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# **The Gulf Military Forces in an Era of Asymmetric War**

## **Iran**

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## Introduction

Iran plays a critical strategic role in the Gulf. It is the region's most populous country with 68.7 million people. It is the one country that is not Arab in character, and has a unique Persian character. It has its own Shi'ite Islamist fundamentalism at a time when Sunni Neo-Salafi fundamentalism is seeking control of the Gulf and Arab world. Its opposition of Israel, and ties to Iraq, Syria, and Lebanon give it broader importance both inside and outside the Gulf.

It is the second largest country in the Gulf one of the largest in the Middle East with an estimated area of 1.648 million square kilometers, and its strategic geography not only dominates the Northern Gulf but the shipping lines both inside and outside the Strait of Hormuz. As **Map 1** shows, Iran's territory extends from the Caspian Sea to the Gulf, and it has land borders with Afghanistan (936 kilometers), Armenia (35 kilometers), Azerbaijan-proper (432 kilometers), Azerbaijan-Naxcivan exclave (179 kilometers), Iraq (1,458 kilometers), Pakistan (909 kilometers), Turkey (499 kilometers), and Turkmenistan (992 kilometers).<sup>1</sup>

Iran's importance as a strategic player in the Gulf is compounded by the importance of its energy resources. Iran is estimated to hold 11.1 percent of the world oil reserves (132.0 billion barrels of oil), and 15.3 percent of the world's natural gas reserves (970.8 trillion cubic feet).<sup>2</sup> In addition, is strategically located near the Strait of Hormuz where most of the Gulf oil passes by every day. Iran's conventional and asymmetric military capabilities near the Strait of Hormuz make Iran all the more important to global energy security.

Iran has always been a key player in regional security, and has long been a destabilizing one. The revolution that deposed the Shah in 1979, brought radical clerical leaders like Khomeini to power. It was followed by the seizure of American diplomats as hostages, and Iranian efforts to export its "Islamic revolution" to other Gulf States like Bahrain and to the Islamic world. Since that time, the United States and several European nations have consistently accused Iran of supporting terrorism. This usually took the shape of supporting proxy groups such as Hezbollah, Hamas, and Islamic Jihad. In addition, neighboring states such as Saudi Arabia and Bahrain have accused Iran of supporting local Shi'ite groups that carried attacks against Saudi and Bahraini targets, including the 1996 Khobar bombing and several attacks during the 1970s.

Several issues have recently given Iran added strategic visibility. First Iran is the region's leading Shi'ite state at a time of growing sectarian tension. While Iran's relations with its neighboring states improved during President Mohammad Khatami's presidency in the 1990s, they are increasingly uncertain. Iran continues to have at least one major active territorial dispute with its neighbors. The most serious is control of the three Islands: the Greater Tunbs, the Lesser Tunbs, and Abu Musa. Since the withdrawal of Britain from the Gulf in the 1970s, the UAE and Iran have argued over the ownership of the islands, and the GCC have supported the UAE's position. The GCC countries have avoided confrontation, but the risk is there. In addition, Iran and Qatar have claimed ownership of the North field (where most of Qatar's gas reserves are), and the issue has never been fully resolved.

Iran has said it has abandoned its goal of spreading its Shi'ite to the southern Gulf States, but this is now being quietly questioned by many strategic and defense planners in the Gulf. The election of Mahmud Ahmadinejad as Iran's president on August 3, 2005 made a radical populist Iran's leading civil leader. His loyalty to hard-line views rhetoric about the return of the hidden Imam, as well as Iran's aggressive meddling in Iraq's internal affairs and aid to Shi'ite militias in

gaining more power, have raised growing concerns among Iran's Sunni neighbors. Leaders in Saudi Arabia, Egypt, and Jordan have accused Iran of wanting to create a "Shi'ite Crescent" that includes Iran, Iraq, Lebanon, and Syria.

Second, two of Iran's main enemies, the Taliban regime and Saddam Hussein have been toppled by the United States since the terrorist attacks on the US on September 11, 2001. Iran no longer faces a threat from either neighbor, and may acquire an ally in Iraq, where a Shi'ite majority has come to power. These developments have increased Iran's power and influence.

At the same, the same invasions that toppled these two regimes have led to a major US military presence in both states and a much larger US air and naval presence in the Gulf. This has increased US and Iranian tension and Iran's pressure on its neighbors. Iran has long used the U.S. presence in the region as a reason to condemn countries such as Kuwait and Saudi Arabia for their close alliance with the United States. In 2006, there were more than 130,000 U.S. troops in countries on two of Iran's borders. In addition, the U.S. traditional presence in the Gulf, especially Bahrain, Kuwait, and Qatar, has not changed.

Third, Iran's nuclear program has been under growing scrutiny by the International Atomic Energy Agency (IAEA), the EU-3 (France, Germany, and England), the United States, and most of Iran's neighboring states. So has the fact it is developing a family of long-range missiles like the Shahab 3. There is increasing concern that Iran is seeking long-range nuclear strike capabilities that would be a destabilizing force in the region. The Mahmoud Ahmadinejad to the presidency of Iran compounded these concerns on August 3, 2005. His statements about the holocaust, and his rhetoric about the end of times have made Iran's nuclear program an existential threat to Israel and most of Iran's "one city" states.

The other side of the story is that Iran has been more conservative in modernizing its conventional military forces. Iran has never rebuilt the level of conventional forces it had before its defeat in its war with Iraq in the 1988. Iran's conventional military readiness, effectiveness, and capabilities have declined since the end of the Iran-Iraq War, and Iran has not been able to find a meaningful way to restore its conventional edge in the region. As will be discussed in details, Iran has only been able to order \$2.3 billion worth of new arms agreements during 1997-2004. Saudi Arabia ordered \$10.5 billion, Kuwait \$3.1 billion, and the UAE ordered \$12.0 billion. Even a small nation like Oman spent \$2.5 billion. This inability to modernize its conventional forces is seen by many experts as one of the reasons for Iran's "nuclear ambitions" and its focus on building its asymmetric capabilities.

Map 1: Iran



Source: CIA, "Iran," 2002, available at [http://www.lib.utexas.edu/maps/middle\\_east\\_and\\_asia/iran\\_pol01.jpg](http://www.lib.utexas.edu/maps/middle_east_and_asia/iran_pol01.jpg)

## Military Spending & Arms Imports

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Iran has faced major problems in modernizing and financing its military forces ever since the revolution in 1979. The US and other Western powers ceased to sell Iran both weapons and parts and munitions for its existing weapons shortly after the revolution. Iran built up major supplies of Chinese, Russian, and other Eastern bloc weapons during the Iran-Iraq War, but its defeats in that war in 1988 result in the loss of some 40-50% of its land order of battle.

It has faced serious financial problems in funding its force modernization, compounded by the systematic mismanagement of its economy. These problems have been eased in recent years by major increases in its oil revenues. Iran's oil export revenues rose from \$11.2 billion in 1998, in constant 2005 US dollars, to an estimated \$49.2 billion in 2006.<sup>3</sup> Even so, the CIA estimates Iran's government revenues in 2005 were only \$48.82 billion versus expenditures of \$60.4 billion.<sup>4</sup>

Iran has, however, used its rising oil revenues to finance higher military spending. According to the IISS, Iran's military budget has been steadily increasing over the past few years, rising from \$2.3 billion in 2000, to \$3.36 billion in 2003, and \$6.2 billion in 2006, which represents a 170% increase in Iran's military budget since 2000.<sup>5</sup>

This has not, however, yet led to a major increase in Iran's arms imports. **Figure 1** shows the trend in new Iranian arms deliveries by supplier from 1993 to 2004. There has been a steady contraction in new arms deliveries from \$2.6 billion during 1993-1996, to \$1.9 billion during 1997-2000, and to \$0.5 billion during 2001-2004.

