repetition of history, when powers traded technology, arms or munitions for strategic purposes, and also for profit. This chapter traces the proliferation patterns of the "big three" as well as North Korea, and also assess the capabilities of the two major recipients – China and North Korea.

China as a recipient

China's herself was a beneficiary of the first phase of proliferation. Sino-Soviet cooperation in the development of nuclear research facilities began in 1953, and in the following year they established a joint organization to study the military applications of nuclear research. While the technology capability was closely tied to Soviet assistance, however the intellectual core of the programme was as much due to Chinese scientists who spend considerable time in the west as students. A central figure in Chinese rocketry was Dr Qian Xueshen, who obtained his degree from the Massachusetts Institute of Technology in 1938. During World War II he was director of the rocket section of the United States National Defense Advisory Board. In 1945 he was sent to Germany with the rank of colonel in the US Army Air Corps to study German rocket technology. When he and others like him returned to China they formed the core of the PRC's missile effort. Thus as Godwin notes, the Chinese missile program

1 For an excellent review of Strategic Forces development in China see Paul Godwin, "Development of the Chinese Armed Forces" (Alabama: Air University Press, June 1988).
was an amalgam of Soviet technology, western experience, and Chinese ingenuity.

China joined the nuclear and missile club with her first explosion on 16 October 1964, and her first Dong Feng-2 missile test fired on 29 June 1964. Oddly enough, the actual rockets first fired in China (the R-2, a copy of the German V-2 with a range of 270km) were carried out under Soviet prodding and extensive assistance, and previous to the nuclear test. It was only after a successful nuclear test however, that the Fifth Academy (created on 26 May 1965) were tasked to create a complete family of four missiles, with the range designed to target Japan, (DF-2) the Philippines(DF-3) Guam(DF-4) and continental USA (DF-5)\(^2\). As relations with the Soviets palled, the targeting included Soviet cities. This was a complete reversal of relationships, the only case where a former patron turned into a hated enemy. For a while China even became an avid supporter of NATO, and insisted on pointing out that the primary threat was to Europe in the west and Japan in the east. The Zhenbao/Demansky island dispute that flared in March 1969 and continued to simmer till 1970, was at least conducive to US-China rapprochement. More to the point it was also a prod to Beijing to push manufacturers and design laboratories towards increased Chinese missile manufacture. This naturally required more resources, and at a time when China was passing through an

economic decline and shortage of funds, the first tentative moves to access the international markets are made.

It is difficult to trace the development of the Chinese ballistic missile program since it was closely linked to the space programme, with even the three primary launch sites\(^3\) the same for both programmes. The first guided missile launched was evidently a Soviet booster, but the announcement stated that the propellant was Chinese. The fuel used was storable liquid fuel\(^4\) The first Chinese missile launched, the Dong Feng – 2 was possibly a modified SS-3 (range 600km with a nuclear warhead). Like the Indian Prithvi it was transportable (but not tactically mobile) with a long caravan of vehicles for support facilities.

The DF-3, first tested in 1969 was designed to be the first "modern" missile. Though it used the same fuel, it was capable of carrying a 1-3MT warhead more than 2,500 km and was deployed in May 1971. The range was subsequently increased, and it remained the mainstay of the strategic forces. It eventually became the first stage in the space launch vehicle (Long March 1) and also the first stage for the upcoming DF-4 IRBM. Silo deployed, the DF-3 could be prefuelled reducing reaction time.

\(^3\) These were Shunagchengzi (Gansu provinces) Wuzhai (shanxi province) and Jingyu (Jilin province) Godwin, note 1.

\(^4\) The fuel used in Soviet missiles passed on to China – the SS2 derivatives- itself used a modified version of the German V-2 rocket fuel. Godwin states that the Chinese are understood to have used the commonly used combination of nitrogen tetroxide and unsymmetrical dimethyl hydrazine \((N\text{2}O_4/\text{UDMH})\). See CNS data base. Monterey Institute http://cns.miis.edu.
In 1970 China’s first successful satellite launch used a solid fuel third stage, thus marking a full twenty years before China was able to come to solid fuel capability. The first ICBM, the DF-5 first made its appearance as a booster in launching satellites (as the Fengbao -1) before it began four partial range tests in 1979 (January-September). The final test of the ICBM followed in February 1980, while full range tests into the Pacific occurred a year later. (18, 21 May 1980) The second shot was assessed to be a failure. The missile was developed exclusively with the US in mind, and to reach the East coast targets. This missile incorporated many new technologies (larger rocket engines, a gyro stabilized platform, an on board computer). A month after full range test flight it was delivered to the military for operational training. In 1972, the visit of President Nixon signaled the (official) beginning of Sino-US rapprochement.

Other landmarks along the road were the first test of a solid fuel sea launched submarine the JL-1 (October 1982) with a range of only 1,700km (to the 4,600 and 7,400km of the American missiles like the Trident and the Poseidon which it resembled closely). Since at this range it could hardly be able to target important Soviet cities, it was decided that the “JL must go ashore” and so it did. The land based version was the DF-21, a two stage 1,700 – 2000 km missile first successfully tested on 20 May 1985. (Some sources note that its range was extended in 1986 with a

---

5 Ottfried Ischebecn, Gitz Neuneck (eds.) "Cooperative Policies for Preventing and Controlling the Spread of Missiles and Nuclear Weapons: Policies and Perspectives in Southern Asia" (Baden-Baden,
600kg warhead and a range of over 1,700km. Other sources however cite the range as 1000 – 2,500km and report that it is a two stage missile using solid fuel. The missile is ejected from its container and ignited when airborne. Fired from a road mobile TEL, it had around 6 vehicles for its operation. The follow on was the DF-25 which was almost identical to the DF-21, but of which little was known. In November 1996, the Chinese announced that this was to be cancelled. Analysts announced that this "India specific" missiles' cancellation marked a turning point in Chinese threat perception. However, there is nothing to show that the DF-25 was not cancelled due to a reduction in threat perception from Moscow, besides which the DF-21 remained targeted at South Asia and stationed in Tibet. The DF-21A, with added propellant and a boosted second stage became the mainstay of the Chinese arsenal. By US accounts only some 20 warheads out of 400 are targeted at the United States – therefore the remaining 380 are on IRBM's. The actual figures of missiles targeted on neighbours may be much more since, interestingly, at least some of these missiles are being reconfigured to the conventional role immediately after Desert Storm. The DF-21A if deployed along China's southern and north

---

6 This range is provided by Hua Di, note 2 and is supported by the Department of Defense Annual "Proliferation: Threat and Response 1997" Office of the Secretary of Defense, United State Government Printing Office, September 1997.

7 This range appears more realistic and is provided in "Ballistic and Cruise Missile Threat" National Air Intelligence Centre, NAIC-1031-0985-98.

8 Eric H. Arnett "China is no excuse", Business Standard, 30 November 1996.


western borders can hit targets in Northern India, Central Asia, and most of Vietnam and Southeast Asia. As of late 1997 the PRC had about 40 re-fire capable launchers at six field garrisons and launch complexes. The DF-21 Mod 2 may eventually replace the CSS-2 completely from service. Ongoing improvements include sophisticated terminal guidance system, and according to Taiwanese reports cited, the new warhead will be similar to the Radar Digital Area Guidance (RADAG) system used by the Perishing II IRBM which has an accuracy within 50m. Taiwanese sources also noted in 1997 that China was working on a 2,800 and 3,000km missile variants of the DF-21.

Sometime in the mid 1980’s China began to seriously pursue a MIRV capability, soon after President Reagan’s “Star Wars” speech in 1983. (though it must be noted that the decision to go in for MIRVing may have been taken in the mid 1970s’ when the US was first fielding this) China’s first tests of its version of the DF-5/5A with a MIRV capability was reported in 1983, with tests continuing on the DF-5 and the DF-32/JL-2 till 1995. It is still not clear whether China has a MIRV or even a MRV capability.

In 1994-95, Russia returned once again as an input into Chinese missile program. In 1995 Russian space authorities sold China three of

11 http://www.fas.org
Russia's most advanced upper state rocket engines in violation of the MTCR. Russians point out however that the sale did not go through the state owned NPO Energiomash, the only legal entity licensed to sell this engine. It is also said to be upgrading may categories of China's conventional and nuclear submarines, including the Kilos it brought from Russia. Russia is also assisting in developing a new generation of Chinese SSN's and SSBN's (the 093 and 094) attack and missile submarines. This assistance is primarily in the area of stealth technology (that is by covering the hulls with a layer of anechoic tiles). These submarines are understood to become operational by 2007. Blank also quotes reports of Russia selling China parts for its mobile SS-24 and 25's TEL's (transporter -erector -launchers), as well as technology to improve the missiles combat readiness. Sources indicate that Russia and China are now cooperating on some 100 odd defense projects. Japanese sources watching the programme, noted that in June 1996, Russia had passed on computer simulation technology from Russia, which was however denied by the Russian Ministry of Atomic Industry spokesman.

