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The Israeli "Nuclear Reactor Strike" and Syrian Weapons of Mass Destruction:

A Background Analysis

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Please note that this document is a working draft and will be revised regularly. To comment, or to provide suggestions and corrections, please e-mail the author at acordesman@aol.com**.**

The circumstances surrounding an Israeli strike on what may have been a Syrian nuclear reactor are still unclear. It is not yet certain that Syria was building a reactor, and if it were, what capacity it would have for producing fissile material, when it might have produced enough material for a weapon, and how Syria planned to deploy any nuclear capability it developed. Major questions remain about the level of North Korean support Syria did or did not receive, and about the level of Syrian-Iranian cooperation if any.

There are, however, several things that are clear about Syria’s position, and that put any Syrian nuclear efforts in context. In brief:

- Syria has fallen far behind Israel in conventional capability and has no practical chance of catching up.
- Syrian capabilities for asymmetric warfare, and the its ability to use allies like the Hezbollah, can irritate or provoke Israel, but not defeat it or deter it from using its massive supremacy in long-range precision strike capability.
- Syrian chemical and possible biological capabilities do not give it a meaningful deterrent to Israel, do not rival Israel’s status as a nuclear power, and might do more to justify an Israeli use of nuclear weapons in retaliation than achieve strategic benefits.
- The Syrian air force is approaching obsolescence as a force. Although Syria has some “modern aircraft,” it lacks the mix of airborne and ground-based sensor and battle management assets, the mix of munitions, IS&R assets, and sortie sustainability it needs to compete. It faces de facto air supremacy from the Israeli air force.

- Missiles are Syria’s only way of striking at Israel with some confidence of success, but Syria still faces steadily more effective Israeli ballistic missile defenses, plus Israeli ability to target and destroy Syria’s larger missile systems with Israel’s precision strike assets.

Seen from this perspective, a Syrian effort to achieve a “break out” by covertly developing nuclear weapons has a kind of logic. It would provide Syria with the status it now lacks, and a potential level of ultimate deterrence that its existing weapons of mass destruction cannot provide. It would give the Syrian regime greater status, and at least symbolically compensate for Syria’s growing inferiority in conventional warfighting capability. Syria might at least possibly see nuclear status as a major negotiating lever making Israel more willing to give up the Golan.

At the same time, some aspects of such a Syrian effort raise serious questions as to whether Syria really could have believed such an effort would succeed, and felt it could benefit from the end result if it did. A surface-built reactor could not be kept secret over time. Israel would certainly have acquired knowledge of the Syrian program long before a reactor was completed and could start producing fissile material. This raises serious questions as to why Syria would have taken the risk of building a light water reactor above ground and especially in a structure that seems to have been similar to North Korean designs. Such actions were almost an invitation to Israel to strike.

Political symbolism is one thing. Warfighting is another. Like Iran, Syria is much bigger than Israel. Like Iran, however, its population is hyperurbanized and at least as vulnerable as Israel’s. Syria’s leadership and economy is heavily concentrated in a small number of targets. Syria would probably only have fission weapons versus Israel’s “boosted” and probable thermonuclear weapons, and Israel could probably inflict at least an order of magnitude more damage on Syria with each nuclear strike.

It seems almost certain that it would take Syria half a decade or more of effort to build up a survivable nuclear-armed missile force. It would be highly vulnerable in the process, and then would still be much more vulnerable than Israel in any countervalue exchange in spite of the different size of the two countries. Israel would also retain a major conventional counterforce strike capability, even if it did not preempt Syria.

Syrian Arms Poverty

Figure One and **Figure Two** show that Syria has fallen far behind Israel and its neighbors in conventional arms transfers. These figures are particularly striking because Syria has only a very weak military industrial base, and Israel has one of the most advanced military development and production facilities in the world. They help explain why Syria’s air force and ground-based air defense systems are numerically strong, but qualitatively obsolete, and why the Syrian Army may have large numbers of weapons but is a largely defensive garrison army that must rely on mass as substitute for force quality.

There have been reports for nearly two decades that this would change because of major Russian arms deliveries. So far, the limited transfers of modern weapons that have occurred have been largely anti-tank guided weapons and short-range surface-to-air missile systems. These have not begun to compensate for the aging and near obsolescence of most of Syria’s force structure. Accordingly, Syria *may* have seen a nuclear program as a compensation for its conventional weakness.

Syrian Efforts to Compensate

Syria has, however, made other efforts to minimize the risk of a future military clash with Israel, and shifts its strategy and procurement effort ways that would include a new focus on “asymmetric warfare” These shifts have been be based on force changes that would: [12]

- Emphasize the procurement of long-range ballistic missiles and weapons of mass destruction as a relatively low cost offset to Israel’s conventional superiority while giving Syria a limited counterweight to Israel’s nuclear strike capability. There are allegations that Syria is working with Iran to achieve chemical warfare capabilities although there has been no mention of nuclear capability acquisitions. [3]
- Give priority to elite commando and Special Forces units that can be used to defend key approaches to Syria and spearhead infiltrations and attacks. Many of these forces are equipped with modern anti-tank guided weapons and other modern crew and manportable weapons that allow them to disperse without relying on armored weapons and other systems Israel can target more easily. They are supported by attack helicopters. There has been no real change in the number of attack helicopters since 2000.[4] Air Defense and Anti-Tank missile capabilities have increased continuously since 2000.[5]
- Maintain a large tank force both as a deterrent to any Israeli attempt to penetrate Syria and to maintain a constant threat to the Golan, even if Syria had no hope of achieving overall parity.

- Use Hezbollah and Amal as proxies to attack Israel, (there is no South Lebanon Army anymore and it was disbanded after the Israeli pullout when the SLA leadership and others fled to Israel) the Golan Heights, and the Sheba Farms area. Following the October 5, 2003 bombing of a suspected Islamic Jihad training camp near Damascus by Israel, it was speculated that the Golan Heights in particular could become a new battleground. However, critics of such a view argue that it would be very difficult for Syria to establish a credible resistance movement among the Syrians in the Golan Heights, mostly the Druze, since they have faced little repression. Some Druze serve in the IDF. They contend that attacks on the Sheba area by Hezbollah are much more likely.

The remarkable successes achieved by Hezbollah during last summer's war against the Israeli Defense Forces had confirmed to the Syrian military that adopting asymmetric, unconventional warfare techniques could allow them to compensate for a clear deficit in conventional military power relative to the Israelis. The vulnerability shown by the IDF when confronted with "irregular warfare" techniques seems to have reduced its reputation for having a clear military advantage over its Arab adversaries.