Russia and China, Iran's two major suppliers, have experienced sharp declines in their exports to Iran. For example, Russia arms exports to Iran declined from \$1.3 billion during 1993-1996 to \$0.1 billion during 2001-2004; while China's arms deliveries to Iran declined from \$0.9 billion during 1993-1996 to \$0.1 billion during 2001-2004.

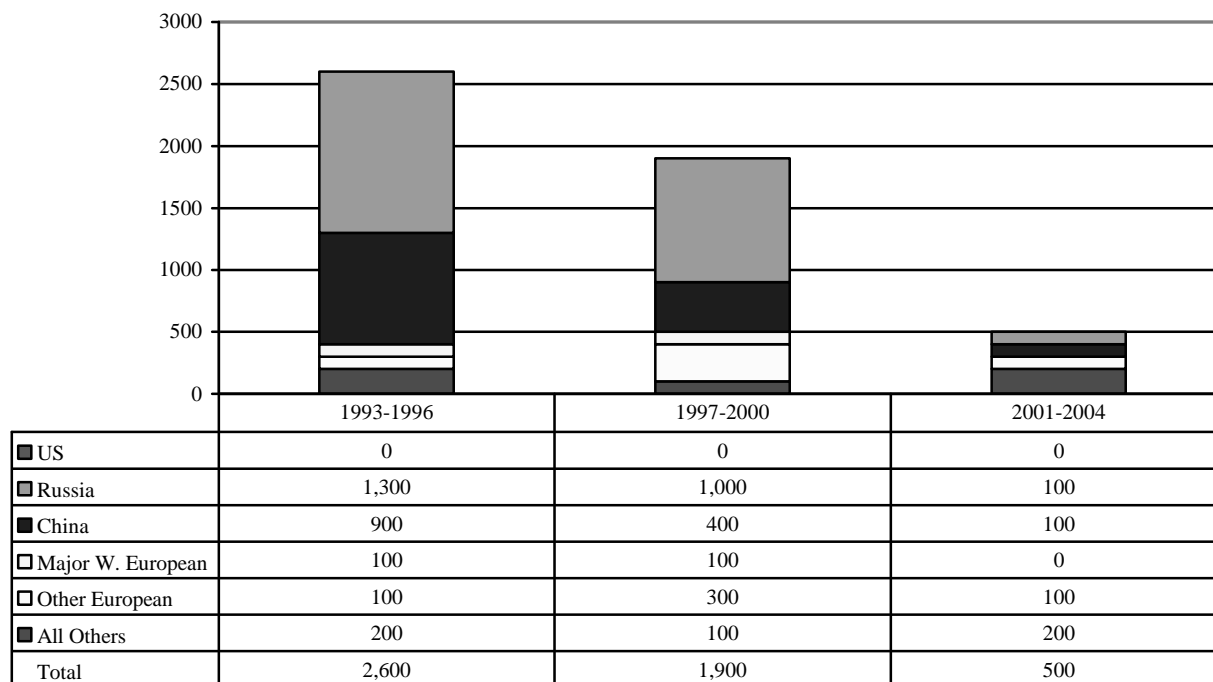
Iran's new arms agreements have had a more mixed trend. As shown in **Figure 2**, the combined value of new agreements over arms purchases increased from \$1.2 billion between 1993 and 1996, to \$1.5 billion between 1997 and 2000, and then decreased to \$0.8 billion between 2001 and 2004. Russia's share in the total value of arms imports rose from \$0.2 billion between 1993-1996 to \$0.4 billion between 1997 and 2004.

China's new arms agreements with Iran increased from \$0.4 billion during 1993-1996 to \$0.60 billion during 1997-2000, and then dropped to \$0.20 billion during 2001-2004. Western European countries had no new arms agreements during 2001-2004, and the amount coming from "All Others" decreased from \$100 million during 1997-2000 to \$100 million during 2001-2004.

As is discussed later, these expenditures have led to some carefully focused purchases that had increased in Iran's military capabilities in several important areas. They have not, however, been large enough to offset the steady aging of most of Iran's military inventory, its inability to obtain parts and upgrades for much of its Western supplied equipment, and anything close to parity with the level of weapons and technology in US, British, and many other Gulf forces. Iran has tried to compensate by creating its own military industries, but such efforts have as yet had only limited impact.

**Figure 1: Iran's Arms Deliveries by Supplier, 1993-2004**

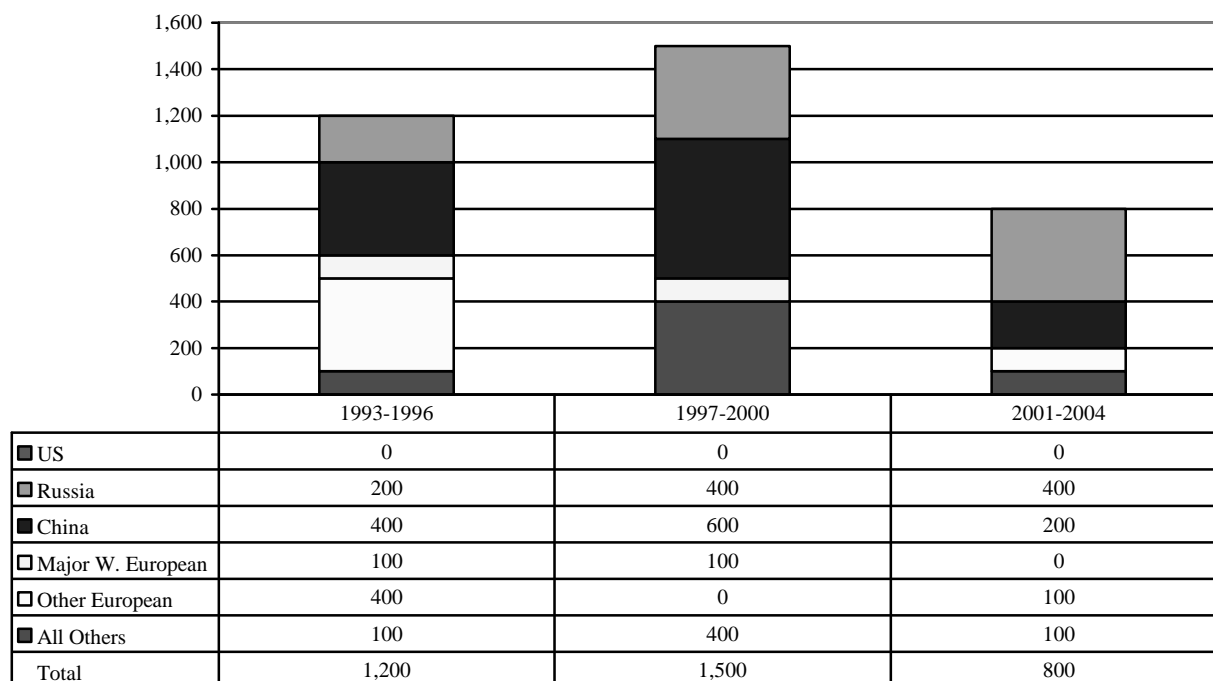
(In Current Million \$US)



Source: Richard F. Grimmett, *Conventional Arms Transfers To Developing Nations, 1997-2004*, CRS, August 29, 2005; and Richard F. Grimmett, *Conventional Arms Transfers To Developing Nations, 1993-2000*, CRS, August 16, 2001.

**Figure 2: Iran's New Arms Agreements by Supplier, 1993-2004**

(In Current Million \$US)



Source: Richard F. Grimmett, *Conventional Arms Transfers To Developing Nations, 1997-2004*, CRS, August 29, 2005; and Richard F. Grimmett, *Conventional Arms Transfers To Developing Nations, 1993-2000*, CRS, August 16, 2001.



## **Military Manpower**

Iran maintained active armed forces with some 545,000 men in 2006; although some 220,000 of this total are 18-month conscripts that receive limited training and have marginal military effectiveness. It also has an army reserve of some 350,000 men, although these reserves receive negligible training and Iran lacks the equipment, supplies, and leadership cadres to make effective use of such reserves without months of reorganization and training.