Russia is also alleged to have sold control and guidance systems from the SS-18 and SS-19 to China for its DF-31 and DF-41, though this could also be from Ukraine. China has made no secret of the fact that it

---

15 Ibid.
16 Ibid, p.9
17 Lamson and Bowen, note 10, p.267.
would like to buy SS-18 technology to upgrade its satellite launching capability. On 21 May 1996, US Defense Secretary Perry demanded that Russia and Ukraine refrain from the transfer of such technology. The SS-18 is a liquid fuelled, two stage missile, which can deliver either a single warhead or MIRV payload of up to 10 RV's. Reportedly, a group of Chinese were expelled from Ukraine for attempting to acquire classified designs on the SS-18\(^\text{18}\).

Most recently, Russia transferred its most formidable weapons the "Sunburn" the anti-ship missile, even before it underwent flight testing in Russia. Another buy is that of SA-N-12 Gadfly Surface to air missile, together with a range of conventional weaponry that will considerably bolster Beijing's efforts to modernize its armed forces. The following chart gives a "broad picture" on the vitality of the foreign input clear.

**Chart - 7.1**

**China's Missile programme – a time scale chart**

*Period of Russian assistance* 1960's – 1970 (10+ years)

First DF fired, (SS-3 types) decision to produce three versions, 1969, DF-3 fired.

*Period of no assistance.* – 1970 -1980 (ten years) no major activity

*Period of exports* 1980 – 1995 (fifteen years)

Solid fuel capability with ICBM launch, liquid fuelled SLBM, land based IRBM (DF-25), MIRV research begins, Series of MRBM's produced for export (Iran, Libya, Syria, Pakistan, Saudi Arabia)

\(^{18}\) Ibid.
Period of Russian assistance, US space launch assistance: 1990 – the present
DF-25 cancelled, three stage, 8,000km DF-31, JL-2 under research, ICBM forces increased. RPV capability, guidance, alloys, warhead minaturaization capability?

China and proliferation: MRBM's and the international market

Around the time China was beginning to develop a strategic force, (mid 1980’s) it also began the first cautious forays into the international market. The demand for tactical missiles was first recognized when the North Koreans came to Beijing for a missile of a longer range than the Scud-A in their possession. China had no such missiles at that time, since the military preferred to focus on long range systems. The period of economic reform that started after 1979, and the R&D crunch that followed led to a decision to reorganize and rationalize the policy of military sales. The Ministry of Ordinance was the first to set up the first arms trade organization called the China North Industries Corporation (NORINCO). Their example was soon followed by the others, and the Ministries of Space offered Satellite launching services, anti aircraft missiles, and anti ship missiles. The First Academy, which dealt with ballistic missiles decided to target this lucrative source by producing missiles exclusively for export, a decision that was helped along by the 2/3ds cut in R&D appropriation, and a fall in domestic buying. This started the first M series of missiles, and the

---

19 The data on early Chinese export sales is given by Hua Di in William Potter & Harold Jencks (eds.) "The International Missile Bazaar" (Boulder: Westview, 1994) pp.163-180.
M-9, a 600km single stage, solid propellant road mobile missile (capable of being launched from a Scud A Transporter Erector Launcher) was all that developing countries could want. The range (600km, single stage sold propellant road mobile, with inertial strap down guidance system) still meant it was a "Strategic" weapon for countries like Syria and Pakistan, and this interest in its utility soon led it to being incorporate in the Chinese Rocket Forces as the DF-15. The M-9 was immediately ordered by Syria even before tests had been completed. (1986) Cheered by the interest, the M-11 followed and was confirmed as having been supplied to Pakistan. (see below). The M-11 had a 300km range, solid propellant, and terminal guidance, and it was again targeted solely for export. Other sources also note that the DF-15/M-9 is said to have a separating warhead system, so that the incoming warhead is more difficult to intercept. The DF-15 was also used in the "missile tests" off Taiwan in July 1995 and 1997, and the report of the US Department of Defense noted that it achieved a remarkable accuracy.

Another of the M family was the M-7 (project 8610) SRBM which is a modified Russian SA-2 SAM with solid fuelled motors. China embarked on this after stealing SAM's destined for North Vietnam across the Chinese rail network in 1966 or 1967 and reverse engineered them as HQ-2²⁰.

The DF-21 came into the news following suspicions that this may have been passed on to Pakistan with modifications, and it was certainly in

²⁰ This is stated in http://www.cdiss.org.
the news when the Chinese decided to use it in exercises in 23 July 1995 (though it was not used to its full range). The DF-21A is the improved version with the longer range of 1,800km with a 600kg warhead.

US analysts and policy makers conclude that China's motives in proliferation are many faceted. Firstly, it is very conscious of its rights as a sovereign power, and sees little benefit to itself in adhering to the MTCR. Second, it is very concerned with future energy sources, and its missile program and diplomacy are aimed at keeping all future energy routes open. Third, the so called "red princes" (the sons and daughters of the ruling elite's) serve on the boards of state industries including the defense sector. Their personal influence leads to the sale of sensitive technologies, this trend increasing as China's defense exports have continued to fall from a level of $3billion (1987-88) to around a fifth of this in 199421.

These companies, apparently not state owned, were said to have conducted business worth $2million a year, a sum that was hardly likely to hurt China22. The Director of Central Intelligence noted that "conventional arms sales have lagged in recent years, encouraging Chinese defense industries to look to technology-related sales, primarily to Pakistan and


22 Sanctions were imposed under the Chemical and Biological Weapons Control and Warfare Elimination Act 1991 which forbids companies from exporting a variety of chemicals and equipment to states identified as state sponsors of terrorism. " The Proliferation Primer- A Majority Report " International Security, Proliferation, and Federal Services Subcommittee, United States Senate Committee on Governmental Affairs, January 1998.
Iran, to recoup" Noting that there has been "some signs" of improvement, however the CIA Director noted that "China's relations with some proliferant countries are long standing and deep." 23

**Strategic capability**

Missile forces today form the core of China's nuclear and conventional posture. Some 300 24 to 400 25 strategic weapons are structured in a "triad" of land based missiles, bombers and submarine launched ballistic missiles with ranges up to 14,500 km and longer range missiles in the offing.

The number of strategic warheads has been put at 400 warheads of two basic categories: some 250 to the "strategic" arsenal, and an estimated 150 for tactical weapons, — presumably lower yield bombs for tactical aircraft, artillery shells, atomic demolition munitions, and possibly short range missiles such as the DF-15(M-9) and DF-11(M-11) 26. The strongest leg remains the land based missiles, with the submarine force catching up.

Information on Chinese tactical nuclear weapons is limited, and there is no confirmation of their official existence. Several low yield tests in the late 1970's, and a large military exercise in June 1982 simulating the
use of tactical nuclear weapons, suggests that they have been developed. Recently the Taiwanese Defence minister referred specifically to nuclear capable "M" missiles both deployed in the south.

Norris notes that the Chinese military will probably focus on three components in the future – small high tech forces for flexible use in regional contingencies, large low tech and medium tech forces for internal security and reinforcement in defense of the homeland, and modest levels of strategic nuclear forces to maintain a viable deterrent against other nuclear powers.\(^{27}\)

Currently China has five types of nuclear capable ballistic missiles (DF-21, DF-3, DF-4 and DF-5A, all of which are of the design of the 1960’s. The DF-3 was China’s first indigenously designed ballistic missile. The DF-4 is a multiple stage, liquid fueled, missile deployed at five main bases, and began development in March 1965, with the first successful full range test flight more than a decade later in August 1980. It is understood to be targeted at Moscow. The DF-5 was the only "true ICBM" and is liquid fuelled. The improved DF-5A had a longer range (8,000 miles) and a larger payload (4-5 megatons) and is currently deployed in hardened underground silos.\(^{28}\) A report of 1998 noted that 6 new DF-5’s had been deployed in the first four months, denoting a one third increase in its arsenal.\(^{29}\)

\(^{27}\) Ibid. p.46
\(^{28}\) Economy and Okensburg. Note 24, p.329
Two new ICBM's are in the pipeline. The DF-31 and the DF-41. The DF-31, is reported to be ready for deployment by 2000. It is quoted as a mobile strategic missile, with multiple warheads, that posed a threat to parts of continental United States\(^{30}\). Classified Air Force reports leaked to the press noted that the new missiles were observed at a launch pad at the Wuzhai Missile and Space Test Centre and was said to have a range of 4,960 miles, sufficient to hit targets along the entire West Coast of the US. The missile is said to incorporate “design aspects similar to those of current generation Russian missiles” the report said. This could include upgraded mobility for the TEL, advanced materials for the booster and payload, use of penetration aids such as decoys, chaff and an improved solid propellant. The missile is understood to have been tested simulating launch from a nuclear missile submarine tubes. In its mobile version, it could be launched from a TEL that incorporates some of the design features of the Belarussian six axle vehicle such as was used to launch the SS-20\(^{31}\). Similarly the DF-41 is also in the pipeline with a estimated range of between 12,000 to 13,500km. these missile reflect the thrust towards more solid fuelled, and more mobile systems for the future.