The *Jerusalem Post* quoted a top Syrian official declaring that, "For years we thought that the IDF had a clear upper hand over Syria's military… After the war in Lebanon we now know that this assumption was not accurate."[6] The same idea was conveyed as well by a senior Israeli official who stated for *Jane's Defence Weekly* that, "The Syrians have carefully learned the lessons from Israel's 2006 fighting in Lebanon, primarily the effectiveness of advanced anti-tank weapons against Israeli armor and the limitations of the Israeli Air Force in suppressing rocket fire on the country's vulnerable civilian rear… It is clear that, while until a year ago the thought of confronting Israel militarily was unthinkable for Syria, today there are Syrians who toy with this possibility."[7]

Indeed, some of the most recent decisions taken by the Syrian military leaders point to the strong possibility of adopting "irregular," Hezbollah-like tactics in a future confrontation with Israel. Syria has recently established new commando units and is said to have increased urban and guerilla warfare training.[8] In addition to improving its capabilities in small-unit combat, Syria has also increasingly shifted its procurement priorities towards the kind of military equipment that proved valuable against the IDF in last summer's conflict. The Israeli strategic expert Ephrain Inbar remarked the recent strategic acumen of the Syrian military:

> Israel has absolute superiority in several fields in warfare… so Syria is investing in fields where it can have an edge. It has invested in recent years in anti-aircraft weapons, rockets, missiles and bunkers. The war in Lebanon proved to the Syrians that they were right to do so.[9]

In March 2007 the AFP quoted an Israeli military and government sources as saying that Syria has recently deployed "hundreds, possibly thousands" of medium and long-range rockets along the border with Israel, thus threatening major towns across northern Israel.[10] These massive deployments have led defense experts such as Inbar to suspect that "Assad could be preparing for low intensity war, a type of war of attrition with Israel, where Syria fires several rockets against Israel without provoking full-fledged war."[11]

The Syrian Modernization and Recapitalization Crisis

Although Syrian missile capabilities (anti-tank and air defense) have increased since 2000, there is little evidence to show that the increase has led to a qualitative improvement in Syrian forces. Syria has rather tended to mass and procure more of the

same. Syria has faced massive problems in recapitalizing its forces and modernization, which have grown worse in recent years rather than better. Its weapons systems and military equipment continue to age since there has been little procurement, even for the few areas Syria has modernized in the past, such as AD and AT missiles. There also has been a cut in foreign forces operating within Syria, with a remaining 150 Russian Army personnel at the final IISS count.[12]

For over two decades, Syria has had to cope with the recapitalization crisis reflected in Figures One and Two and its failure to acquire modern arms and military technology. Syria attempted to remedy some of its growing modernization problems by procuring upgrades and technology from Russia and the West, but Syria has not done well in obtaining such help.

Its only major conventional force improvements during the mid and late-1990s were some Ukrainian modifications for part of the T-55 tank fleet and AT-14 Kornet anti-tank guided missiles. Some reports indicate that the Syrian Armed Forces did acquire an additional 1500 Kornets as well as upgrade packages for up to a brigade of T-72 tanks. The upgrade will boost the T-72's armor while adding an attachment that would enable the tank to fire ATGMs.[13] Yet it is important to note that Syria tried four previous times to upgrade the T-72s with little success and past attempts to incorporate elements of the current upgrade package were met with great difficulty.

The Russian Connection

Syria has not yet succeeded in negotiating major new arms agreements with Russia and other suppliers. Western companies want firm cash guarantees and are reluctant to sell to Syria. China and North Korea cannot supply the quality of conventional arms Syria needs, and any purchase of equipment that does not come from Russia will create interoperability problems that will compound Syrian weaknesses in sustainability and combined arms.

Bulgaria, for example, could supply Syria with much of the Soviet-era replacement parts that it needs, as an illegal sale by a Bulgarian firm of 50 sets of gear boxes and engines for T-55s in 2001 illustrates, but the country had expressed its desire to join NATO. NATO clearly does not support the export of arms to Syria, and Bulgaria had launched an investigation into the sale of Soviet APC parts to Syria in 2003, culminating in at least six arrests. Bulgaria hopes to rid itself of the perception that it will sell arms to almost any group interested to support its flagging defense industry and thus is unlikely to continue or strengthen ties with Syria.[14]

Russia is Syria's most logical source of new advanced conventional arms, and there were reports during the early 1990s that indicated that Syria would be able to spend some USD1.4 billion on military modernization between 1992 and 1994. Syria found, however, that post-Communist Russia did not make concessionary arms sales that approached the level of gifts, or show the past tolerance for unpaid loans. This was a major stumbling block throughout the 1990s. Syria had piled up a massive debt over the years. It owed Russia roughly USD7-11 billion for past arms purchases, and a total of $20 billion for both its military and civil debt. Russia was well aware that there was little prospect that it would ever be paid and this had a chilling impact on Syria's ability to obtain arms. [15]

Russia and Syria have claimed to resolve the issue on several occasions. Syria signed a new cooperation agreement with Russia in April 1994, for "defensive weapons and spare parts." Syria held extensive new arms purchasing talks with Russia in 1997 and 1998. In February 1999, Syria announced plans to spend as much as USD2 billion on a range of Russian armaments, including more anti-tank systems – which seem to have included deliveries of more AT-14 Kornets.[16]

Syria and Russia held talks in May 1999 to discuss expanding military cooperation, and in particular to arrange the sale of Russian advanced weapons systems to Syria.[17] According to some reports, Russia now seemed willing to put repayments of its debt on hold.[18] A five-year, USD2 billion contract was under discussion.[19] According to one report, Syria apparently requested Su-27 fighters and the S-300 air defense system, but was offered the cheaper MiG-29 fighters and Tor-M1 air defense systems.[20]

Syria and Russia held new high level talks on military cooperation in September 1999. These talks seem to have again involved an USD 2-2.5 billion deal over five years, and the possible purchase of the S-300 surface-to-air missile defense system, the Sukhoi Su-27 multirole fighter, MiG-29SMT fighters, T-80 tanks, and more anti-tank weapons. Once again, however, the contractual status of such agreements, the weapons involved, and delivery schedules remained unclear.[21]

Progress was made in resolving the military debt issue in 2005. In a meeting between al-Assad and Russian Finance Minister Alexei Kudrin, Russia agreed to write off 73% of Syria's USD13.4bn debt, thus significantly reducing the Syrian foreign debt to less than 10% of its GDP and allowing it to allot more funding to weapon acquisitions.[22] In talks between the Syrians and the Russians in January 2005, the two countries were reported to have reached six cooperation agreements, one of them focusing on military issues.[23] In April 2005, Russia agreed to a $100 million contract to sell Strelets SA-18 surface-to-air missiles to Syria.[24]

Syria may also have gotten Russian agreement to accelerate its military acquisition programs. According to the testimony of Gen. Yossi Baidatz to the Knesset on June 5, 2007, Syria procured Pantsir-S1E and Tor-M1 air-defense systems and anti-tank guided weapons systems from Russia.[25] The purchase of 50 Pantsir-S1E self-propelled short-range gun and missile air-defense systems was first reported in May 2007 by *Jane's.*[26] The Pantsir-S1Es are to start delivery in 2007. They will be equipped with the latest Roman I-Band fire control radar, and will have a range of 12 km, more than double that of the Strelets (SA-18) that were acquired in 2005.