Iran's military manpower problems are shaped by a number of factors. Iran divided its armed forces into regular and revolutionary components, following the revolution in 1979, creating a split between the regular forces that existed under the Shah, and the Revolutionary Guards installed during the rule of the Ayatollah Khomeini. This split has been reinforced by a highly compartmented or "stovepiped" military forces force, which have only made limited progress in joint warfare.

Military training is often subject to political problems and many large-scale exercises do more to "posture" to Iran's neighbors than create effective forces. The combat-trained military personnel Iran developed during the Iran-Iraq War have virtually all left service. Iran is now a largely conscript force with limited military training and little combat experience. The deep divisions between "moderates" and "hard-liners" in Iran's government have inevitably politicized the armed forces, which remain under the command of the supreme religious leader, the Ayatollah Khamenei.

## **The Iranian Army**

The Iranian army is large compared to other countries in the Gulf region. It has some 350,000 men (220,000 conscripts), organized into four corps, and with four armored divisions, six infantry divisions, six artillery groups, two commando divisions, an airborne division, aviation groups, and other smaller independent formations. These latter units include independent armored, infantry, and commando brigades.

In practice, each Iranian division has a somewhat different organization. For example, only one Iranian division (the 92nd) is well enough equipped to be considered a true armored division and two of the armored divisions are notably larger than the others. Two of the infantry divisions (28th and 84th) are more heavily mechanized than the others.<sup>6</sup> The lighter and smaller formations in the regular army include the 23rd Special Forces Division, which was formed in 1993-1994, and the 55th paratroop division. According to one source, the 23rd Special Forces Division has 5,000 full-time regulars, and is one of the most professional units in the Iranian Army.

The airborne and special forces are trained at a facility in Shiraz.<sup>7</sup> The regular army also has a number of independent brigades and groups. These include some small armored units, 1 infantry brigade, 1 airborne and 2-3 Special Forces brigades, coastal defense units, a growing number of air defense groups, 5 artillery brigades/regiments, 4-6 army aviation units, and a growing number of logistic and supply formations. The land forces have six major garrisons and 13 major casernes. There is a military academy at Tehran, and a signal-training center in Shiraz.<sup>8</sup>

### ***Iranian Tank Strength***

Iran has steadily rebuilt its armored strength since the Iran-Iraq War, although its forces are still significantly smaller than under the Shah. It had some 1,613 main battle tanks in 2006, and the

number has risen steadily in recent years. Iran had a total of 1,135 in 2000, 1,565 in 2003, and 1,613 in 2006. The IISS estimates that Iran's inventory of main battle tanks now includes some 168 M-47/M-48 and 150 M-60A1, 100 Chieftain Mark 3/5s, 540 T-54/T-55s/Type-59s, 75 T-62s, 480 T-72/T-72S, and 100 Zulfiqars. Its T-72 strength has increased from 120 in 2000 (Other estimates indicate that Iran may have as many as 300 Type 59s and/or 150-250 Type-69IIs).

Only 480-580 of Iran's main battle tanks can be described as "modern" by common standards. Iran has some 865 other armored fighting vehicles, 550-670 armored personnel carriers, 2,085 towed artillery weapons, 310 self-propelled artillery weapons, more than 870 multiple rocket launchers, some 1,700 air defense guns and large numbers of light anti-aircraft missiles, large numbers of anti-tank weapons and guided missiles, and some 50 attack helicopters. This is a large inventory of major weapons, although many are worn and obsolete.

Only part of Iran's tank inventory is operational. It is uncertain how many of Iran's Chieftains and M-47/M-48s are operational, since the total number of Chieftains includes the remainder of 187 improved FV4030/1 versions of the Mark 5 Chieftain that were delivered to the country before the fall of the Shah. Smaller problems seem to exist throughout the rest of the force, and some experts estimate that Iran's sustainable *operational* tank strength may be fewer than 1,000 tanks. Furthermore, Iran's Chieftains and M-60s are at least 16-20 years old, and the T-72 and Zulfiqar are Iran's only tanks with advanced fire control systems, sights, and armor-piercing ammunition.

Iran's T-72Ss are export versions of the Soviet T-72B. Some have been built under license in Iran, and are armed with a 125 mm 2A46M smoothbore gun. They have a relatively modern IA40-1 fire control system and computer, a laser range finder, and a night and day image intensifying sighting system. The T-72S is powered by an 840-horsepower V-84MS diesel engine, has upgraded suspension and mine protection capabilities, and a combat weight of 44.5 tons. Russian sources indicate that Iran has ordered 1,000 T-72s from Russia.

As mentioned earlier, Iran has developed a main battle tank called the Zulfiqar, with a 125 mm smoothbore gun and welded steel turret of Iranian design. According to one report, the Zulfiqar is powered by a V-46-6-12 V-12 diesel engine with 780 horsepower and uses a SPAT 1200 automatic transmission. This engine is used in the Soviet T-72, but the tank transmission design seems to be closer to that of the US M-60. The Zulfiqar seems to have a relatively modern fire control system and Iran may have improved its T-72s with a similar upgrade. The Zulfiqar's combat weight is reported to be 36 tons, and its maximum speed supposedly reaches 65 kilometers per hour at power-to-weight ratio of 21.7 horsepower per ton. The tank is equipped has a 7.62 mm coaxial and a 12.7 mm roof mounted machine gun. It uses modern Slovenia Fontana EFCS-3 computerized fire control system to provide a fully stabilized fire on the move capability. It may have a roof-mounted laser-warning device and it could use the same reactive armor system discussed earlier. Roughly 100 Zulifqar are thought to be in service.

Iran has extended the service life of some of its T-54s, T-55s, and T-59s by improving their armor and fire control systems, and by arming them with an Iranian-made M-68 rifled 105 mm gun similar to the one used in the M-60A1. Reportedly, the Armament Industries Division of the Iranian Defense Industries Organization produces this gun. The Revolutionary Guard is reported to have a special variant of the T-54 called the Safir-74. Iran has developed explosive reactive armor add-ons for its tanks, although the effectiveness of such armor remains unclear.



Some of Iran's 168 M-47/M-48s include upgraded version of the M-47M. The American firm of Bowen-McLaughlin York, which also built a vehicle manufacturing plant in Iran, upgraded these tanks between 1970 and 1972. The M-47s have many of the components of the M-60A1, including the diesel engine, automatic transmission, suspension, gun control system, and fire components. The upgrade resulted in an extended operating range of the M-47 from 130 to 600 kilometers as compared to 130 kilometers before, and increased storage space to hold 79 rounds by eliminating the bow mounted machine gun thereby reducing the crew to four. An estimated 150 conversions have been delivered to Iran.

In spite of its tank imports and production since the Iran-Iraq War, Iran's total operational main battle tank holdings are only sufficient to fully equip 5 to 7 of its divisions by Western standards. Iran can only sustain about half the number of its main battle tanks for any period of extended maneuver warfare. At present, however, Iran's tanks are dispersed in relatively small lots among all of its regular Army and some of its Islamic Revolutionary Guard Corps (IRGC) combat units - all the IRGC units generally only have small tank force cadres and it is unclear to what extent these forces will be armored in the future. The 92nd Armored Division is the only Iranian division that has enough tanks to realistically be considered an armored division, even by regional comparisons.

### ***Other Iranian Armor***

Iran seems to have possessed about 1,000-1,360 armored infantry fighting vehicles (AIFVs) and armored personnel carriers (APCs) in its operational inventory in 2006, although counts are contradictory and it is difficult to estimate what parts of Iran's holdings are fully operational and/or sustainable for any length of time in combat. The IISS, for example, estimates an inventory of 690 light tanks and armored infantry fighting vehicles, and 640 APCs. Virtually all estimates indicate, however, that Iran has only about half of the equipment it would need to fully mechanize its forces at its disposal.<sup>9</sup>

Iran appears to have retained 70-80 British-supplied Scorpions out of the 250 it received before the fall of the Shah. These light tanks are tracked weapon systems equipped with 76 mm guns. However, the Scorpion is more than 20 years old, and as few as 30 may be fully operational. . Iran has developed a new light tank called the Tosan ("Wild Horse" or "Fury") with a 90 mm gun, some of which may already be in service.