The Chinese are said to have had less success with their submarine force. The single existing submarine which was launched in April 1981, is armed with the Julang -1 (JL-1)This Xia class SSBN and the five Han class SSN (which may also be nuclear capable) have never sailed beyond

---


\(^{31}\) Ibid.
regional waters. No additional Xia class submarines are planned apparently, but the testing of the DF-31 in a submarine mode would require an entirely new class of submarines. The Chinese bomber force is said to be based on 1950's aircraft, according to one source. The main bomber is the Hong-6 based on the Soviet Yu-16 medium range bomber. However the purchase of more than 26 Russian SS-27 fighters at a cost of $1 billion may indicate a new purpose. Once production begins in China, this fleet would obviously be set to expand. Once again, the Chinese could be dependant on foreign technology to "boot" the missile forces, and diversify launch platforms. Analysts observe that the missile force at present is "technologically obsolete" with warheads far too large for tactical warfighting purposes. They also allege that the entire command, control, communications, and battle management system is either obsolete or nonexistent - in short the Chinese have not reached a "second strike" capability.

These assessments came under considerable pressure following the disclosure of the extensive spying allegedly undertaken by China at one of the most sensitive American weapons laboratories. Following the release of the so called "Cox's Report" after the Chairman Representative Cox, (R-Calif) who headed the investigation, and the more technical Directorate of

33 Schwartz. note 9.
34 The 700 page report was released on April 25, 1999. For the text of the Cox Report see http://cns.miis.edu.
Central Intelligence (DCI) Statement on Damage Assessment. (this is dealt with in more detail later in this section.)

However the end result was that China may have accessed nuclear test codes, computer design models and other data forms in three critical areas

- Nuclear warhead modernization
- Missile guidance and design technology
- Electromagnetic weapons technology.

The DCI report\(^{35}\), while it noted that the information accessed from the US did make a significant contribution to China's second strike capability, however noted that significant deficiencies existed in the Chinese weapons programme., and that to date the Chinese spying and information collection effort had not significantly (an unquantifiable word) resulted in any apparent modernization of the deployed strategic force (not mentioning anything however about the future force) .

In warhead technology, China has had an ongoing programme to develop MRV/MIRV technology as well as nuclear warhead minaturization for a more mobile and lighter force. In September 1981, China successfully delivered three satellites with one launch vehicle giving it (according to some) a incipient multiple warhead capability. In May 1995 China tested the DF-31 with MRV's/ MIRV's, possibly to prove warheads in the 100-

\(^{35}\) Statement of George J. Tenet. Director, Directorate of Central Intelligence, 21 April, 1999.
200kt range and a large one in the 600 to 700kt range. Paul Dibbs estimates that by 2010 China will deploy 5—70 MIRVed solid fuel ICBM’s with ranges of 8,000-12,000 km deployed either on mobile launchers or in hardened silos. Dibbs also states that China will deploy six SSBN (ship submersible ballistic nuclear) with 8,000 km range MIRVed SLBM’s. Military sources are also quoted as saying that China is expected to produce MIRV technology in the near future, along with their miniaturized warheads. The systems in development (DF-31/JL-2, DF-41) are expected to have new warheads of 200-300kt, which is yet to be certified. This raises the question of whether China has received the technology for "cold testing". Recently, Sha Zhukang, the influential director of the Foreign Ministry’s Arms Control Department, noted that China had no objection to computer simulation since it was only to check the safety of the existing stockpile, thus ignoring that computer simulation could mean also the designing of new warheads.

---


Table – 7.2

Chinese Missile Capability

<table>
<thead>
<tr>
<th>Missile</th>
<th>Type</th>
<th>Number</th>
<th>Range</th>
<th>Fuel</th>
<th>Payload</th>
<th>FF/YOD</th>
</tr>
</thead>
<tbody>
<tr>
<td>DF-3A CSS-2</td>
<td>Mobile, single stage (Limited)</td>
<td>50-60</td>
<td>2,800</td>
<td>liquid</td>
<td>1-3mt</td>
<td>26 Dec 1966/1964</td>
</tr>
<tr>
<td>DF-4</td>
<td>2stage, fixed</td>
<td>10-20</td>
<td>4750</td>
<td>Liquid</td>
<td>3 mt</td>
<td>10 Sept 1971/1965</td>
</tr>
<tr>
<td>DF-5A</td>
<td>Two stage, silos</td>
<td></td>
<td>13,000</td>
<td>Liquid</td>
<td>4-5mt</td>
<td>10 Sept 1971/1965</td>
</tr>
<tr>
<td>DF-11 M-11</td>
<td>Mobile</td>
<td>-----</td>
<td>3-400</td>
<td>Solid</td>
<td>-------</td>
<td>1982</td>
</tr>
<tr>
<td>DF-9, M-9</td>
<td>Mobile Separating warhead</td>
<td>------</td>
<td>500-600</td>
<td>Solid</td>
<td>250kt</td>
<td>1990/1982</td>
</tr>
<tr>
<td>DF-21</td>
<td>Mobile</td>
<td>36</td>
<td>1,800</td>
<td>Solid</td>
<td>300 kt</td>
<td>1978/1988</td>
</tr>
<tr>
<td>DF-31(dev)</td>
<td>mobile</td>
<td>--</td>
<td>8,000</td>
<td>Solid</td>
<td>MIRV</td>
<td>Expected 2000</td>
</tr>
<tr>
<td>JL-1</td>
<td>SLBM</td>
<td>12</td>
<td>1,700-2,000</td>
<td>Solid</td>
<td>200-500KT</td>
<td>1967/1982</td>
</tr>
<tr>
<td>JL-2(dev)</td>
<td>SLBM</td>
<td>--</td>
<td>8000</td>
<td>Solid</td>
<td>2-300kt</td>
<td>Na</td>
</tr>
<tr>
<td>DF-41 (dev)</td>
<td>ICBM</td>
<td>--</td>
<td>12-13,000</td>
<td>Solid</td>
<td>-------</td>
<td>---</td>
</tr>
</tbody>
</table>


North Korea

North Korea has since the early 1990’s become the centre of non-proliferation efforts. Pyongyang became a significant exporter or arms in its own right in the later 1980’s and one source notes that arms had become the primary source of hard currency accounting for more than 50 percent of exports, and that she was exporting to nearly 50 countries worldwide.

38 This sounds exaggerated but is given by Time, 25 March 1991.
North Korea's first supplies of rockets, FROG 5's and FROG-7A's came from the Soviet Union. A successful reverse engineering of the FROG-7A was the first attempt in the direction of missiles. The first Scud-B's arrived not from the Soviet Union but from Egypt, who supplied them in return for MiG-21 pilots to assist the war effort in 1973. Over the years a reverse engineered Scud copy (the Scud Mod A) was flight tested in 1984. This was never intended to be produced, but formed the test bed for a Hwasong 5 (Scud – mod B) which incorporated several new production and engineering improvements. These included slightly lighter structural material, and marginally more powerful engines which resulted in a range increase to 320km (from the Scud-A's 300km) with however a poor CEP of 500-1000 metres at maximum range. Chinese assistance in aerodynamic and Japanese assistance in electronics however helped them to improve both range and accuracy rapidly. Finance came from Iran, which signed an agreement by which nearly 90-100 Scud – B's were sent off to Iran during the war, (1987) Bermudez and Carus note that the Iranians received the Scuds prior to the North Korean forces, underlining the importance of Iranian financing. Other sources also noted that the Iranians may have received help for a chemical warhead to be fitted to the missile.

39 This information is from Martin Navias, “Going Ballistic: The Build up of Missile in the Middle East”, (New York: Brassey's, 1993), p.80.