Syria has also sought to improve its anti-tank missile arsenal by purchasing the state-of-the-art 9M123 Khrizantema, which is a more sophisticated missile than the Kornet and Metis anti-tank weapons successfully used by Hezbollah.[27] In 2007, Syria signed a deal with Russia for the purchase of six aircraft simulators: three A-level integrated helicopter simulators and three Sukhoi Su-22/24 fighter-bomber simulators. [28]

On June 28, 2007, Russian Foreign Minister Sergei Lavrov was dispatched to Jerusalem to clarify Russia's position on arms sales to Syria. Lavrov stated that Russian arms sales to Syria were "absolutely in line with [Russia's] international obligations," and that any and all systems sold are "not destabilizing the balance [of power] in the region."

Lavrov's defense of Russian arms sales came amidst conflicting statements concerning the sale of MiG-31Es and MiG-29M/M2 fighters to unspecified Middle Eastern Countries. The Russian export agent Rosoboronexport (ROE) denied any such sales took place, but strikingly the Russian Federal Industry Agency Chairman Boris Alyoshin confirmed that there was a contract to supply upgraded MiG-31Es to a foreign customer. Meanwhile sources in New Delhi claimed that ROE was preparing to sell as many as 250 Sukhoi Su-30MKs to Iran, using Syria as a possible pass-through nation so as to provide Moscow with deniability; however, experts remain highly skeptical on this matter.[29]

There are also increased indications that Russia is seeking to bolster its strategic presence in the Mediterranean. Admiral Vladimir Masorin, Commander of the Russian Navy, commented that Russia intended to send a frigate to join NATO maritime forces in the Eastern Mediterranean in September. Russia was interested in both protecting existing energy supply routes and increasing its own influence as a regional energy supplier. This may signal a new and potentially destabilizing future role played by Russia in shaping the balance of power in the Middle East.

Some sources claim that upgrades to the infrastructure and defenses of the Syrian port of Tartus are geared towards facilitating a Russian Black Sea Fleet deployment to the Mediterranean. The Russian newspaper *Kommersant* cited unnamed Russian ministry of defense sources that claimed that Tartus would come under the protection of Russian long-range S-300PMU-2 Favorit SAM systems manned by Russian personnel. Tartus's proximity to the Turkish port of Ceyhan – the terminus for the Caspian Pipeline Consortium (CPC) oil pipeline, which was opposed by Russia – was not lost on observers of Russia's increasing strategic posturing in the Middle East. *Jane's* reported that some 2,000 Russian military personnel as being in Syria, training Syrian officers, along with the writing off of the majority of Syria's debt to Moscow, and Russia renewed interest in the Mediterranean, Russia's importance in the Israeli-Syrian military balance may need to be reevaluated.[30]

Recent Russian Arms Transfers

Russian sales to Syria have a somewhat similar pattern to Russian sales to Iran. In late November 2005 Russia and Iran signed a contract whereby Russia would supply Iran with the Tor-M1 (SA-15 "Gauntlet") SAM system to be delivered over the next two years.[31] Although Russia claims there was no need for Israel to worry, this sale may have put a strain on Russian-Israeli relations. The sale was completed in January of this year, despite US and Israeli objections. Moreover, the report in *Kommersant* regarding the sale of Mig-31s and Mig-29M/M2s was cause for great concern in Israel.

Another point of contention is possible Russian intention to sell Syria new Iskandar missiles, which would give Syria the ability to hit anywhere inside Israel save the southernmost areas, as well as the Igla manportable air-defense systems.[32] Putin agreed only to sell the vehicle-mounted 9K38 Igla (SA-18) low-altitude surface-to-air missiles to Syria but has not specified the number of missiles to be sold. Israel's concern about the transfer of weapons to Hezbollah or Palestinian insurgent groups continues, since the vehicle-mounted missiles could be dismantled and transferred to the individual militia groups.[33]

In August of 2006, *Jane's* reported that Syria received the first batches of the Kolomna KBM Strelets (Archer) multiple launch units for use with the 9M39 Igla (SA-18 “Grouse”) fire-and-forget SAM system. Strelets can be integrated on a variety of land, sea and air platforms, with the latter being helicopters for use in the air-to-air role. It can be used to update fully tracked systems such as SA-13 “Gopher”, and can also be fitted to towed anti-aircraft guns such as the ZSU-23-2 currently deployed by the Syrian Air Defence Command.[34]

The Igla and possibly the Iskandar sale were part of discussions to sell not only the missiles, but also dozens of AT-14 Kornet-E, AT-13 Metis, and possibly the Almaz S-300PMU medium-range low- to high-altitude SAM system.[35] Earlier in 2005, it was reported that Syria was interested in acquiring Iskander-E short-range ballistic missiles that has a range of 280 km. The Iskander-E is the export version of the Kolomna-designed 9M72 short-range ballistic missile currently in use in the Russian military.[36]

Continuing to Go “Hollow”

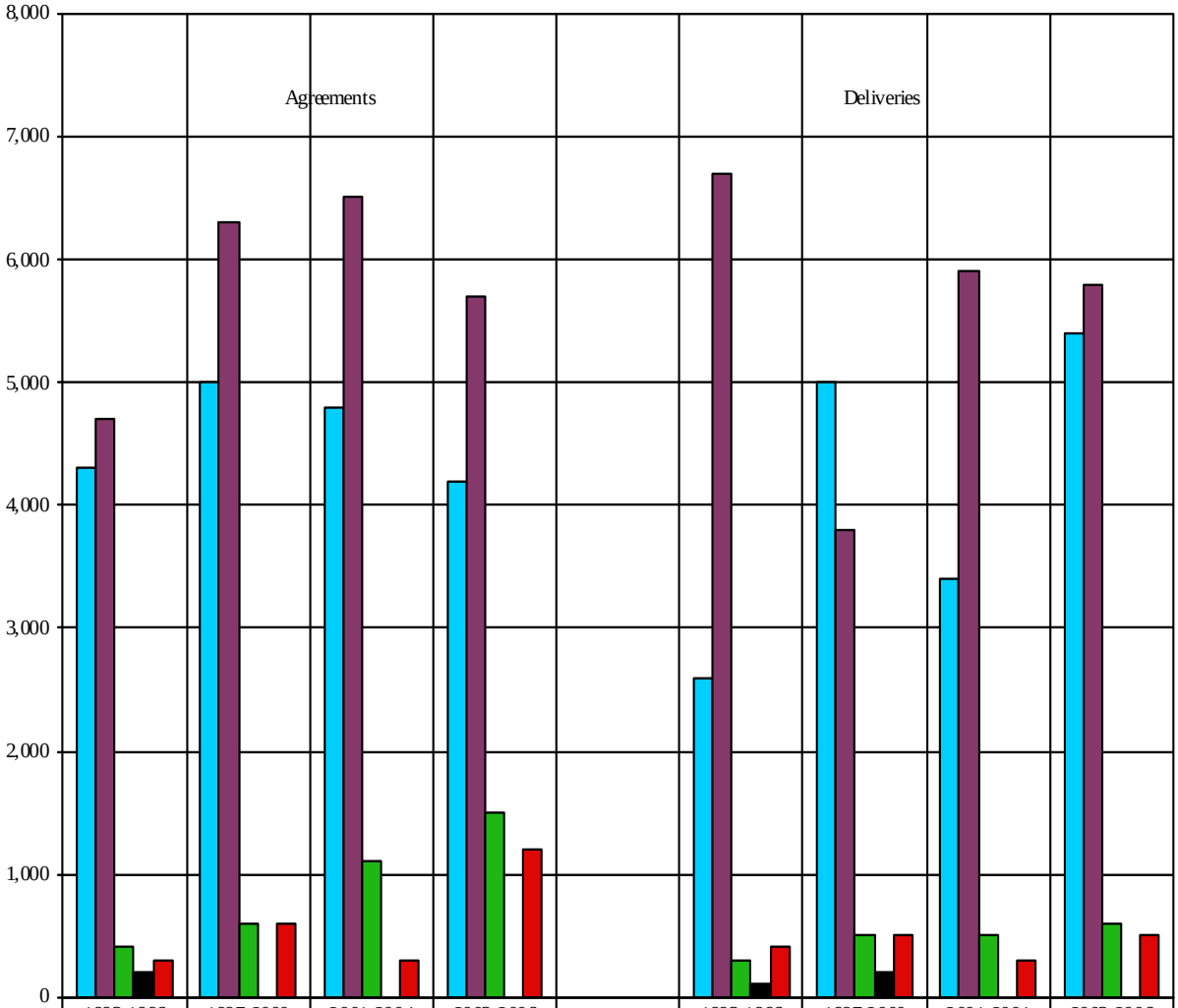
Barring massive outside aid, Syrian forces are almost certain to continue to go “hollow” for the foreseeable future, although moderate deliveries of advanced modern aircraft, tanks, and surface-to-air missile systems like the S-300 could still help correct key Syrian weaknesses. It is interesting to note that Syria has not yet invested or explored acquisitions for an integrated air defense system.[37]