As far as other armored fighting vehicles are concerned, Iran had some 210 BMP-1s and 400 BMP-2 equivalents in service. The BMPs are Soviet-designed systems, but have serious ergonomic and weapons suite problems. They are hard to fight from, hard to exit, and too slow to keep pace with modern tanks. They also lack thermal vision systems and modern long-range fire control systems, and their main weapons are difficult to operate in combat even from static positions. Further, Iran has at least 35 EE-9 Cascavel armored reconnaissance vehicles, and one estimate indicates an inventory of 100. The Cascavel is an acceptable design for Third World combat, although it lacks modern sensors and weapons.

Iran's army had some 200 M-113s and other Western APCs, and a mix of BTR-40s, BTR-50s and BTR-60s, numbering 300 in total. Iran is producing an armored fighting vehicle called the Boragh (Boraq) and a lighter APC called the Cobra or BMT-2, of which some 140 are in service. The Boragh seems to be a copy of a Chinese version of the BMP-1. It is a fully tracked and amphibious and has a combat weight of 13 tons. It can carry 8-12 people, plus two crew. Reports differ as to its armament - perhaps reflecting different variants. Initial reports indicate that it has

a turret armed with a 73 mm smoothbore gun and anti-tank guided missile launcher. It may, however, lack the commander's position that exists in the BMP-1, and be armed with a 12.7 mm machine gun. Iran has developed an armor package designed to fit over the hull of the Boragh to provide protection against 30mm armor-piercing ammunition.<sup>10</sup> Variants with 120mm mortars, one-man turrets with Iranian-made Toophan ATGMs, and AT-4 ATGMs, and others with 73mm BMP-2 turret guns also seem to be deployed.

The Cobra or BMT-2 is a low profile, wheeled troop carrier, which can hold seven personnel. Some of its versions may have twin 23mm AA guns.

Iran had an unknown number of British Chieftain bridge laying tanks and a wide range of specialized armored vehicles as well as some heavy equipment transporters. Iran is steadily improving its ability to support armored operations in the field, and to provide recovery and field repair capability. However, its exercises reveal that these capabilities still remain limited relative to those of US forces as they lack recovery and field repair capability in combination with poor interoperability. Most likely, these problems will seriously limit the cohesion, speed, and sustainability of Iranian armored operations.

Iran's armored warfare doctrine seems to be borrowed from US, British, and Russian sources without achieving any coherent concept of operations. Even so, Iran's armored doctrine is improving more quickly than its organization and exercise performance. Iran's armored forces are very poorly structured, and the country's equipment pool is dissipated between far too many regular and IRGC units. As mentioned before, Iran has only one armored division -- the 92nd Armored Division -- with enough tanks and other armor to be considered a true armored unit.

### ***Iranian Anti-Armored Weapons***

Iran had large holdings of anti-tank guided weapons and has been manufacturing copies of Soviet-systems, while buying missiles from China, Russia, and the Ukraine. It has approximately 50-75 TOW and 20-30 Dragon anti-tank guided missile launchers that were originally supplied by the US, although the operational status of such systems is uncertain. It has Soviet and Asian versions of the AT-2, AT-3, and AT-5. Iran seems to have at least 100-200 AT-4 (9K111) launchers, but it is impossible to make an accurate estimate because Iran is producing its own copies of the AT-3. Iran also has some 750 RPG-7V, RPG-11, and 3.5" rocket launchers, and roughly 150 M-18 57 mm, 200 M-20 75 mm and B-10 82 mm, and 200 M-40 106 mm and B-11 107 mm recoilless guns.

Iran produces various anti-tank weapons. These include an improved version of the man portable RPG-7 anti-tank rocket with an 80 mm tandem HEAT warhead instead of the standard 30 mm design, the NAFEZ anti-tank rocket, and a copy of the Soviet SPG-9 73 mm recoilless anti-tank gun. Iran also makes a copy of the Russian AT-3 9M14M (Sagger or Ra'ad) anti-tank guided missile. This system is a crew-operable system with a guidance system that can be linked to a launcher holding up to four missiles. It has a maximum range of 3,000 meters, a minimum range of 500 meters, and a flight speed of 120 meters per second. Iran is also seeking more advanced technology from Russia. The US maintains that a Russian company sold Iran Krasnopol artillery shells while the company denies any connection with Iran.<sup>11</sup> Prospective sanctions are likely to deter arms manufacturers from filling the many needs of the Iranian military.

The Iranian copy of the AT-3 is made by the Shahid Shah Abaday Industrial Group in Tehran, and seems to be an early version that lacks semi-automatic guidance. Hence, the operator must sight the target, rather than use a joystick to guide the missile to the target by using the light from

the missile. The Iranian version of the AT-3 also seems to have a maximum armored penetration capability of 500 mm, which is not enough to penetrate the forward armor of the latest Western and Russian main battle tanks. Russia has, however, refitted most of its systems to semi-automatic line of sight guidance and warheads capable of penetrating 800 mm. Iran may have or be acquiring such capability, and it would significantly improve the lethality of its anti-armor forces.

### ***Iranian Artillery Strength***

Iran had some 3,200 operational medium and heavy artillery weapons and multiple rocket launchers, and some 5,000 mortars. Its towed artillery consisted largely of Soviet designs. Self-propelled artillery included 60 2S1 122mm howitzer, and some Iranian copies. There were some 180 aging M-109 155mm weapon systems of which Iran is seeking to produce its own weapons as part of the "Thunder" series. It had some 70 aging 170mm, 165mm, and 203mm weapon systems. Iran also had large numbers of multiple rocket launchers, including some 700 107mm weapons, 150-200 122mm weapons, 20-odd 240mm weapons, and some 333mm weapons. It manufactures its own multiple rocket launchers, including the long-range Fajr series.

This total is very high compared to the artillery strength of most regional powers, and it reflects Iran's continuing effort to build up artillery strength that began during the Iran-Iraq War. Iran had to use artillery as a substitute for armor and air power during much of the Iran-Iraq War, and generally used relatively static fire. However, Iran's reliance on towed artillery and slow moving multiple rocket launchers limits Iran's combined arms maneuver capabilities, and Iran has failed to develop effective night and beyond-visual-range targeting capability.

Some 2,100 of Iran's weapons were towed tube artillery weapons, versus 310 self-propelled tube weapons, and 700-900 vehicle-mounted or towed multiple rocket launchers. Iran's holdings of self-propelled weapons still appeared to include a substantial number of US-supplied systems, including 25-30 M-110 203 mm howitzers, 20-30 M-107 175 mm guns, and 130-150 M-109 155 mm howitzers. These weapons were worn, have not been modernized in over 15 years, and lack modern fire control systems and artillery radars. Many also lacked sustainability, and a considerable number may not be operational.

Iran understands that it has less than a quarter of the self-propelled artillery it needs to properly support its present force structure, and that maneuverable artillery is critical to success in dealing with Iraqi and other maneuver forces. It is attempting to compensate for the resulting lack of modern artillery and artillery mobility by replacing its US-made self-propelled weapons with other self-propelled systems. Iran has purchased 60-80 Soviet 2S1 122 mm self-propelled howitzers, and has developed an indigenous version called Raad (Thunder 1/Thunder 2). The Thunder 1 is a 122mm weapon similar to Russian designs. The Thunder 2 is a "rapid fire" 155 mm self-propelled weapon. Both systems are now in deployment.

Iran had some 5,000 mortars. These include 107 mm and 120 mm heavy mortars and 800-900 81 mm and 82 mm mortars. The Iranian army has at least several hundred of its heavy mortars mounted on armored vehicles.