41 Jane's Defence Weekly 14 January 1989
TARGET RANGES REQUIRED BY N. KOREA

<table>
<thead>
<tr>
<th>Range</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>500km</td>
<td>the Scud C</td>
</tr>
<tr>
<td>1,000-1,500km</td>
<td>the Nodong-1</td>
</tr>
<tr>
<td>1,500 to 2,500 km</td>
<td>the No dong 1</td>
</tr>
</tbody>
</table>

Future development appears to have followed the requirements of targeting (see chart – 7.2), thus leading to the missile program being divided into four distinct but interrelated projects. A longer range version *Hwasong 6* (known in the west as Scud C), Nodong-1, Taeop dong 1 and Taepo dong 2. Iran was to financially back these efforts.

The Scud – C was apparently more capable than the Iraqi attempts, and after work began in 1988, it was test fired in 1990 with a 550km range, achieved through a reduction in warhead weight according to sources (1000 to 770 kg), and a slight increase in size and thus propellant capacity. It is also assessed to have an improved guidance package. In November 1990, an IGRC commander from Teheran finalised details in a deal worth a reported $500 million. Deliveries began soon after by air and sea, and a firing was reported to have taken place in Iran in May 1991.

---


43 Ibid.p.30
The Iranian connection proved to be advantageous in more ways than one. Using Iran as a transhipment point, some 60 Scud-C’s and 12 TEL’s began to arrive in Syria. This was after Syria had been rebuffed by the Soviet Union in its quest to get SS-23’s. According to Cordesmann and Wagner, Syria tried to get the missiles including the SS-12’s and even the SS-25 ICBM after it was certain that the INF Treaty would go through. For some reason, China after being approached was also cautious about selling the Syrians the M-9. Soon after, the North Korean shipment followed. The Syrians are believed to have paid for these out of the $2 billion paid to them by the Saudis after the Gulf War.

Egypt was another beneficiary with North Korea proving Scud assembly facilities and the means to develop the Project-T, a Scud derivative with a range increased to 450 km (payload could be smaller). In mid 1996 North Korea is reported to have sent Scud-C’s related material to Egypt, which would enable Cairo to start production. This shift to providing production facilities may have been due to the Israeli and American tendency to intercept shipment that it considered as dangerous. Shortly afterwards Syria is reported to have conducted a Scud-C test. Another report noted that North Korea had been asked to reverse engineer the SS-

---

44 National Briefings: North Korea http://www.cdiss.org
46 Navias note 36,p.81.
47 For instance the US is reported to have asked Israel not to intercept a shipment for Syria in October 1991 since it would have endangered the Madrid peace process. "Let Cargo of Scud go through Israel told" The Independent 18 October 1991.
21 SRBM by Syria, to replace the aging FROG rocket. Clearly however, there were limits beyond which the basic Scud design could not be improved upon to increase capability.

The Nodong development had begun as a parallel program with the Scud-C. It is seen by some analysts as a completely new missile drawing up on the experiences of the previous programmes. The engine used four uncoupled Scud-B engines, or a new unified engine was developed that used four coupled thrusts chambers and a common turbo pump. Sources note that this design route was similar to the Russian designs and later Chinese ones. Analysts charge that this similarity is not coincidental, and that this was the same route taken by the Isayev Design Bureau during the late 1950's and early 1960's that designed the engines for both the R-17 (SS-1C and Scud-B) and the R-21 (SS-N-5). Therefore Russian assistance had begun well before the collapse of the Soviet Union with the Makayev design bureau closely involved. Iranian financial backing as noted, was crucial and facilitated the development of the Nodong, (which was then tested as the Shahab –3 on 22 July 1998.) Pakistan during the mid 1990's also signed several agreements with North Korea which called for the provision of Nodong I technology, components and perhaps missiles (possibly tested eventually as the “Ghauri” (Hatf-5) on 6 April 1998). The

48 Joseph S. Bermudez “Taeop-dong launch brings DPRK missiles back into the spotlight” Jane's Intelligence Review October 1998. pp 30-32
49 Ibid. 32.
50 This may be further collaborated by the fact that around 60 Russian missile scientists from Makayev DB were detained as they were about to board a flight to North Korea in October 1992. Missile Monitor Vol.4, No4. Fall 1998.
Nodong – 1 may first have been tested in late May 1990, though there is very little data on this. On 29th May 1993, North Korea tested four missiles, including the Nodong, together with two Scud-C’s in to the Sea of Japan. This is thought to have been a demonstration for the visiting Iranian military officials. In April 1997, Japanese Foreign Minister Yukihiko Ikeda noted that there were “reports” that North Koreans had deployed a missile of more than 1000km range. This followed by reports in Japanese newspapers\(^{51}\) that US satellites had spied the deployment of three Nodongs 1’s on the eastern coast. This was a surprising event since North Korea had been facing a famine and had been trying to get western food aid, and seemed a deliberately provocative act.

Sometimes in late 1993 or early 1994 Kim Il Sung ordered the development of a space launch vehicle perhaps due to South Korea’s launch of a second research satellite Urybol II in September 1993). The candidates for possible conversion were the Taepo Dong I and 2, IRBM both still at the design stage. The Taepo Dong (TP) I & 2 were clearly an ambitious development plan. Bermudez notes that while the two are clubbed together by most analysts, they are in fact completely different systems. The TP-1 uses the No-dong as the first stage and a Hwasong-6 as the second stage in a cluster, or as other sources note, the M-11 with the tail fins removed\(^{52}\). The alloy used may be an aluminum magnesium.

\(^{51}\) *Sankei Shimbun* (Tokyo), April 11, 1997.

\(^{52}\) Bermudez calls it Hwasong 6 while the cdiss web site reports it as a M-11. Note 53 and note 54.
alloy as used in the Nodong-2 which is under development. While the TP-2 is also a two stage system which appears to be constructed by employing a newly designed first stage and a Nodong-1 as the second stage. The length of this new missile and its other specifications are still contested with some claiming it as approximately 35 m long, with the first stage perhaps 18 m long and resembling the first stage of the DF-4. This missile has been assessed by the US intelligence as having sufficient range to reach Alaska, - that is a range of 4,000 to 6,000km with a 1,000kg warheads. This range with the existing configuration would be possible only if more advanced fuels have been used. This input of better fuel mixtures would signify a jump in technology in a period of less than eight years.

While earlier estimates of a possible test in 1998 had been analysed as too optimistic, the North Koreans surprised watchers by testing it on 31 August 1998 from its Hwadae gun Missile Tests Facility. The test demonstrated successful staging capability, and traveled east over Japan for a distance of approximately 1,400-1,600km and landed in the Pacific. This was put forward as a satellite launching effort, but there was apparently no confirmation on a new object in space by any agency. According to Charles Vick of the Federation of American scientists, the first stage was the Nodong booster, the second stage a modified Scud C or D, and that the third stage was a 15,000-45,000 lb thrust solid motor from an SA-2 anti aircraft missile system modified for the purpose. Others however disagree, and maintain that the North Koreans may have employed the Stromboli engine motor which Pakistan had been using for its Hatf-1 and
Hatf -2. However the Air Intelligence Report says that North Koreans may have used the Chinese M-11 as the upper stage of its TD-1. The TD-1 is estimated to come into operation somewhere around 2000-2005. The test was seen as a ploy to get a better bargaining position with the US, as well as to advertise North Korean capabilities just before the foundation day anniversary on 9 September 1998.

Meanwhile US spy satellites noted that three new missile bases appeared to be under construction. According to the Pentagon, the first site being built was a launch facility located approximately 50 miles south of the Chinese border at Yongo Dongo. The second (Chiha-ri) was a support base. Analysts noted that these sites were possibly for tests and commercial launch demonstrations, rather than a military build up.

**Figure 7.1**

**TIME SCALE MAP**

* A new missile every three years?

---


54 "North Korea Tests Long Range Missile" Reuters, 1 September 1998.
There is clearly very little likelihood that the North Koreans were able to make the transition from Scud technology in 1984 to the staging technology and presumed satellite launcher of the Taepo dong-1 in 1998 – that is less than 14 years without significant foreign aid. The fact remains that most of North Korean missiles are a hybrid of Russian and Chinese technology, with apparently other inputs thrown in. For instance, the TD-1 is assessed by the Monterey Institute to have benefited from Japanese technology acquired via other countries, Ukrainian missile experts, as well as experts from other former Soviet republics. The report, submitted by the Centre for Non Proliferation Studies at the Monterey Institute of International Studies, and the Centre for Contemporary International Problems at the Russian Diplomatic Academy also noted that China had expressed surprise at the TD-1 launch, and had flatly denied any assistance. However, some US experts note that the TD-1 is very close in many respects to the DF-3, and therefore see the Chinese passing on old technology for a price. The rapid development of alloys, fuel mixtures, and engine points to foreign assistance, particularly in the area of advanced engineering and human resource according to Bermudez who alleges that apart from Ukraine and Russian designer, Iran may have diverted Russian technology. Other sources however allege that China is assisting North Korea with SLV and satellite technology, comprising

---

56 "DPRK Missile development" Korea Times, 02 October, 1999.
57 Bermudez. Note 37.
exchange of both scientists and technology\textsuperscript{58}. This US report was naturally denied by China. Further assistance by China in areas of missile technology is the North Korean firing of a new anti-ship missile which is a derivative of the Chinese silkworm. Its range is approximate 120-160km.