Syria's limitations will be further compounded by its problems in absorbing new equipment. These include endemic corruption, a politicized and compartmented command structure, inadequate military pay, poor manpower management, poor technical training, and poor overall training - particularly in realistic combat exercises and aggressor training. Syrian forces have inadequate combat and service support, equipment for night and poor weather warfare, long-range sensors and targeting systems, and mobile rapidly maneuverable logistics, recording, and combat repair capability. While individual Syrian officers have shown an understanding of many of these problems, Syria has never taken effective action to deal with them.

Figure One

Arab and Israeli New Arms Agreements and Deliveries by Country: 1993-2004

(in $US Current Millions)



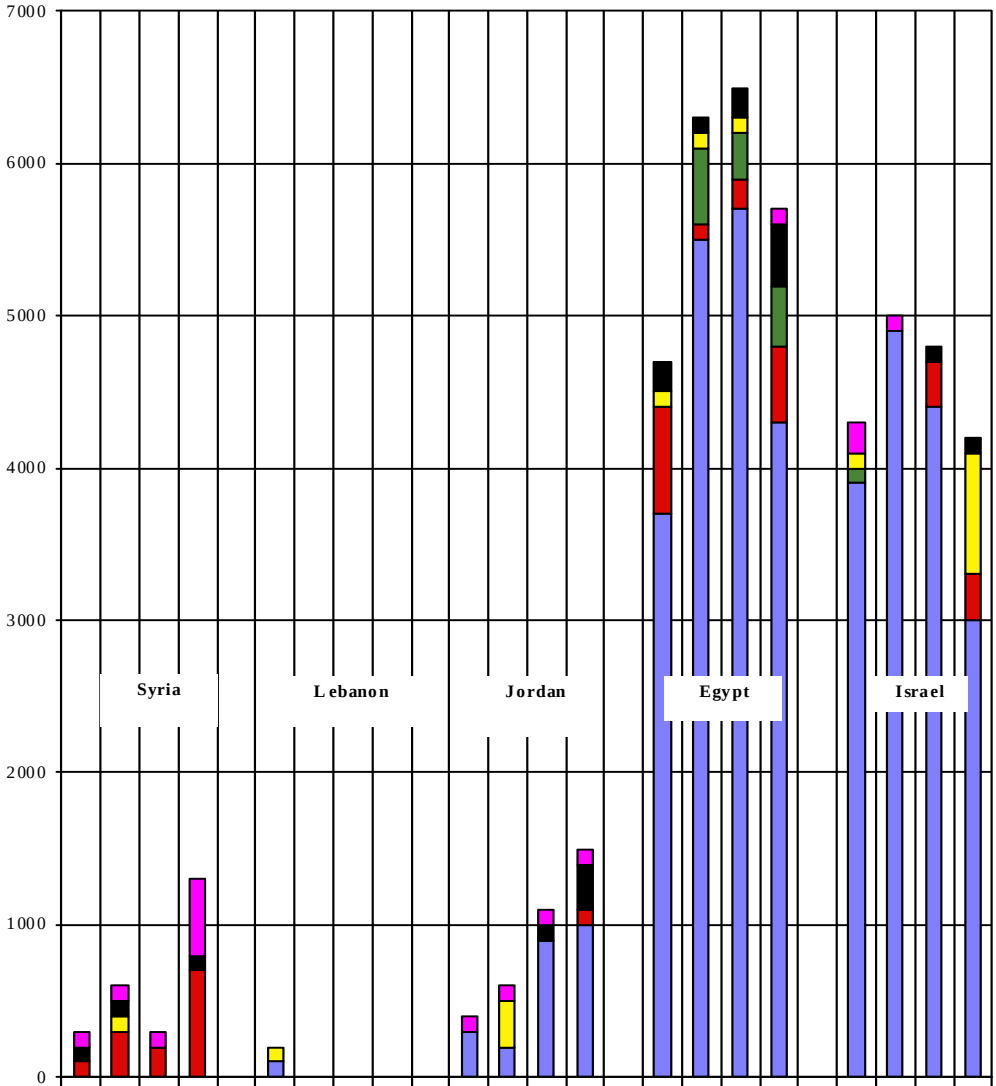
	1993-1996	1997-2000	2001-2004	2003-2006	.	1993-1996	1997-2000	2001-2004	2003-2006
Israel	4,300	5,000	4,800	4,200		2,600	5,000	3,400	5,400
Egypt	4,700	6,300	6,500	5,700		6,700	3,800	5,900	5,800
Jordan	400	600	1,100	1,500		300	500	500	600
Lebanon	200	0	0	NA		100	200	NA	NA
Syria	300	600	300	1,200		400	500	300	500

0 = Data less than $50 million or nil. All data rounded to the nearest $100 million.
Source: Richard F. Grimmett, Conventional Arms Transfers to the Developing Nations, Congressional Research Service, various editions.