The 700-900 multiple rocket launchers in Iran's inventory were evidence on its tactical emphasis on massed, static firepower. It is difficult to estimate Iran's inventory, but its holdings include roughly 10 M-1989 240 mm multiple rocket launchers, 500-700 Chinese Type 63 and Iranian Haseb and Fadjir-1 107 mm multiple rocket launchers, and 100+ Soviet BM-21, Soviet BM-11 122, mm launchers as well as some Fadjir-5 333mm weapon systems.

Iran has produced its own multiple rocket launchers. These include some 50 122mm, 40 round Hadid rocket launcher systems. In addition, Iran produces variants of Chinese and Russian 122 mm rockets called the Arash and Noor. The Iranian state television announced the production of the DM-3b seeker for the Noor. The DM-3b is an active radar sensor that is used in the final stages of flight to acquire and home in on ship targets. A joint program between Iran's Aerospace Industries Organization (AID) and the China Aerospace Science and Industry Corp developed the Noor.<sup>12</sup> The Falaq 1 and 2 series are examples of vehicle mounted unguided rocket systems in the Iranian arsenal. The Falaq 1 fires a 240mm rocket with 50kg of explosives, and can reach a target up to 10 km away. The Falaq 2 is slightly larger, carries ten more kg of explosives, and flies almost a full kilometer further.<sup>13</sup>

Iran's land forces operate a number of Iranian-made long-range unguided rockets, including the Shahin 1 and 2, Oghab, and Nazeat. They also include some 10 large 240mm artillery rockets with a range of up to 40-43 kilometers called the Fadjr 3. The key longer-range systems seem to include:<sup>14</sup>

- The Shahin 1 (sometimes called the Fadjr 4) is a trailer-launched 333 mm caliber unguided artillery rocket. Two rockets are normally mounted on each trailer, and they have with a solid propelled rocket motor, a maximum range of 75 kilometers, and a 175-kilogram conventional or chemical warhead. The Shahin evidently can be equipped with three types of warheads: a 180 kilogram high explosive warhead, a warhead using high explosive submunitions, and a warhead that uses chemical weapons. There is a truck-mounted version, called the Fajr 5, with a rack of four rockets. A larger Shanin 2, with a range of 20 kilometers, is also deployed.
- The Fadjr-3 is a truck-mounted system with a 12 round launcher for 240mm rockets. It has a maximum range of 43 kilometers, and a 45 kg payload in its warhead.
- The Fadjr 5 is truck mounted 333 mm caliber unguided artillery rocket with a solid propelled rocket motor, a maximum range of 75 kilometers, and a 175-kilogram conventional or chemical warhead. It carries four rockets, and they can evidently be equipped with three types of warheads: a kilogram high explosive warhead, a warhead using high explosive submunitions, and a warhead that uses chemical weapons.
- The Oghab is a 320 mm caliber unguided artillery rocket that is spin stabilized in flight, has a maximum range of 34 kilometers, and a 70-kilogram HE fragmentation warhead -- although chemical warheads may be available. While it may have a chemical warhead, it has an operational CEP that has proved to be in excess of 500 meters at maximum range. Further, Iran has no ability to target accurately the Oghab or any other long range missile against mobile or point targets at long ranges, other than a limited ability to use RPVs.
- The Nazeat is a TEL launched system with conventional and possibly chemical and biological warheads. The full details of this system remain unclear, but it seems to be based on Chinese technology and uses a solid fuel rocket, with a simple inertial guidance system. Nazeat units are equipped with communications vans, meteorological vans, and a global positioning system for surveying the launch site. Some reports indicate there are two variants of the Nazeat solid-fueled rocket system -- a 355.6 mm caliber rocket with 105 kilometers range and a 150-kilogram warhead, and a 450 mm caliber rocket with a reported range of 130-150 kilometers and a 250-kilogram warhead. Both systems have maximum closing velocities of Mach 4-5, but both also appear to suffer from poor reliability and accuracy. Other reports indicate all Nazeats are 335.6mm and there are four versions of progressively larger size, with ranges from 80 to 120 kilometers. It is claimed to have a CEP within 5% of its range.
- The Zelzal 2 is a 610mm long-range rocket, with a warhead with a 600-kilogram payload and a maximum range of up to 210 kilometers. A single rocket is mounted on a launcher on a truck. It is unguided, but is spin stabilized, and is claimed to have a CEP within 5% of its range.
- The Fateh A-110 is a developmental system believed to be similar to the Chinese CSS-8, which is a surface-to-surface system derived from the Russian SA-2 surface-to-air missile.

Iran has only made limited progress in deploying artillery fire control and battle management systems, counter-battery radar capability, and long-range target acquisition capability (although it does have some RPVs) to support its self-propelled weapons. Iran has actively sought more modern fire control and targeting systems since the mid-1980s. It has had some success in deploying and testing RPVs as targeting systems, and has obtained some additional counterbattery radars, but it is unclear how many it obtained or put in service.

Iran has transferred large numbers of Fadjr rockets to the Hezbollah in Lebanon.<sup>15</sup>

### ***Iranian Army Air Defense Systems***

Iranian land forces had a total of some 1,700 anti-aircraft guns, including 14.5 mm ZPU-2/4s, 23 mm ZSU-23-4s and ZU-23s, 35 mm M-1939s, 37 mm Type 55s, and 57 mm ZSU-57-2s. Iran also had 100-180 Bofors L/70 40 mm guns, and moderate numbers of Skyguard 35 mm twin anti-aircraft guns (many of which may not be operational). Its largest holdings consisted of unguided ZU-23-2s (which it can manufacture) and M-1939s.

It is unclear how many of these systems are really operational as air defense weapons and most would have to be used to provide very short-range “curtain fire” defense of small point targets. They would not be effective against a modern aircraft using an air-to-ground missile or laser guided weapon. The only notable exception is the ZSU-23-4 radar guided anti-aircraft gun. Iran has 50-100 fully operational ZSU-23-4s. The weapon is short-ranged, and vulnerable to electronic counter-measures (ECM), but is far more lethal than Iran’s unguided guns.

Iran had large numbers of SA-7 (Strela 2M), and SA-14 (Strela) man portable surface-to-air missiles, and some SA-16s and HN-5/HQ-5 as well as Misaq man portable surface-to-air missiles. It had some US-made Stinger man portable surface-to-air missiles it bought from Afghan rebels, but these may no longer be operational or may have been used for reverse engineering purposes. Iran also has some RBS-70 low-level surface-to-air missiles. Iran seems to be producing some version of the SA-7, perhaps with Chinese assistance. It is not clear whether Iran can do this in any large number. Iran’s land-based air defense forces are also acquiring growing numbers of Chinese FM-80s, a Chinese variant of the French-designed Crotale.

### ***Iranian Army Aviation***

Iran pioneered use of army aviation and attack helicopters during the time of the Shah, but built up its holdings of helicopters far more quickly than it expanded its training and maintenance capability. As a result, it had an ineffective and unsustainable force at the time the Shah fell. Its inability since that time to obtain adequate spare parts and help in modernizing the aircraft has long made Iranian operational helicopter holdings uncertain.

The Iranian Army seems to retain 50 AH-1J Sea Cobra attack helicopters, 20 CH-47C, 50 Bell-214, 68 AB-205A, 10 AB-206, and 25 Mi-8/Mi-27 transport and utility helicopters. There are also reports that Iran signed orders for four Mi-17s in 1999 and 30 Mi-8s in 2001.

These Western-supplied transport and support helicopters have low operational readiness, and they have little sustained sortie capability.

Iran is also seeking to create a significant RPV force that borrows in many ways from Israeli technical developments and doctrine. It has produced some such RPVs, such as the Mohajer series – and several exercise reports refer to their use. It has sold some of these systems to the Hezbollah, but insufficient data are available to assess this aspect of Iranian capabilities.