North Korea's proliferation activities are apparent in the missile programs of Pakistan and Iran. North Korea finally admitted that it sold missiles abroad and would continue to do so in 16 June 1998. "We will continue developing, testing and deploying missiles," said a statement carried by the official Korean Central News Agency, adding significantly" Our missile export is aimed at obtaining foreign money we need at present."\textsuperscript{59}

\begin{table}[h]
\centering
\caption{North Korean Ballistic Missile Capabilities}
\begin{tabular}{|c|c|c|c|c|c|c|}
\hline
 & Scud-A & Scud-B & Scud-C & Nodong-1 & Nodong2 & TD-1* & TD-2* \\
\hline
Range (km) & 300 & 320 & 550 & 1,000 & 1,500 & 2000 & 4-6000 \\
\hline
Payload (kg) & 985 & 985 & 500 & 1,000 & 1000 & 1000 & 1000 \\
\hline
Stages Single Single Single Single Single Two Two \\
\hline
Length (met) & 11.25 & 11.25 & 12.55 & 15.5 & 15.5 & Nk & 18/14 \\
\hline
Diameter & 0.9 & 0.9 & 0.9 & 1.3 & 1.3 & Nk & 2.4/1.3 \\
\hline
Fule (kg) & 4,000 & 4,000 & 5,000 & 16,000 & 16,000 & 20,000 & Nk \\
\hline
Exports None Egypt, Iran, Syria Iran, Libya, Syria Iran, Pakistan? \\
\hline
\end{tabular}
\end{table}

\textsuperscript{*} These are estimates only. \textsuperscript{*}Source: cdiss.org. Jane's Intelligence Review October 1998.

\textsuperscript{58} This report quoted US official sources. Washington Times 23 February 1999.

\textsuperscript{59} http://www.sightings.com
RUSSIA

The genesis of the Russian arsenal is well known (which like the US, was derived from German designs after World War II) and does not need further description. (Table -4.4) Russia one the one hand, is still a nuclear weapon power of considerable standing. Analysts note three distinctive threats that are perceived from Russia. One is the "unsanctioned" used of Russia's strategic arsenal by personnel within Russia, second a greater chance of triggering a nuclear response due to loss of control, and third, a deliberate or uncontrolled sales of missiles and related technology to countries that are "suspect" states. Before evaluating these “threats” it is as well to review the state of the Russian arsenal.

The stockpile of Russian strategic and tactical warheads is estimated to be around 20,000 - 25,000 nuclear weapons out of which some 7000 to more than 12,000 are non strategic warheads. The unilateral initiatives declared by Gorbachev and and Yeltsin in 1991 and 1992 respectively obliges Moscow to firstly consolidate ground launched tactical warheads and eliminate all of them by 2000. The START agreements could also result in the retirement and eventual dis-assembly of some 7,000 strategic warheads , by which warheads should be reduced to 3-3,500 by December 31, 2007. Even if the START II is not ratified by the Duma, the decline will continue possibly to fewer than 3,000 due to economic constraints and systems obsolescence. AT the same time

---

production of additional warheads will continue into the 21st Century as new strategic missiles systems are deployed. It must be noted that START II does not specify that warheads have to be eliminated, and counts only the number of accountable warheads (that is, those that are assigned to that particular delivery vehicle). START II thus allows both sides to keep 3,500 deployed strategic nuclear warheads each, but says nothing about non-deployed warheads. The US plans to keep about 5,000 of these at various levels of readiness61, while it is not known how many the Russians would keep. START II also does not limit non strategic warheads. After the treaty is implemented the US and Russia will continue to possess 10,000 total nuclear weapons each62 – even though only 3,500 can only be placed on delivery vehicles. The actual distribution of warheads is largely left to the country, with no ceilings on the “mix” except that SLBM’s can have only 1,750. Since there is no ceiling on the total warheads each side may keep, the possibility of a rapid break out remains.

The Treaty however presents Russia with some serious problems, that has caused the Duma to resist ratification. To maintain parity the Russians have to “build up” and deploy more than 5000 new single warheads ICBM’s at the same time as they will be destroying their existing multiple warhead missiles. The following START III which seeks to further reduce deployed warheads to 2000- 2,5000 would be a step in the right

62 Ibid.p.35.
direction, except that with this any build up of an ABM shield by one side would be seen as destabilizing by the other.

In July 1998, the Russian Security Council adopted the Programme of Development of the Russian Strategic Nuclear Weapons Forces covering plans till 2007. Though the programme details are unknown, at least one analyst has noted that Russia might follow the US lead in extending nuclear threats to cover a wider range of contingencies. The insecurity engendered by a failing security cover is illustrated by the statements of officials. The first Deputy Prime Minister Yuri Maslyukov said that "in seven or eight years, Russia will be left without a single missile, submarine, or bomber built during the Soviet times". Maslyukov also estimates that by 2007-2010 Russia would not be able to afford more than a few hundred warheads. However, at the moment Russia continues to modernize her arsenal. Current plans indicates a building of 35-45 Topol ICBM a year from 2000 and a force of roughly 7 Yuri Dolgoruky SSBN's by 2010. Russia is also developing a new battlefield missile to replace the Scud. Russia's industrial base can support the full range of both solid and liquid propellant ballistic missile and associated technologies. Russia retains a strategic missile force of 1,200 operational ICBM And SLBM launchers.

64 Ibid.
Russia has declared a chemical weapons stockpile that is the largest in the world: 40,000 tons of chemical agents, mostly weaponized. Russia continues to research this aspect, but says that labs are now concentrating on defense against these agents, an activity that is not banned by the Chemical Weapons Convention. In May 1997 President Yeltsin signed a federal law on the destruction of chemical weapons, but this is unlikely to happen in the near future for political and practical reasons.

There are however hundreds of launchers and thousands of Scud and SS-21 SRBM's. Ukraine continues to manufacture some of the guidance and control components used in current Russian ICBM's and SLBM's. It also has the infrastructure to design, develop, and produce both liquid and solid propellant ICBM's and space launch vehicles and related components. Belarus produces the chassis for road mobile missile launchers.

**Table - 7.5**

<table>
<thead>
<tr>
<th>Type</th>
<th>No</th>
<th>YoD</th>
<th>Range(km)</th>
<th>Warheads</th>
<th>W x Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bombers</td>
<td>70</td>
<td>1984-87</td>
<td>11-12,800</td>
<td>806</td>
<td></td>
</tr>
<tr>
<td>(Tu95M,Tu-160)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ICBM</td>
<td>180</td>
<td>1979</td>
<td>11,000</td>
<td>1800</td>
<td>10x550/750kT</td>
</tr>
<tr>
<td>SS-18</td>
<td>165</td>
<td>1980</td>
<td>10,000</td>
<td>990</td>
<td>6x550kT</td>
</tr>
</tbody>
</table>

65 "Proliferation: Threat and Response" Office of the Secretary of Defense, November 1997. According to these sources, destruction of the stockpile may cost the equivalent of $5 billion.

66 Ibid.p.45.
<table>
<thead>
<tr>
<th></th>
<th>36</th>
<th>1987</th>
<th>10,000</th>
<th>460</th>
<th>10x550kt</th>
</tr>
</thead>
<tbody>
<tr>
<td>SS-24</td>
<td>360</td>
<td>1985</td>
<td>10,500</td>
<td>360</td>
<td>1x550kt</td>
</tr>
<tr>
<td>SS-25</td>
<td>D</td>
<td>D</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Topol-M</td>
<td>D</td>
<td>D</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>751</td>
<td>1987</td>
<td>10,500</td>
<td>3610</td>
<td></td>
</tr>
<tr>
<td>SLBM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SS-N-18</td>
<td>192</td>
<td>1978</td>
<td>6500</td>
<td>576</td>
<td>3x500kt</td>
</tr>
<tr>
<td>SS-N-20</td>
<td>80</td>
<td>1983</td>
<td>8300</td>
<td>800</td>
<td>10x200kt</td>
</tr>
<tr>
<td>ss-N-23</td>
<td>112</td>
<td>1986</td>
<td>9000</td>
<td>448</td>
<td>4x100kt</td>
</tr>
<tr>
<td>TOTAL</td>
<td>384</td>
<td>1986</td>
<td>9000</td>
<td>1824</td>
<td></td>
</tr>
</tbody>
</table>

YoD – Year of Development  
WxY – Warheads x yield  
Source: Robert S. Norris "Worldwide Nuclear Deployments 1998"

The threat from Russia

As noted earlier there are three distinctive threats that are perceived from Russia - the “unsanctioned” used of Russia’s strategic arsenal by personnel within Russia, a nuclear response due to a “hair trigger response” and third, a deliberate or uncontrolled sales of missiles and related technology to countries that are “suspect” states.