Figure Two

Arab and Israeli New Arms Orders by Supplier Country: 1993-2004

(Arms Agreements in $US Current Millions)



	1993-1993	1993-2000	2001-2001	2001-2003	.	1993-1993	1993-2000	2001-2001	2001-2003	.	1993-1993	1993-2000	2001-2001	2001-2003	.	1993-1993	1993-2000	2001-2001	2001-2003	.	1993-1993	1993-2000	2001-2001	2001-2003
All Others	100	100	100	500		0	0	0	0		100	100	100	100		0	0	0	100		200	100	0	0
Other Europe	100	100	0	100		0	0	0	0		0	0	100	300		200	100	200	400		0	0	100	100
Major W. Europe	0	100	0	0		100	0	0	0		0	300	0	0		100	100	100	0		100	0	0	800
China	0	0	0	0		0	0	0	0		0	0	0	0		0	500	300	400		100	0	0	0
Russia	100	300	200	700		0	0	0	0		0	0	0	100		700	100	200	500		0	0	300	300
US	0	0	0	0		100	0	0	0		300	200	900	1,00		3,70	5,50	5,70	4,30		390	490	440	3,00

0 = less than $50 million or nil, and all data rounded to the nearest $100 million.

Source: Adapted by Anthony H. Cordesman, from Richard F. Grimmett, Conventional Arms Transfers to the Developing Nations, Congressional Research Service, various editions.

Syrian Weapons of Mass Destruction

Syria has long sought missiles and weapons of mass destruction to match Israel’s capabilities. In practice, however, it has never had the resources or technology base to compete with Israel or to developing a meaningful nuclear weapons effort.

Figure Three summarizes current reporting on Syrian weapons of mass destruction before the reports of an Israeli strike on a possible Syrian nuclear reactor. The data are often speculative. It is clear, however, that Syria has pursued the updating of its surface-to-surface missiles in spite of all of its resource constraints, and has given such forces high priority.

Syrian Progress in WMD Development

Syrian has chemical weapons, and most experts believe it has mustard agents and at least ordinary nerve gas. It may have persistent nerve gas as well. It is believed to have cluster warheads for delivering chemical weapons, and probably has chemical bombs and rocket warheads as well. It may have chemical artillery shells.

There are reports that Syria imported hundreds of tons of hydrochloric acid and ethylene glycol-MEG from Iran. These chemical agents are precursors for the production of mustard blister agents and Sarin nerve gas. The precursors would be used and mounted on Scud-B/C warheads and/or on aerial bombs. Construction of the chemical facilities was due to start in late 2005, estimating one year to complete construction. Thereafter production of precursors will start in Syria and the Syrian dependence on Iran for chemical agents will diminish if not disappear completely.[38]

There are also reports that Syria has recently benefited from sales and technology transfers by Iran. These reports indicate that Syria is undertaking “an innovative chemical warfare (CW) program in cooperation with Iran.” Syria’s CW program began in the mid-1970’s and its facilities are known to have successfully produced VX and Sarin nerve agents as well as mustard blister agents, but not independently. The Scientific Studies and Research Center (CERS) run the facilities in Dumayr, Khan Abou, Shamat and Furklus.[39]

The same reports indicate that no contract has yet been signed, but that the draft agreements would lead Iranian scientists from the Iranian Defense Industries Organization (DIO) to assist Syria in establishing the infrastructure and location of the new chemical facilities. It will also supply Syria with reactors, pipes, condensers, heat exchangers and storage and feed tanks as well as chemical detection equipment for airborne agents. Then Iran will assist in producing and piloting the first four or five CW facilities throughout Syria, producing precursors for VX and Sarin nerve agents and mustard blister agents.

Syria may be working on biological weapons. The nature of its progress, if any, is unclear.

Syrian Progress in Delivery Systems

As for delivery systems, **Figure Three** shows Syria has SSC-1B Sepal cruise missiles it could adapt as well as SS-21s (which may have aged to the point they no longer are operational), and Scud Bs.

Syria's most advanced existing system – and the one it is most likely to use if it acquires nuclear weapons -- seems to be a North Korean upgrade of the Scud that seems to have been exported to both Iran and Syria, although some unconfirmed reports have surfaced that Syria may be acquiring Iranian-made Shahabs. According to Global Security,[40]

> A program to modify the Scud-B (300 km/1,000 kg) is reported to have begun in 1988. The modified missile, referred to as the Scud-PIP (product improvement program), or Scud-C (500 km/700-800 kg), which achieved a longer range than its predecessors by reducing the payload and extending the length of the rocket body to increase the propellant by 25%. The first of three successful test firings of the SCUD-C was reported to have been completed in June 1990 with one in July 1991 at least one between May 29th, and May 30th 1993 with additional test conducted by Iran, Syria and North Korea. (3, 4) The Scud-C was committed to full production in 1991 replacing the Scud-B production.
>
> The first of three successful test firings of the SCUD-C was reported to have been completed in June 1990. Production capacity of the Scud-C was estimated at four to eight per month, and Pyongyang has hundreds of Scuds in its inventory and available for use by its missile forces. In 1990, Iran is reported to have arranged for delivery of Scud-Cs, as well as North Korean assistance in setting up an assembly and manufacturing facility. Syria may also have received shipments of the Scud-C along with launchers, beginning in April 1991.

A similar analysis by the Federation of American Scientists describes the system as follows:[41]

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The FAS analysis probably exaggerates some aspects of the missile's performance, particularly range and accuracy. It puts the range at a vague 300-500-700 kilometers, and the CEP at an extremely accurate 50 meters, when 200-400 may well be more accurate. Like Syria's Scud Bs, however, it is almost certain to be able to carry a fission nuclear weapon, and the FAS states is warhead weighs 750-989 kilograms with payload. The IISS reports that Syria may have some 30 Scud C missiles, as well as 18 Scud Bs.[42]

Some sources have reported that Syria has tried to upgrade its missile forces by buying the Russian SS-X-26 or Iskander E missile from Russia. The missile has a maximum range of 280-300 kilometers and could hit Israeli cites like Haifa, Jerusalem, and Tel Aviv. Unlike Syria's present missiles, the SS-X-26 is solid fueled and could improve Syria's ability to rapidly disperse its missiles and fire without delays for fueling or preparation. So far, however, Russia seems to have rejected such sales, as well as the sale of new surface-to-air missiles that might be converted for such use.[43]

The SS-X-26 is believed to be a replacement for both the Scud and the SS-23, which had to be abandoned as a result of the IRBM treaty. It is a mobile system mounted on a tracked TEL (transporter-erector-launcher) that can carry two missiles. Work by the Federation of American Scientists (FAS) indicates that it is a high technology system that could have cluster munition warhead, a fuel-air explosive enhanced-blast warhead, a tactical earth penetrator for bunker busting and an electro- magnetic pulse device for anti-radar missions. It does, however, have a small 480-kilogram warhead, and the FAS indicates it would need advanced terminal precision guidance. It speculates that this could be provided by using, “active terminal sensor such as a millimeter wave radar, satellite terminal guidance using GLOSNASS, an improved inertial platform, or some combination of these approaches.”[44]

The only major positive recent development in Syrian capabilities is that Syria fired three Scud missiles in 2005 which all seem to have been tested in an “airburst” mode where the warheads might be using cluster munitions that could carry chemical or biological weapons. One was an older Scud B, with a range of about 300 kilometers, but two were the improved No Dong missiles sometimes called the Scud D, with a range of up to 700 kilometers. There are also some analysts who still feel Syria might have acquired Iraq’s weapons of mass destruction when Saddam Hussein had them smuggled out of Iraq before the US-led invasion. Such reporting is anecdotal and so far has little credibility.