## ***Iranian Army C4I***

Iranian Army communications have improved, as have Iranian battle management and communications exercises. They are now capable of better coordination between branches, the density of communications equipment has improved, and the functional lines of communication and command now place more emphasis on maneuver, quick reaction, and combined arms. However, Iranian battle management and communications capabilities seem to remain relatively limited.

Iran's holdings still consist largely of aging VHF radio with some HF and UHF capability. This equipment cannot handle high traffic densities and secure communications are poor. Iran still relies heavily on analogue data handling and manually switched telephone systems. It is, however, acquiring a steadily growing number of Chinese and Western encryption systems and some digital voice, fax, and telex encryption capability.

### ***Other Aspects of Iranian Army Capability***

Iran's Army has improved its organization, doctrine, training, and equipment for land force operations. Iran still, however, is a slow moving force with limited armored maneuver capability and artillery forces better suited for static defense and the use of mass fire than the efficient use of rapidly switched and well-targeted fire. Sustainability is limited, as is field recovery and repair capability. Overall manpower quality is mediocre because of a lack of adequate realistic training and a heavy reliance on conscripts.

The army has some capability for power projection and armored maneuver warfare, but does not train seriously for long-range maneuver and does little training for amphibious warfare or deployment by sea. Its logistics, maintenance, and sustainment system is largely defensive and designed to support Iranian forces in defending Iran out of local bases. It does not practice difficult amphibious operations, particularly "across the beach" operations. It could, however, deploy into Kuwait and cross the border into Iraq. It can also move at least brigade-sized mechanized units across the Gulf by amphibious ship and ferry if it does not meet significant naval and air opposition to any such movement. It lacks the air strength and naval air and missile defense capabilities to be able to defend such an operation.

**Figure 3: Iranian Army's Force Structure Trends, 1990-2006**

	1990	2000	2005	2006
<b>Manpower</b>	305,000	350,000	350,000	350,000
<i>Active</i>	305,000	350,000	350,000	350,000
<i>Conscripts</i>	250,000	220,000	220,000	220,000
<b>Combat Units</b>	<b>52</b>	<b>26-28</b>	<b>26-28</b>	<b>28-29</b>
<i>Army HQ</i>	3	4	4	4
<i>Armored Division</i>	0	4	4	4
<i>Mechanized Division</i>	4	0	0	0
<i>Infantry Division</i>	6	6	6	6
<i>Airborne Division</i>	1	1	1	1

<i>Special Operation Division</i>	1	1	1	1
<i>Commando Division</i>	0	1	2	2
<i>Armored Brigade</i>	some	0	0	0
<i>Mechanized Brigade</i>	some	1	1	0
<i>Artillery Battalion</i>	0	4-5	4-5	4-5
<i>Artillery Battalion</i>	0	4-5	4-5	6
<i>Mechanized Battalion</i>	28	0	0	0
<b>Main Battle Tanks</b>	500	1,345	1,613	1,613+
<i>T-54</i>	some	400	540	540
<i>T-59</i>	some	0	0	0
<i>T-62</i>	some	75	75	75+
<i>T-72</i>	some	480	480	480
<i>Chieftain Mk 3/5</i>	some	140	100	100
<i>M-47/-48</i>	some	150	168	168
<i>M-60A1</i>	some	100	150	150
<i>Zulfiqar</i>	0	0	100	100
<b>Light Tanks</b>	30	80	80+	80+
<i>Scorpion</i>	30	80	80	80
<i>Towsan</i>	0	0	some	some
<b>Reconnaissance (Recce)</b>	130	35	35	35
<i>EE-9 Cascavel</i>	130	35	35	35
<b>Armored Infantry Fighting Vehicles (AIFV)</b>	100+	440	610	610
<i>BMP-1</i>	100+	300	210	210
<i>BMP-2</i>	0	140	400	400
<b>Armored Personal Carrier (APC)</b>	500	550	640	640
<i>BTR-50/-60</i>	some	300	300	300
<i>M-113</i>	some	250	200	200
<i>Boragh</i>	0	0	140	140
<b>TOWED</b>	some	2,170	2,010	2,010
<i>105mm: M-101A1</i>	339+	130	130	130
<i>105mm: Oto Melara</i>	36	0	0	0
<i>122mm: D-30</i>	0	600	540	540
<i>122mm: PRC type-54</i>	0	100	100	100
<i>130mm: M-46/Type-59</i>	125	1,100	985	985
<i>152mm: D-20</i>	0	30	30	30



<i>155mm: WAC-21</i>	0	20	15	15
<i>155mm: M-71</i>	50	0	0	0
<i>155mm: M-114</i>	0	70	70	70
<i>155mm: FH-77B</i>	18	0	0	0
<i>155mm: GHN-45</i>	130	100	120	120
<i>203mm: M-115</i>	30	20	20	20
<b>Self Propelled</b>	140	290	310+	310+
<i>122mm: 2S1</i>	0	60	60	60
<i>122mm: Thunder 1</i>	0	0	some	some
<i>155mm: M-109</i>	100	60	180	180
<i>155mm: Thunder 2</i>	0	0	some	some
<i>170mm: M-1978</i>	0	10	10	10
<i>175mm: M-107</i>	30	30	30	30
<i>203mm: M-110</i>	10	30	30	30
<b>Multiple Rocket Launchers</b>	some	764+	876+	876+
<i>107mm: PRC Type-63</i>	some	600	700	700
<i>107mm: Haseb</i>	0	0	some	some
<i>107mm: Fadjr 1</i>	0	0	some	Some
<i>122mm: Hadid/Arash/Noor</i>	0	50	50	50
<i>122mm: BM-21</i>	65	100	100	100
<i>122mm: BM-11</i>	some	5	7	7
<i>240mm: M-1985</i>	0	9	9	9
<i>240mm: Fadjr 3</i>	0	0	10	10
<i>333mm: Fadjr 5</i>	0	0	some	some
<b>Mortars</b>	3,000+	6,500	5,000	5,000
<i>60mm:</i>	0	some	some	some
<i>81mm:</i>	some	some	some	some
<i>82mm:</i>	0	some	some	some
<i>107mm: 4.2in M-30</i>	some	some	some	some
<i>120mm: M-65</i>	3,000	some	some	some
<b>Surface to Surface Missiles</b>		some	some	some42+
<i>Scud-B/-C Launchers, est. 300 MSLS</i>	some	10	12-18 with	12-18
<i>Shahab 3</i>	some	some	some	some
<i>CSS-8</i>	0	25	30	30
<i>Oghab</i>	some	some	some	some

<i>Shaheen 1/-2</i>	some	some	some	some
<i>Nazeat</i>	some	some	some	some
<b>Surface to Air Missiles</b>	some	some	some	some
<i>SA-7</i>	some	some	some	0
<i>SA-14</i>	some	some	some	0
<i>SA-16</i>	some	some	some	0
<i>HQ-7</i>	some	some	some	some
<b>ATGW</b>	some	some	75	75
<i>ENTAC</i>	some	0	0	0
<i>SS-11/-12</i>	some	0	0	0
<i>Dragon</i>	some	0	0	0
<i>AT-3 Sagger</i>	0	0	some	some
<i>AT-4 Spigot</i>	0	some	some	some
<i>AT-5 Spandrel</i>	0	0	some	some
<i>Saeqhe 1/2</i>	0	0	some	some
<i>Toophan</i>	0	0	some	some
<b>Rocket Launchers</b>	0	some	some	some
<i>73mm: RPG-7</i>	0	some	some	some
<b>Recoilless Launchers</b>	some	some	some	some
<i>57mm</i>	some	0	0	0
<i>75mm: M-20</i>	some	some	some	some
<i>82mm: B-10</i>	0	some	some	some
<i>106mm: M-40</i>	some	some	200	200
<i>107mm: B-11</i>	0	some	some	some
<b>Air Defense Guns</b>	1,500	1,700	1,700	1,700
<i>14.5mm: ZPU-2/-4</i>	some	some	some	some
<i>23mm: ZU-23 Towed</i>	some	some	some	some
<i>23mm: ZSU-23-4 SP</i>	some	some	some	some
<i>35mm:</i>	some	some	some	some
<i>37mm: M-1939</i>	some	some	some	some
<i>37mm: PRC Type-55</i>	some	some	some	some
<i>57mm: ZSU-57-2-Sp</i>	some	some	some	some
<i>57mm: S-60</i>	some	some	some	some
<b>Surface to Air Missile</b>	230	some	some	some
<i>1 Hawk</i>	30	0	0	0