Quoting from a “secret” report of the CIA, the Washington Times noted that “The Russian nuclear command and control system is being subjected to stresses it was not designed to withstand as a result of wrenching social changes, economic hardship, and malaise within the armed forces...” It noted that “command posts of the Strategic Rocket Forces(SRF), the service in charge of nuclear missiles, and other units below the level of the general staff have the technical ability to launch without authorization of political leaders or the general staff. Controls over tactical nuclear arms - the battlefield nuclear arms and nuclear torpedoes - are also assessed to be poor. These appear to be the weapons most at
risk. Nuclear submarine crews in particular appear to have an autonomous launch capability for tactical nuclear weapons, it noted, that may extend to strategic weapons as well. It also notes that while only the President and the Defense Minister have the nuclear briefcases, the conservative Russian general staff had the final authority to either launch a pre-emptive nuclear attack during an international crisis. Such a crisis might be triggered by a severe political crises, which would exacerbate the divisions and factionalization within the military, and even splitting the nuclear commands. However, at present there is little to justify such a scenario. Moreover it is difficult to see how NATO perceives a military threat from an internal use of nuclear weapons within Russia.

On the other hand, it might well be argued that a "short fuse" of Russian reaction could be aggravated by the almost total loss of her early warning system that was once operational around the Soviet border. This was particularly evident when the launch of a Norwegian weather rocket in January 1995 triggered a tactical warning report that automatically activated President Yeltsin's "cheget" (or the nuclear briefcase). However, even this threat reduces as the reality of Russian nuclear weapons is considered. With a vastly reduced arsenal as outlined above, and two threats – NATO and China – on both sides, Russia's remaining nuclear arsenal would seem to be purely defensive. US Governmental sources seem to tell a different story. Ambassador Robert E. Hunter, Permanent

U.S Representative to NATO at a press conference noted that members of the military who had visited Russian strategic rocket forces bases had been impressed by the tight security there, though the question of tactical nuclear weapons continued to be uncertain. It is this aspect that is sought to be reduced by the sharing of early warning data with Russia, as well as an ongoing effort by the US to keep Russia abreast of all NATO exercises, as well as joint space co-operation.

The third aspect however appears to be more realistic. Reports do seem to indicate that Russia has a certain "Proliferation strategy". Analysts note a newly invigorated push by Russia to increase exports, with the Ministry of Industry and Trade superseding players like Glavkosmos and Minatom. Also apparent is a return to "statism" evident in the struggle for control over the Rosvooruzheniiye, the state arms exporter. The Ministry of Defense had submitted a strategic plan to set up its own commercial venture and take a cut from arms exports. The pressure for increasing military exports was also evident with the Russian Union of Industrialists and Entrepreneurs asking for "targeted loans" (that is, direct state subsidies) for high tech exports including weapons exports. Lastly, the Russian armed forces faces an imminent block obsolescence of the weapons it now has, with no relief in sight without exports to countries like Iran and China.


At a lower level, regional governors are strong supporters of the export policy to fund factories and keep workers employed. Indeed whole factories are run for export only. Thus factories or arms companies often offer to the buyer weapons that are yet to reach the Russian arsenal. For instance, Russia now offers missiles for its S-300PMU (a hot item since it has no likeness in the western camp) which are designed to give users a four fold increased in the number of missiles that can be employed by the system. The former Director of Rosvooruzheniya was (not surprisingly) calling for increased exports, that would assist Russia in regaining her lost status- especially in those countries where she had once had a strategic presence. Thus Russian exports have been reinvigorated to India and Iran.

Russian exports to China (addressed at the beginning of this chapter) does indicate a willingness to hand over some of the latest weapons in the Russian arsenal. This may however indicate a mix of a need for profit, as well as a possibility of keeping a leverage of a power that may emerge as a future threat. This is not unlike what the US herself appears to follow to allow national R&D to prosper and as an analyst notes, allows the US "to perpetuate other states" backwardness and dependence upon us.\(^{72}\)

\(^{70}\) This includes the 9m96E and 9m96E2. Nezavisimaya Gazeta (Moscow), July 22, 1998 in fbis-sov-98-222, August 13, 1998


This is supported by the utterances of leading politicians like Prime Minister Primakov who said that increasing arms exports would be a priority. The charge that Russian arms exports are directly controlled from very high level sources appears to be substantiated in a few cases – notably that of the gyroscopes and accelerometers that were found on their way to Iraq (See Chapter-5). After initially denying that the gyros were Russian (in spite of serial numbers) the sale was acknowledged and a criminal investigation initiated on April 9, 1989. Two years later the case was abandoned, on the plea that the gyros had been sold as scrap metal. Other cases are the seizure of 21 tons of maraging steel in Azerbaijan on its way to Iran, on March 6, 1998. The companies concerned, Inor and Yevorplas 2000 and MOSO said that the steel was used for myriad other uses, and in any case they had clearance from authorities. In April 1998, a New York Times article reported that the Grafit State Scientific Research Institute which had developed graphite based materials and composites used in ballistic missiles and the nose cone of the Buran space vehicle, had attempted to ship this to Iran, a shipment which was intercepted in Austria. In May 1997, a report noted that the Russian Central Aerohydodynamic (TsAGI) and Rosvooruzheniye had (the Russian export company) had signed a contract to construct a wind tunnel and related facilities for the Iranian missile program, and that The Irno

Production Association had agreed to supply manufacturing equipment as well as missile components and special materials in the same $150,000 contract. This was denied by the Russians, though there were continued allegations that high officials in the arms export agency and the Space Agency had been involved in the deal\textsuperscript{75}. The following table however underlines that few of these deals have actually been intercepted.

<table>
<thead>
<tr>
<th>Category</th>
<th>Status</th>
<th>Export</th>
<th>Manufacturer</th>
<th>Exporter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Materials and Components</td>
<td>Intercepted</td>
<td>21 tons of maraging steel</td>
<td>Suspected INOR</td>
<td>MOSO Yevropalas 2000</td>
</tr>
<tr>
<td></td>
<td>Intercepted</td>
<td>Composites for warheads (To Iraq)</td>
<td>NII Grafit</td>
<td>NK</td>
</tr>
<tr>
<td></td>
<td>Intercepted</td>
<td>Gyroscopes (To Iraq)</td>
<td>Mars Rotor Plant, Research and Testing Institute of Chemical and construction Equipment (NIikhSM)</td>
<td>Ilicit</td>
</tr>
<tr>
<td>Alleged</td>
<td>Guidance system manufacturing equipment, technology transfer of two types of liquid propellant missile engines, complete rocket engine, and designs for a propulsion system for a communication satellite</td>
<td>Energomash Mars Rotor Plant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cancelled</td>
<td>Turbopumps for RD 214 rocket engines (To Iran)</td>
<td>Samara State Scientific and Production Enterprise, NK Engines</td>
<td>Samara state scientific and production Enterprise-NK Engines</td>
<td></td>
</tr>
<tr>
<td>Alleged</td>
<td>Components for RD-214 (to Iran)</td>
<td>NPO Trud and Energomash</td>
<td>Unknown</td>
<td></td>
</tr>
<tr>
<td>Alleged</td>
<td>Missile components</td>
<td>Polyus Scientific research Institute</td>
<td>Unknown</td>
<td></td>
</tr>
<tr>
<td>Alleged</td>
<td>620kg special alloys and foils</td>
<td>Inor</td>
<td>Rosvooruzhniye</td>
<td></td>
</tr>
<tr>
<td>Alleged</td>
<td>Wind tunnel and related facilities</td>
<td>TsAGI</td>
<td>As above</td>
<td></td>
</tr>
</tbody>
</table>


\textsuperscript{75} Fred Wehling "Russian Nuclear and Missile Exports to Iran" *Non Proliferation Review*, Winter 1999, pp134-143.
Another worry that is being aired in western circles is that Russia has produced a new version of the Scud with a range of 300km and far more accurate than its predecessors. According to a *Jane’s Defence Weekly* the new version of the 1950’s classic missile can also carry submunitions to saturate a target areas. It is also unclear why Russia would again want a short range missile in the new scenario, unless it is seen as a hedge against NATO expansion. Another charge is that the SS-21 was for a while available for $1.7 million per missile and $3.3 million for its launcher to anyone with the cash.