Possible Syrian Strategy, Tactics, and Employment

Various experts have postulated that Syria could use its chemical and possibly biological weapons against Israel or any other neighbor in range as terror weapons, and sees them as at least a partial deterrent to Israeli strikes with weapons of mass destruction in anything other than an existential conflict.

Other experts have suggested that Syria might use chemical weapons against Israeli army forces as they mobilized to support a surprise attack on the Golan, on Israel's weapons of mass destruction, or in attacks on some other critical Israeli target or facility. There have also been suggestions that Syria might attempt covert attacks or use a terrorist or other proxy.

It is impossible to dismiss such possibilities, and there are no reliable unclassified sources on Syrian doctrine, plans, or intentions for using weapons of mass destruction. Syria does, however, face the fact that any such attack might be seen as the prelude to a Syrian attack on Israeli population centers and that a mass attack producing high lethality against Israel's mobilization centers would probably be viewed as being too unacceptable for Israel to ignore.

Syria would also now have to take the risk of using chemical (or possibly biological) weapons whose lethality it could never have tested under operational conditions. It would also have to depend on limited test data of the actual missile warhead and its munitions and submunitions for delivering CBW agents, and on the accuracy and reliability of missiles that it has never fired in any numbers.

The past gaps between technical estimates of the capability of such systems before use, and the operational reality of actual use has shown that such weapons can have several orders of magnitude less real-world lethality than theory and technical estimates would

indicate. Syria also lacks advanced intelligence, surveillance, and reconnaissance (IS&R) assets, although it might acquire them in the future or piggyback on a mix of commercial satellite and future Iranian satellite data. Seen from this perspective, the far greater lethality and known behavior of nuclear weapons might well seem far more attractive than the use of Syria’s present chemical (and possibly biological) weapons, and seem to be far more effective as a deterrent and weapon of intimidation/persuasion.

As little is know about Israeli plans and doctrine for using weapons of mass destruction as about Syrian plans and doctrine. However, given Israel's past actions, the response might well be Israeli massive retaliation with a mix of air and missile strikes designed to destroy much of Syria's continuity of government, military facilities and capabilities, and economy and infrastructure. A major Syrian attack on Israeli civilian targets might well lead to Israeli retaliation against Syrian cities with nuclear weapons. If Israel sought to send a decisive signal as to the cost of strikes on Israel, these might be nuclear ground bursts design to both cripple Syria and prevent its recovery.

It also seems likely that if Israel ever came to believe Syria was preparing to use highly lethal biological weapons, or nuclear weapons – or that a crisis might lead Syria to do so -- Israel would massively preempt with nuolcear strikes on Syria and do so without warning.

Figure Three

Syria's Search for Weapons of Mass Destruction

Delivery Systems

- Syria has shorter range nuclear-capable systems:
- Short-range M-1B missiles (up to 60 miles range) seem to be in delivery from PRC.
- SS-N-3, and SSC-1b cruise missiles. The SSC-1b is a large anti-ship/land-attack cruise missile that Syria might be modify to carry a nuclear warhead. Its length is 10.2-11.74 meters, it has a launch weight of some 4,500 kilograms, a range of 25-460 meters, a speed of Mach 1.4, inertial/command + active radar terminal homing guidance, and a large 513 kilogram conventional warhead. Russia, however, deployed a version with a 350-kiloton nuclear warhead. The system is road mobile and easy to disperse and conceal.[45]
- May be converting some long range surface-to-air and naval cruise missiles to use chemical warheads.
- 20 Su-24 long range strike fighters.
- 44 operational MiG-23BN Flogger F fighter ground attack aircraft.
- 20 Su-20 fighter ground attack aircraft.
- 90 Su-22 fighter ground attack aircraft.[46]
- 18 FROG-7 launchers and rockets.
- Negotiations for PRC-made M-9 missile (185-375 mile range).
- Multiple rocket launchers and tube artillery.
- Syria thought to be interested in purchasing Russia's Iskander-E (SS-X-26) ballistic missile when once it has finished development.[47]

■ Syria has significant numbers of long-range rockets and missiles :

- Four SSM brigades: 1 with FROG, 1 with Scud Bs, 1 with Scud Cs, and 1 with SS-21s.
- Some reports indicate Syria had delivery of 18 SS-21 launchers and at least 36 SS-21 missiles with 80-100 kilometers range. According to the May 1998 estimate of the Center for Nonproliferation Studies at the Monterey Institute of International Studies, Syria possessed 200 SS-21 Scarab missiles.[48] May have developed chemical warheads for them. According to Global Security, the SS-21 SCARAB (9K79 Tochka) single-stage, short-range, tactical-ballistic missile is transported and fired from the 9P129 6x6 wheeled transporter erector launcher.[49] It has a maximum range of 70 km and a CEP of 160 meters, while the improved composite propellant 9M79-1 (Tochka-U) has a maximum range of 120 km. The basic warhead is the 9N123F HE-Frag warhead that has 120 kg of high explosives. The 9N123K submunition warhead can probably carry either bomblets or mines. The Russian versions of the SS-21 also carried the AA60 tactical nuclear warhead. Other Russian warheads are believed to have included chemical, terminally guided warhead, and a smart-munition bomblet warhead. It is very doubtful that Syria could build a nuclear warhead small enough for this system unless it was given the design and full engineering details by another country, and only Soviet bloc states would have the required technical expertise.
- Many experts believe some Syrian surface-to-surface missiles armed with chemical weapons began to be stored in concrete shelters in the mountains near Damascus and in the Palmyra region

no later than 1986, and that plans have long existed to deploy them forward in an emergency since that date