<i>RBS-70</i>	200	some	some	some
<i>SA-7/-14/-16</i>	some	some	some	some
<i>HQ-7</i>	0	some	some	some
<i>UAV</i>	0	some	some	some
<i>Mohajer II/III/IV</i>	0	some	some	some
<b>Aircraft</b>	49+	77	36	17
<i>Cessna 185</i>	40+	50	10	10
<i>F-27</i>	2	19	2	2
<i>Falcon 20</i>	2	8	20	1
<i>Turbo Commander 690</i>	5	0	4	4
<b>Helicopters</b>	410	556	223	223
<i>AH-1J Attack</i>	100	100	50	50
<i>CH-47C Heavy Transport</i>	10	40	20	20
<i>Bell 214A/C</i>	250	165	50	50
<i>Bell 204</i>	0	30	0	0
<i>AB-205A</i>	35	40	68	68
<i>AB-206</i>	15	90	10	10
<i>AB-12</i>	0	12	0	0
<i>Mi-8/-17</i>	0	0	25	25
<i>Hughes 300C</i>	0	5	0	0
<i>RH-53D</i>	0	9	0	0
<i>SH-53D</i>	0	10	0	0
<i>SA-319</i>	0	10	0	0
<i>UH-1H</i>	0	45	0	0

Source: IISS, *Military Balance*, various editions including 1989-1990, 1999-2000, 2004-2005, 2005-2006.

## **The Islamic Revolutionary Guards Corps (Pasdaran)**

The Islamic Revolutionary Guards Corps (IRGC) has contributed some 125,000 men to Iran's forces in recent years, and has substantial capabilities for asymmetric warfare and covert operations. The IRGC operates most of Iran's surface-to-surface missiles, and is believed to have custody over potentially deployed nuclear weapons, most or all other CBRN weapons, and operate Iran's nuclear-armed missile forces if they are deployed.

### ***IRGC Land Forces***

The IRGC has small elements equipped with armor and as the equivalent of conventional army units, and some units trained for covert missions and asymmetric warfare, but most of its forces are lightly equipped infantry trained and equipped for internal security missions. These forces are reported to have between 120,000 and 130,000 men, but such totals are uncertain. They also include conscripts recruited from the same pool as regular army conscripts, and training and retention levels are low. The IRGC land forces do, however, control the Basij and other paramilitary forces if they are mobilized for war.

Some sources, like the IISS, report a force structure with 20 "divisions," but most units seem to be battalion-sized elements. The total manpower pool of the IRGC could only support about 5-6 light infantry divisions. There is supposed to be one airborne brigade.

The IRGC often claims to conduct very large exercises, sometimes with 100,000 men or more. The exact size of such exercises is unclear, but they are generally a small fraction of IRGC claims. With the exception of small elite elements, training is very limited and largely suitable for internal security purposes. Most forces would require substantial refresher training to act in any mission other than static infantry defense.

The IRGC remains the center of Iran's hardline security forces, but has become steadily more bureaucratic and less effective as a conventional fighting force since the end of the Iran-Iraq War in 1988. Corruption and careerism are growing problems, and the IRGC's role in defense industry has led to financial abuses. At this point in time, it is the elite elements of the IRGC that give it real meaning beyond serving the regime's need to control its population.

### ***The IRGC Air Force***

The air force of the IRGC is believed to operate Iran's three Shahab-3 IRBM units (whose true operational status remains uncertain), and may have had custody of its chemical weapons and any biological weapons. While the actual operational status of the Shahab-3 remains uncertain; Iran's supreme leader, Ayatollah Ali Khamenei, announced in 2003 that Shahab-3 missiles had been delivered to the Islamic Revolutionary Guards Corps (IRGC). In addition, six Shahab-3s were displayed in Tehran during a military parade in September 2003.<sup>16</sup>

It is not clear what combat formations exist within the IRGC, but the IRGC may operate Iran's 10 EMB-312 Tucanos.<sup>17</sup> It seems to operate many of Iran's 45 PC-7 training aircraft, as well as some Pakistani-made trainers at a training school near Mushhak, but this school may be run by the regular air force. It has also claimed to manufacture gliders for use in unconventional warfare. These are unsuitable delivery platforms but could carry small number weapons.<sup>18</sup>

## ***The IRGC Naval Forces***

The IRGC also has a naval branch with some 20,000 men, including marine units of some 5,000 men. Other sources show this force subordinated to the regular naval forces. Such a force could deliver small nuclear weapons or other CBRN weapons into ports, oil and desalination facilities, and felt operational areas in the Gulf and Gulf of Oman.

The naval branch has bases in the Gulf, many near key shipping channels and some near the Strait of Hormuz. These include facilities at Al-Farsiyah, Halul (an oil platform), Sirri, Abu Musa, Bandaer-e Abbas, Khorramshahr, and Larak. It also controls Iran's coastal defense forces, including naval guns and an HY-3 Seersucker land-based anti-ship missile unit deployed in 5-7 sites along the Gulf coast.

Its forces can carry out extensive raids against Gulf shipping, carry out regular amphibious exercises with the land branch of the IRGC against objectives like Islands in the Gulf, and could conduct raids against Saudi Arabia or other countries on the Southern Gulf coast. They give Iran a major capability for asymmetric warfare. The Guards also seem to work closely with Iranian intelligence, and appear to be represented unofficially in some embassies, Iranian businesses and purchasing offices, and other foreign fronts.

The IRGC naval forces have at least 40 light patrol boats, 10 Houdong guided missile patrol boats armed with C-802 anti-ship missiles, and a battery of HY-2 Seersucker land-based anti-ship missiles. Some of these systems could be modified to carry a small CBRN weapon, but hardly are optimal delivery platforms because of their limited-range payload and sensor/guidance platforms unsuited for the mission.

## ***Proxy and Covert CBRN Operations***

The IRGC has a complex structure that includes both political and military units. It has separate organizational elements for its land, naval, and air units, which include both military and paramilitary units. The Basij and the tribal units of the Pasdaran are subordinated to its land unit command, although the commander of the Basij often seems to report directly to the commander-in-chief and Minister of the Pasdaran and through him to the Leader of the Islamic Revolution.

The IRGC has close ties to the foreign operations branch of the Iranian Ministry of Intelligence and Security (MOIS), particularly through the IRGC's Qods force. The Ministry of Intelligence and Security was established in 1983, and has an extensive network of offices in Iranian embassies. It is often difficult to separate the activities of the IRGC, VEVAK, and Foreign Ministry, and many seem to be integrated operations managed by a ministerial committee called the "Special Operations Council" that includes the Leader of the Islamic Revolution, President, Minister of Intelligence and Security, and other members of the Supreme Council for National Defense.<sup>19</sup>

Other elements of the IRGC can support proxy or covert use of CBRN weapons. They run some training camps inside Iran for outside "volunteers." Some IRGC still seem to be deployed in Lebanon and actively involved in training and arming Hezbollah, other anti-Israeli groups, and other elements.<sup>20</sup> The IRGC has been responsible for major arms shipments to Hezbollah, including large numbers of AT-3 anti-tank guided missiles, long-range rockets and some Iranian-made Mohajer UAVs.<sup>21</sup>

Some reports indicate Iran has exported thousands of 122mm rockets and Fajr 4 and Fajr 5 long-range rockets, including the ARASH with a range of 21-29 kilometers. These reports give the Fajr 5 a range of 75 kilometers with a payload of 200 kilograms. Iran seems to have sent such arms to the Hezbollah and some various Palestinian movements, including some shiploads of arms to the Palestinian Authority.<sup>22</sup>