At another level are the charges of “loose nukes” or the covert diversion of the former arsenal. James E. Goodby of Stanford University noted at least three well known cases of smuggling, which he cites. One involved a chemical engineer from the Luch Scientific plant at Podolsk, who over time smuggled a little over 3.7 pounds of 90% enriched uranium. Goodby notes that a 100 pounds could make a simple bomb, possibly less for the technical man. A second instance was that of a Russian naval officer who stole three pieces of naval reactor fuel from a storage facility near Murmansk, Russia which had no real security to speak of. The officer was caught trying to sell 10 pounds of 20% enriched uranium for a price of $50,000. A third incident of theft involved a Czech nuclear scientist, a

---


Russian and a Belarussian citizen. This seemed to point to first, an "insider" threat. Second, the thieves had been driven by nothing more than greed or privation. Fourth, the range of possible routes were so vast as to make it possible to pass on the material to any customer to the south, east or west. However as the author notes, there was no case of an attempted smuggling of a warhead, and the quantities smuggled were extremely small. As Indian analyst K. Subramanyam notes, nuclear smuggling has always carried on, sometimes for heating purposes, and other myriad uses. This fringe market however, is yet to be exploited by any country with a serious nuclear programme.

The United States

There is little doubt that while on the one hand the US sought to keep proliferation under tight controls, this was fine tuned by strategic interests. As previous chapters brought out, the US implicitly allowed the passing of nuclear materials and know how to Israel, and later ignored the Pakistani nuclear programme to retain that country as a strategic partner in the fight against the Soviets in Afghanistan.

At another level it can be argued that the very stationing of nuclear weapons and missiles in Europe was the biggest single step in proliferation in terms of scale. While this was propounded as the one way to make Europeans (especially Germans) stay non nuclear, however there is little to

show that these countries did not singly still attempt to make their own nuclear weapons. Previous chapters noted that Sweden and Switzerland went on with their nuclear programmes for many years in spite of being NPT signatories. Germany and France had got together to plan a covert nuclear cooperation programme, which fizzled out more due to the French reluctance than any lack of interest by the Germans at the time. The French Israeli cooperation of the 1950's is another example of the "proliferation effects" of a restrictive export policy combined with a complete reliance on these weapons in war strategy.

However, the US has assisted proliferation on a more "traditional" scale as well. Being the nodal centre for scientific research into missilery, it was but natural that the US would be the target of those proliferant countries willing to bend the rules to get what they wanted.

On November 22, 1990 the New York Times published an article headlined "Chinese Atom Arms Spying in U.S Reported. It alleged that Chinese intelligence agents succeeded in stealing nuclear weapons secrets from the government's Lawrence Livermore National Laboratory in the 1980's, data which had been used by the Chinese to construct a nuclear device identified in some published accounts as an experimental neutron bomb. This bomb was said to have been detonated in September 1988. The suspect was a Taiwan born American scientist working at Los Alamos, and was fired but never arrested due to a lack of hard evidence.

The story did not pick up in the media, and the issue apparently died there. The *Wall Street Journal* picking up the same article nearly a decade later, noted that in the mid 1980's Peter Lee, another Taiwan born scientist working at Los Alamos, had "passed classified information to China about laser technology. The lasers according to officials could be used to simulate nuclear explosions for either weapons design or stockpile maintenance.\(^{80}\)

In 1998, another story published the results of a House Panel investigation.\(^{81}\) This noted that the subcommittee investigated charges that China had bolstered its satellite launching capabilities through the acquisition of sensitive U.S technologies. Follow on stories noted that the House Panel, chaired by California republican Christopher Cox had also noted allegations that China had obtained "secret Design information" on the W88 warheads and that the FBI (Federal Bureau of Investigation) was conducting an investigation into the matter. The article noted "there is considerable debate about how much information was passed to Beijing. IT appears however, that China did not get any equipment, blueprints or advanced designs. Instead, officials believe, China was given general, but still highly secret, information about the warhead's weight, size and explosive power, and its state of the art internal configuration, which allowed designers to minimize size and weight without losing power.\(^{82}\)


\(^{82}\) Ibid.
Later reports however noted that senior nuclear weapons experts at Los Alamos had detected "eerie similarities" between the latest Chinese and US bomb designs and it was alleged that Beijing had tested a smaller and more lethal nuclear device configured remarkably like the W88\(^{83}\). The W88 is the United States most advanced miniature nuclear warheads, and it sits atop the Trident II SLBM. Later reports noted that the W88 was to be placed on a new truck based mobile missile that my be operational in three or four years and would be able to reach the western regions of the US\(^ {84}\).

Following this, the FBI (Federal Investigation Bureau) launched an investigation into all those with access to the W88 designs, and reportedly narrowed it down to five possible suspects including Wen ho Lee, a Chinese American computer scientist. In April 1996, the DOE (Department of Energy, is said to have briefed CIA officials and National Security Advisor Sandy Berger for the first time on the theft of the W88. However the investigation appears to have faltered, and in April 1997, the FBI is said to have issued a report on improving security at the nuclear weapons labs. They also briefed National Security Advisor and noted that "there was evident of several other Chinese espionage operations that were still under way inside the weapons labs\(^{85}\). Lee was subsequently fired from the labs on March 8, 1999.


In another case, in 1993, the China National Aero Technology Import and Export Corporation (CATIC), a branch of the military, had decided to acquire an entire military aircraft plant from the firm MacDonnell Douglas which was facing financial extinction. Beijing demanded that the defense contractor throw in the plant as a condition of finalizing the $1.9 billion deal to manufacture 40 planes in China. It was agreed to sell the plant for $5.4 million. The Commerce Department allegedly rejected the protests of military and intelligence analysts and cleared the sale with stipulations that the machines could not be used for military production. Eventually McDonnell Douglas discovered that six of the machines had not been sent to the agreed upon plant in Beijing but 800 miles away to the Nanchang Aircraft Co.-a facility used to manufacture Silkworm cruise missiles.86

Most of this information came out at a time of Presidential elections, and this (it was alleged) was a reason why the Clinton Administration failed to act87. It was also alleged that large funds had been channeled to the party by sources within China. The most publicized case was that of the Liu Chaoying, daughter of Gen. Liu Huaqing, China’s most senior general and one of the seven members of China’s all powerful ruling party standing committee, who was said to have channeled over $35,000 to the Democrats political campaigns. This money is said to have come from

87 This allegation was made by most analysts as well as a Senate Republican Policy Committee See Wall Street Journal, editorial, 11 March 1999. Also see United States Senate Republican Policy Committee, "China’s Theft of U.S Nuclear Secrets: The Public Record" March 12, 1999. http://www.Senate.gov
Chinese military intelligence. In turn it appears that Liu's company called Casil, a company owned by Chinese Aerospace Ministry with some 80 subsidiaries and joint ventures had benefited from these deals. Casil had been set up in 1975 to acquire and sell rocket systems. It is alleged that two US firms, Loral Space and communication Ltd. And Hughes Electronics Corporation might have shared sensitive military information with China after a failed satellite launch that resulted in a crash and the destruction of the satellite in 1996. Engineers from Loral, assisted by engineers from Hughes Electronics, "charged forward" to correct the problems in the Long March satellite launchers, thus improving the capability of the Dong Feng series as well. A report of the senate subcommittee on proliferation noted that the kind of space technology that China acquired from the US was just what was needed to make an ICBM-stage coupling for extended range, accurate guidance, and system integration. That serious breaches had occurred was also confirmed by the National Air Intelligence Centre.

More serious in this was the role of the CIA (Central Intelligence Agency). The Agency was found to have close links to Hughes, and had leaked information on the scope of the impending Senate Select Committee investigation, enabling the company to anticipate the moves of congressional investigators. The firm, while one of the trusted contractors

---


of the US intelligence community, has had intimate ties with the CIA for
decades, and clearly it had much to profit in using Chinese launchers,
which charges less than a fourth of major western launching firms.

The Administration reacted by pleading the need to keep China
"engaged" in the effort to contain proliferation. John Holum, Acting
Undersecretary of State for Arms Control and International Security, noted
that while the South Asian tests and Iran's missile tests underlined the
"looming threat " of non proliferation, it merely showed that China was
indispensable to effective nonproliferation policy. He also noted
"Unquestionably China has been part of the proliferation problem...
and went on to outline the assistance to Pakistan's nuclear weapons
programme. He noted that the tools for getting China to stop proliferation
included incentives as well as sanctions. He also noted that the commercial
satellite business had been removed from the ITAR list (International Traffic
in Arms Regulations) which contains the US Munitions List. This change
had been approved by the previous administrations following the insertion
by Congress for loosening the list. However, other allegations of Chinese
access to US technology continued.