- Up to 12 Scud B launchers and 200 Scud B missiles with 310 kilometers range, a theoretical CEP of 900 meters, and a non-alert reaction time of 60 minutes Syria is believed to have chemical warheads with cluster munitions. Scud B warhead is various reported to weigh 985 kilograms, and have a payload of 770-950 kilograms. The inventory of Scud B missiles is believed to be approximately 200. According to the Federation of American Scientists, the Scud B has a range of 300 km. Unsophisticated gyroscopes guided the missile only during powered flight - which lasts about 80 seconds…Scuds had notoriously poor accuracy, and the farther they flew, the more inaccurate they became. The longer range SCUD B, also known as SS-1c…used unsymmetrical dimethylhydrazine (UDMH), a more powerful (and toxic) fuel…The SCUD-B was introduced on the JS-3 tracked chassis in 1961 and appeared on the MAZ-543 wheeled chassis in 1965. The SCUD-C SS-1d achieved an initial operational capability with Soviet forces around 1965. It had a longer range, though lower accuracy, than the SCUD B, and was deployed in smaller numbers.”[50] This system – possibly with improvements – is deployed in Iran as the Shahab 1.
- The Monterey Institute of International Studies’ Center for Nonproliferation Studies reports that the Chinese provided technical assistance to upgrade Scud B missiles in 1993.[51]
- New long-range North Korean Scud Cs deployed
  - Jane’s cites an American Department of Defense document published in 1992 alleging that Syria had purchased 150 Scud C missiles.
  - Two brigades of 18 launchers each are said to be deployed in a horseshoe shaped valley. This estimate of 36 launchers is based on the fact there are 36 tunnels into the hillside. The launchers must be for the Scud C since the older Scud Bs would not be within range of most of Israel. Up to 50 missiles are stored in bunkers to north as possible reloads. There is a maintenance building and barracks.
  - Underground bunkers are thought to have sufficient storage for some 1,000 Scud-C missiles according to a fall 2002 article in the Middle East Quarterly.[52]
  - Estimates indicate that Syria has 24-36 Scud launchers for a total of 260-300 missiles of all types. The normal ratio of launchers to missiles is 10:1, but Syria is focusing on both survivability and the capability to launch a large preemptive strike.
  - The Scud Cs have ranges of up to 550-600 kilometers. They have a CEP of 1,000-2,600 meters. Nerve gas warheads using VX with cluster bomblets seem to have begun production in early 1997. Syria is believed to have 50-80 Scud C missiles.
  - A training site exists about 6 kilometers south of Hama, with an underground facility where TELs and missiles are stored.
- Jane’s reports that, “It was reported in early 1998 that Israeli intelligence experts had estimated that there were between 24 and 36 ‘Scud’ launchers at most Syrian missile sites – far more launchers than previously estimated.” Traditionally, armies deploying Scuds stock about 10 missiles per launcher. The higher number of Syrian launchers suggests a ratio closer to 2 missiles per launcher – this would enable Syria to launch a large first-wave strike before launchers were destroyed.
- Syria can now build both the entire Scud B and Scud C. It has sheltered and/or underground missile production/assembly facilities at Aleppo, Hama, and near Damascus, which have been built with aid from Chinese, Iranian, and North Korean technicians. Possibly some Russian technical aid.
- Israeli defense officials have been reported as stating that Syria has been producing about 30 Scud C missiles per year at an underground facility.[53]
- A missile test site exists 15 kilometers south of Homs where Syria has tested missile modifications and new chemical warheads. It has heavy perimeter defenses, a storage area and

bunkers, heavily sheltered bunkers, and a missile storage area just west of the site. According to some reports, Syria has built two missile plants near Hama, about 110 miles north of Damascus, one is for solid fueled rockets and the other is for liquid fueled systems. North Korea may have provided the equipment for the liquid fuel plant, and Syria may now be able to produce the missile.

- Reports of Chinese deliveries of missiles but little hard evidence:
  - Reports of PRC deliveries of missile components by China Precision Machinery Company, maker of the M-11, in July 1996. The M-11 has a 186-mile (280 kilometer) range with a warhead of 1,100 pounds. Missile components may have included "contained sensitive guidance equipment."[54]
- All reports of Syrian purchases and production of Chinese M-9 missile are unconfirmed and of extremely dubious value:
  - Some sources believe M-9 missile components, or M-9-like components delivered to Syria. Missile is reported to have a CEP as low as 300 meters.
  - Some intelligence reports indicate that 24 M-9 launchers were sighted in late 1991.[55] Other reports suggest that the 1991 missile deliveries were subsequently cancelled due to US pressure.
  - Since 1989 there have been persistent rumors that Syria was trying to import the M-9 form China. Up to the mid-1990s, Israeli sources believed that these attempts ended in failure - Beijing reportedly backed out of the deal due to US pressure. The reports surfaced again in the late 1990s, with suggestions that the M-9 had been delivered from China - possibly in kit form, or partly assembled.
  - Jane's reported in March 1999 that Syria had created a production facility to build both the M-11 (CSS-7/DF-11) and M-9 missiles with ranges of 280 and 600-800 kilometers respectively. It reports that production of the booster stage of the M-11 began in 1996, and that missile production is expected to start "soon."
  - An April 1993 report in Jane's Intelligence Review report indicated that North Korea and Iran (with Chinese assistance) helped in the construction of underground production facilities for the Scud C and M-9 missiles. At the time of the article (April 1993), production of the Scud C was believed to be 12-18 months off, while M-9 production was believed to be 2-3 years away.[56]
- Senior administration officials were quoted as stating that China had sold missile technology to Syria. 30-90 tons of chemicals for solid propellant were sold to Syria by mid 1992.[57]
- Some sources claim Syria is developing, with considerable North Korean assistance, a Syrian version of the Korean No Dong (sometimes referred to as the Scud-D).
  - A number of sources reported the September 23, 2000 test flight of the Syrian No Dong.
  - Four tunnels for shelters for No Dong launchers have been excavated, as of late 2002.[58]
  - Syria expected to produce or have already started production at the rate of about 30 missiles per year.[59]
  - Israeli officials claimed that Syria was developing "multiple warhead clusters" in a bid to defeat Israel's Arrow missile defense system.[60]
- The Center for Nonproliferation Studies at the Monterey Institute of International Studies has compiled a chronology of North Korean assistance to Syria through 2000[61]:

Date	Item(s)	Remarks
1991	24 Scud-Cs and 20	Syria pays approximately $250 million, and Libya

March	TELs	reportedly helps finance transaction.
1991 April	60 Scud-Cs and 12 TELs	First delivery after agreement for Syria to acquire 150 Scud-Cs for an estimated $500 million.
1991 May	36 Scud-Cs	Missiles transported by Yugoslavian freighter.
1991 summer	Unknown number of Scud-Cs	Missiles delivered by North Korean ship *Mupo* and transferred to Syria via Cyprus.
1992	24 Scud-C missiles; missile-production and assembly equipment	Delivered by North Korean freighter *Tae Hung Ho* in March. Part of the shipment was airlifted to Syria via the Iranian port of Bandar Abbas, and the remaining cargo was transported directly to the Tartus. The manufacturing equipment reportedly destined for suspected missile factories in Hama and Aleppo.
1992	Approximately 50 Scud-Cs	A North Korean ship carrying 100 Scud-Cs depart for the Iranian port Bandar Abbas in October. Half of the delivery transported overland to Syria.
1993	seven MAZ 543 chassis and unknown number of Scud-Cs	In August, two Russian Condor aircraft transport the missiles and chassis from Sunan International Airport to Damascus. According to Israeli Foreign Minister Shimon Peres, North Korea offered to stop the delivery if Israel paid $500 million.
1994	Unknown number of Scud-C missiles and TELs	
1994	Unknown number of Scud-C cluster warheads	
1996	Missile expertise	Syrian missile technicians spend two weeks training in North Korea.
1999	10 tons of powdered aluminum	Originally from China, shipment delivered to the Centre des Etudes de Recherche Scientifique, the institute in charge of Syria’s missile program.
2000	Scud-D missile	Unconfirmed; Syria conducted Scud-D flight test on 23 September 2000.
2000	No Dong missiles and TELs	Unconfirmed; North Korean firm Ch’ongchon’gang reportedly delivers 50 No Dong missiles and seven TELs to Syria. Missiles possibly procured on behalf of

		Iraq, Egypt and Libya for $600 million.

- Sheltered or underground missile production/assembly facilities at Aleppo and Hamas have been built with aid from Chinese, Iranian, and North Korean technicians. Possibly some Russian technical aid.
- A missile test site exists 15 kilometers south of Homs where Syria has tested missile modifications and new chemical warheads. It has heavy perimeter defenses, a storage area and bunkers, heavily sheltered bunkers, and a missile storage area just west of the site.

- Syria has improved its targeting capability in recent years by making extensive direct and indirect use of commercial satellite imagery, much of which now offers 3 meter levels of resolution and comes with coordinate data with near GPS-like levels of accuracy. One-meter levels of resolution will become commercially available.
- The CIA estimated in January 1999 that Syria continued work on establishing a solid-propellant rocket motor development and production capability. Foreign equipment and assistance have been and will continue to be essential for this effort.

Chemical Weapons

- First acquired small amounts of chemical weapons from Egypt in 1973.
- Began production of non-persistent nerve gas in 1984. May have had chemical warheads for missiles as early as 1985.
- Experts believe has stockpiled 500 to 1,000 metric tons of chemical agents. Holdings thought to include persistent (VX) and non-persistent nerve agents (Sarin) as well as blister agents.
- Believed to have begun deploying VX in late 1996, early 1997.
  - CIA reported in June 1997 that Syria had acquired new chemical weapons technology from Russia and Eastern Europe in 1996.
  - Unconfirmed reports of sheltered Scud missiles with unitary Sarin or Tabun nerve gas warheads, now being replaced by cluster warheads with VX bomblets, deployed in caves and shelters near Damascus.
  - Tested Scuds in manner indicating possible chemical warheads in 1996.
  - Seems to have cluster warheads and bombs.
  - May have VX and Sarin in modified Soviet ZAB-incendiary bombs and PTAB-500 cluster bombs. Reports stated that US intelligence source had obtained information indicating a late October 1999 test of a live chemical bomb dropped by a Syrian MiG-23.[62]
- Acquired design for Soviet Scud warhead using VX in 1970s.
- Major nerve gas, and possible other chemical agent production facilities north of Damascus. Two to three plants.
  - One facility is located near Homs and is located next to a major petrochemical plant. It reportedly produces several hundred tons of nerve gas a year.
  - Reports is building new major plant at Safira, near Aleppo.
  - Reports that a facility co-located with the Center d’Etdues et de Recherche Scientifique (CERS) is developing a warhead with chemical bomblets for the Scud C.
- Many parts of the program are dispersed and compartmented. Missiles, rockets, bombs, and artillery shells are produced/modified and loaded in other facilities. Many may be modified to use VX bomblets.

- Wide range of delivery systems:
  - Extensive testing of chemical warheads for Scud Bs. May have tested chemical warheads for Scud Cs. Recent tests include a July 2001 test of a Scud B near Aleppo and a May 1998 test of a Scud C with a VX warhead near Damascus.
  - Shells, bombs, and nerve gas warheads for multiple rocket launchers.
  - FROG warheads may be under development.
  - Reports of SS-21 capability to deliver chemical weapons are not believed by US or Israeli experts.
  - Israeli sources believe Syria has binary weapons and cluster bomb technology suitable for delivering chemical weapons.
  - The CIA estimated in January 1999 that Syria continued to seek CW-related precursors from various sources during the reporting period. Damascus already has a stockpile of the nerve agent Sarin and may be trying to develop more toxic and persistent nerve agents. Syria remains dependent on foreign sources for key elements of its CW program, including precursor chemicals and key production equipment.
  - The CIA stated that Chinese entities sought to supply Iran and Syria with CW-related chemicals during this reporting period.

Biological Weapons

- Signed, but not ratified the 1972 Biological and Toxin Weapons Convention. Extensive research effort.
- US State Department, Bureau of Arms Control report in August 1996 indicated that, “it is highly probably that Syria is developing an offensive biological capability.”
- Extensive research effort. Reports of one underground facility and one near the coast.
- Probable production capability for anthrax and botulism, and possibly other agents.
- Israeli sources claim Syria weaponized botulinum and ricin toxins in early 1990s, and probably anthrax.
- Limited indications may be developing or testing biological variations on ZAB-incendiary bombs and PTAB-500 cluster bombs and Scud warheads.
- Major questions exist regarding Syria’s strike capabilities. Older types of biological weapons using wet agents, and placed in older bomb and warhead designs with limited dissemination capability, can achieve only a small fraction of the potential effectiveness of biological weapons. Dry micropowders using advanced agents – such as the most lethal forms of Anthrax – can have the effectiveness of small theater nuclear weapons. It is difficult to design adequate missile warheads to disseminate such agents, but this is not beyond Syrian capabilities – particularly since much of the technology needed to make effective cluster munitions and bomblets for VX gas can be adapted to the delivery of biological weapons.[63]
- The design of biological bombs and missile warheads with the lethality of small nuclear weapons may now be within Syrian capabilities, as is the design of UAV, helicopter, cruise missile, or aircraft-borne systems to deliver the agent slowly over a long line of flight and taking maximum advanced of wind and weather conditions. US and Soviet texts proved that this kind of “line source” delivery could achieve lethalities as high as 50-100 kiloton weapons by the late 1950s, and the technology is well within Syria’s grasp. So is the use of proxy or covert delivery.
- According to CIA estimates, it is considered “highly probably that Syria also is developing an offensive BW capability.”[64]

Nuclear Weapons

- Ongoing research effort.
- No evidence of major progress in development effort.
- Announced nuclear reactor purchase plans including 10 megawatt research reactor from Argentina. Discussions with Argentina were resumed in the mid-1990s, but plans to build a Syrian reactor were scrapped under US pressure.
- Syria tried to obtain six power reactors (for a total of 6000 megawatts of generating capacity) in 1980s from a number of countries, including the Soviet Union, Belgium and Switzerland, but plans were never implemented.
- The Center for Nonproliferation Studies at the Monterey Institute of International Studies quotes a Jane’s Intelligence Review article from 1993 claiming Syria attempted to purchase “large (thousand ton) quantities” of yellowcake from Namibia.[65]
- In December 1991 Syria purchased a 30 kilowatt neutron-source research reactor from China, reactor is not suitable for weapons production. The Atomic Energy Commission of Syria received 980. g of 90.2% enriched Uranium 235 as part of the deal.
- Russia and Syria have approved a draft of a plan for cooperation on civil nuclear power, which is expected to provide opportunities for Syria to expand its indigenous nuclear capabilities.[66] Reports surfaced in January of 2003 indicating that Syria and Russia had reached an agreement on the construction of a $2 billion facility which would include a nuclear reactor. Although within several days, Russian Foreign Ministry officials had indicated that no reactor would be sold.[67]

Missile Defenses

- Seeking Russian S-300or S-400 surface-to-air missile system with limited anti tactical ballistic missile capability.

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