The Cox investigation led to a serious review of the testimony of
Gordon Oehler, former director of the CIA's Non proliferation centre. The

---

91 The specific performance characteristics such as an antenna capabilities, encryption
devices, and propulsion systems were outlined in Category XV of the Munitions List, which
would define which satellites would require approval by the US Department of
Commerce or by the U. S Munitions List. Testimony of the Honorable John D. Holum, acting
Undersecretary of State for Arms Control and International Security Affairs before
http://www.usoia.gov

364
Senate Sub-Committee heard Mr Oehler, who noted "There's no question in my mind, that China sold 34 M-11 missiles to Pakistan in November 1992" but that "intelligence analysts were very discouraged to see their work was regularly dismissed." It was alleged that the Clinton Administration, had held back from sanctions for fear of damaging US-Chinese trade. Later China was offered financial incentives and more US satellite launches, if China would vigorously inspect exports of missile components, production technology and machinery used to maintain or upgrade missile parts. In short, follow the export control lists of the MTCR. However, the answer was "a flat no" leading to a decision not to include it during the Presidents visit to Beijing.

The most spectacular instance of the leakage of technology was discovered in April 1999. It was reported that Me Wen ho Lee had transferred not just the details of the W88 warhead but also transferred huge amounts of secret data from a computer system at Los Alamos compromising virtually every nuclear weapon in the US arsenal. This was done in 1994 and 1995. American officials said that this was useful to any nuclear power trying to replicate the Us atomic designs. This was discovered after Mr Lee was fired, and when they examined his office computer. Apparently, the data had been sent even as investigations on Mr Lee were ongoing. The information transferred were what is called "legacy

---


codes. According to John Browne, Director of Los Alamos, the codes consist of computer data used to design nuclear weapons, analyze test results and evaluate weapons materials and the safety characteristics of America's nuclear warheads. The legacy codes can be used as tools to help design nuclear weapons through computer simulation and are thus valuable on their own. But they become more valuable when combined with specific performance data, which would then enable someone to generate a computer simulation of American warhead designs. Mr Lee transferred both the legacy codes as well as specific performance data which was akin to a "scientific blueprint". This would be particularly useful to a country that had signed on to the test ban, and would provide valuable information for computer simulation. Most of Mr Lee's transfers occurred just before China signed the CTBT.

While the progress of events is fairly clear, less apparent was the reason why the investigation that had been ongoing since 1995 was stalled in 1997. The Department of Justice declined an FBI request to seek court approval to gain surreptitious access to Mr. Lee's office computer, while a request for a wire tap was similarly rejected. Ms Janet Reno, head of the Justice Department is accused of having been obstructive to attempts by the FBI to increase surveillance on Mr. Lee. The Washington Post noted that the warning on the W88 warhead had come at a time when

the administration was on the verge of the 1997 "strategic partnership" summit with Beijing. It was also facing congressional investigations into campaign funds.\textsuperscript{96}

Other accusations of Chinese access to American technology include that of high performance computers. A study quoted by a prominent analyst noted that the Commerce Department approved more than $154 billion worth of strategically sensitive equipment to China. This "dual use" equipment went to directly to nuclear missile and military sites. More than half this figure consisted of super computers which would allow that country to process the American nuclear codes and simulate the workings of US arsenal. The list of other exports include\textsuperscript{97}

- Equipment for uranium prospecting, which was sold to China's National Nuclear Corporation, by a California company. This technology was allegedly transferred to Iran.

- The China Precision Machinery Import - Export Corporation was allowed to buy a computer system useful for simulating wind effects.

- The Chinese Academy of Sciences was allowed to buy equipment from the Convex Computer Corporations for processing data from an experimental fusion reactor. This was also later exported to Iran.

- Other beneficiaries includes National University of Defense Technology, The University of Electronic Science and Technology (which in involved


\textsuperscript{97} The following is based on an alleged list of items that is given by Gary Milhollin "What China Didn't Need to Steal" \textit{New York Times} May 5, 1999.
in stealth technology) the Beijing University of Astronautics, (missile navigation, flight dynamic, and guidance)

- $241 million worth of machinery for making semiconductors that can go into missiles

- $131 million worth of high speed oscilloscopes which can record data from a nuclear test

- $111 million of precision machine tools

- $5.4 million of vibration testing equipment which enable testing of missile to handle shock, impact and rapid acceleration.

- An American scientist working for a defense contractor is reported to have sold information for an advanced radar being developed to detect submarines. Peter Lee, was not prosecuted because the Navy refused to let prosecutors disclose information about the technology in court98.

Apart from this, reports allege that the Chinese have been issuing bonds in the US to facilitate their funding. More than $6billion worth of bonds have been issued in recent years, with the CITIC (China International Trust and Investment Corp.) heavily involved. (CITIC chairman Wang Jun was once involved in an operation to sell $4million worth of AK-47 to California street gangs). Financial institutions are used also, according to the analyst, by intelligence agencies for a variety of purposes99.

99 Peter Schweizer "You, Too may be Funding China's Army" USA Today May 14, 1997.
Clearly the incentives to proliferation and technology theft is considerable, since it yields the individual profit, and the recipient country considerable time gained and money saved. Espionage in such areas is hardly new, with stories of the Soviet and CIA spying into each others secrets now the stuff of legend. However, this technology spill naturally occurs the most frequently from the technologically superior states to the lesser endowed ones, a process as logical as it is inevitable.

Of the four reviewed here, two (Russia and the US) are major exporters of technology, and arms, and have had these relationship’s for strategic gain. China is a major “absorber” of technology from these two powers, and in turn disseminates it to various others for profit or power. Being a missile developer in her own right, her graph of capability has been low, with the country preferring to slowly indigenize technology, than go in for quick fixes. North Korea is clearly both a missile developer and again a limited absorber of technology. In that, if China receives technology that is considered obsolete in the US, she herself will pass on what is considered of limited strategic value only. North Korea therefore has to look elsewhere for more recent technology, as well as materials, scientific talent etc. This may account for the inputs from Ukraine and perhaps Russia though there is clearly a highly skilled and motivated work force in Pyongyang. Lacking the industrial and technological base that China has, Pyongyang’s missile prowess may remain shaky, and prone to sanctions. However, being a a clear actor in a sellers market in missilery enables the foreign exchange to flow in – which in turn sustains the programme.
The "capabilities" sections highlighted that for China and North Korea, much of the spiral of development has been speeded up by foreign technology inputs. For China these have come alternately from the US or Russia, and though there has been no sudden jump in capability (as in the North Korean case) yet the rise has been slow but steady to the level where they are now. North Korea's however has been relatively more spectacular, making a new missile apparently once in every three years.

Russia and the US may both have a proliferation strategy. However lacking any concrete information (and the overabundance of allegations and suspicions) there it little to go by except past practise. In this, the picture is far from reassuring. As previous chapters have brought out, the US has either overlooked, assisted or connived actively in the nuclear and missile programmes of Israel, France, UK, and Pakistan. The motivation here has been strategic, with the profit factor perhaps an added factor. The possibility therefore that China has received such "aid" cannot be ruled out. Russia may also be ruled by the same motives, though it must be admitted that very little can be said of the priorities of that country given the

100 Apart from the historical factor, it now emerges that the US and France are currently trying to negotiate an agreement (for example) under which the two sides will begin to share sensitive computer codes that describe how bombs behave when they are detonated. The US has quietly offered France sophisticated facilities that are in the cold testing business, and that of weapon research. That this has occurred at the same time as the CTBT was being negotiated adds to the assessment that this overarching objective led the US to allow a degree of technology liberalization to both China and France. In addition France is also building a mammoth $4 billion laser facility near Bordeaux for weapons related research – said to be nine stories high and the size of three football fields – with the assistance of a scientist from Lawrence Livermore. DoD officials say that this is basically limited to ensuring safety of the French arsenal. William Drozdiak and R. Jeffrey Smith US Closely Linked to French Nuclear Weapons Development", Washington Post, http://www-tech.mit.edu
multiplicity of command and control centres overall, and the actors involved. The following figure outlines the patterns of proliferation. Here it is clear that "satellite" states while receiving technology have in turn passed it on to their allies for gain. While the gap between the US and China may be considerable (in that at present China is fielding largely 1960's technology) the gap between Chinese and North Korea technical capability is considerably less, but prone to delay and perhaps a complete stoppage if patrons refuse to oblige. The third tier countries are almost completely dependant on the process of a continued flow of technology and the continued working of this cycle.

FiG - 7.2
The Proliferation Cycle

In the above figure, the dotted lines represent the second tier transfers to third countries. It is also acknowledged that there are a great many more transfers than that picture above. But the figure only takes into account the largest or the most dramatic transfers of technology.