### ***The Quds (Qods) Forces***

The IRGC has a large intelligence operations and unconventional warfare component. Roughly 5,000 of the men in the IRGC are assigned to the unconventional warfare mission. The IRGC has the equivalent of one Special Forces division, plus additional smaller formations, and these forces are given special priority in terms of training and equipment. In addition, the IRGC has a special Quds force which plays a major role in giving Iran the ability to conduct unconventional warfare overseas using various foreign movements as proxies.<sup>23</sup>

The budget for the Quds forces is a classified budget directly controlled by Khamenei, and is not reflected in the Iranian general budget. It operates primarily outside Iran's borders, although it has bases inside and outside of Iran. The Quds troops are divided into specific groups or "corps" for each country or area in which they operate. There are Directorates for Iraq; Lebanon, Palestine, and Jordan; Afghanistan, Pakistan, and India; Turkey, the Arabian Peninsula; Asian countries of the former Soviet Union, Western Nations (Europe and North America) and North Africa (Egypt, Tunisia, Algeria, Sudan, and Morocco).

The Quds has offices or "sections" in many Iranian embassies, which are closed to most embassy staff. It is not clear whether these are integrated with Iranian intelligence operations, or that the ambassador in such embassies has control of, or detailed knowledge of, operations by the Quds staff. However, there are indications that most operations are coordinated between the IRGC and offices within the Iranian Foreign Ministry and Ministry of Intelligence and Security (MOIS). There are separate operational organizations in Lebanon, Turkey, Pakistan, and several North African countries. There also indications that such elements may have participated in the bombings of the Israeli Embassy in Argentina in 1992, and the Jewish Community Center in Buenos Aires in 1994 -- although Iran has strongly denied this.<sup>24</sup>

The Quds force seems to control many of Iran's training camps for unconventional warfare, extremists, and terrorists in Iran and countries like the Sudan and Lebanon. It has at least four major training facilities in Iran. The Quds forces have a main training center at Imam Ali University that is based in the Sa'dabad Palace in Northern Tehran. Troops are trained to carry out military and terrorist operations, and are indoctrinated in ideology. There are other training camps in the Qom, Tabriz, and Mashhad governates, and in Lebanon and the Sudan. These include the Al Nasr camp for training Iraqi Shi'ites and Iraqi and Turkish Kurds in northwest Iran, and a camp near Mashhad for training Afghan and Tajik revolutionaries. The Quds seems to help operate the Manzariyah training center near Qom, which recruits from foreign students in the religious seminary and which seems to have trained some Bahraini extremists. Some foreigners are reported to have received training in demolition and sabotage at an IRGC facility near Isfahan, in airport infiltration at a facility near Mashhad and Shiraz, and in underwater warfare at an IRGC facility at Bandar Abbas.<sup>25</sup>

## ***Role in Iran's Industries***

The IRGC plays a major role in Iran's military industries. Its lead role in Iran's efforts to acquire surface-to-surface missiles and weapons of mass destruction, gives it growing experience with advanced military technology. As a result, the IRGC is believed to be the branch of Iran's forces that plays the largest role in Iran's military industries.<sup>26</sup> It also operates all of Iran's Scuds, controls most its chemical and biological weapons, and provides the military leadership for missile production and the production of all weapons of mass destruction.

## ***The Basij and Other Paramilitary Forces***

The rest of Iran's paramilitary and internal security forces seem to have relatively little capability in such missions. The Basij (Mobilization of the Oppressed) is a popular reserve force of about 90,000 men with an active and reserve strength of up to 300,000 and a mobilization capacity of nearly 1,000,000 men. It is controlled by the Islamic Revolutionary Guards Corps, and consists largely of youths, men who have completed military service, and the elderly.

Iran also has 45,000-60,000 men in the Ministry of Interior serving as police and border guards, with light utility vehicles, light patrol aircraft (Cessna 185/310 and AB-205 and AB-206s), 90 coastal patrol craft, and 40 harbor patrol craft.

## **The Iranian Air Force**

The Iranian Air Force still is numerically strong, but most of its equipment is aging, worn, and has limited mission capability. It had some 52,000 men; 37,000 in the air force in 2006, and 15,000 in the Air Defense force, which operates Iran's land-based air defenses. It had over 300 combat aircraft in its inventory (The IISS estimates 281).

Many of these aircraft, are either not operational or cannot be sustained in extended air combat. This includes 50-60% of Iran's US and French supplied aircraft and some 20-30% of its Russian and Chinese supplied aircraft. It has nine fighter-ground attack squadrons with 162-186 aircraft; seven fighter squadrons, with 70-74 aircraft, a reconnaissance unit with 4-8 aircraft, and a number of transport aircraft, helicopters, and special purpose aircraft. It operates most of Iraq's land-based air defenses, including some 150 I Hawks, 45 HQ-21s, 10 SA-5s, 30 Rapiers, 15 Tigercats, and additional forces equipped with light surface-to-air missiles.

The Iranian air force is headquartered in Teheran with training, administration, and logistics branches, as well as a major central Air Defense Operations Center. It has a political directorate and a small naval coordination staff. It has three major regional headquarters: Northern Zone (Badl Sar), Central Zone (Hamaden), and Southern Zone (Bushehr).

Each regional zone seems to control a major air defense sector with subordinate air bases and facilities. The key air defense sub-zones and related bases in the Northern Zone are at Badl Sar, Mashhad, and Shahabad Kord. The sub-zones and bases in the Central Zone are at Hamadan and Dezful, and the sub-zones and bases in the Southern Zone are at Bushehr, Bandar Abbas, and Jask. Iran has large combat air bases at Mehrabad, Tabriz, Hamadan, Dezful, Bushehr, Shiraz, Isfahan, and Bandar Abbas. It has smaller bases at least at eleven other locations. Shiraz provides interceptor training and is the main base for transport aircraft.



## ***Iranian Air Strength***

As is the case with most aspects of Iranian military forces, estimates of Iran's exact air strength differ by source. The IISS estimates the air force has 14 main combat squadrons. These include nine fighter ground-attack squadrons, with 4/55-65 US-supplied F-4D/E and 4/55-65 F-5E/FII, and 1/27-30 Soviet-supplied Su-24MK. Iran has 7 Su-25K and 24 Mirage F-1 Iraqi aircraft it seized during the Gulf War, and some may be operational. Some reports indicate that Iran has ordered an unknown number of TU-22M-3 'Backfire C' long-range strategic bombers from either Russia or the Ukraine.<sup>27</sup> While such discussions do seem to have taken place, no purchases or deliveries can be confirmed.

Iran had five air defense squadrons, with 2/20-25 F-5B, 60 US-supplied F-14, 2/25-30 Russian/Iraqi-supplied MiG-29, and 1/25-35 Chinese supplied F-7M.<sup>28</sup> The Iranian air force had a small reconnaissance squadron with 3-8 RF-4E. It has 5 C-130H MP maritime reconnaissance aircraft, 1 RC-130 and other intelligence/reconnaissance aircraft, together with large numbers of transports and helicopters.

Most Iranian squadrons can perform both air defense and attack missions, regardless of their principal mission -- although this is not true of Iran's F-14 (air defense) and Su-24s (strike/attack) units. Iran's F-14s were, however, designed as dual-capable aircraft, and have not been able to use their Phoenix air-to-air missiles since the early 1980s. Iran has claimed that it is modernizing its F-14s by equipping them with I-Hawk missiles adapted to the air-to-air role, but it is far from clear that this is the case or that such adaptations can have more than limited effectiveness. In practice, this means that Iran might well use the F-14s in nuclear strike missions. They are capable of long range, high payload missions, and would require minimal adaptation to carry and release a nuclear weapon.<sup>29</sup>

As a result, Iran has a large number of attack and air defense aircraft that could carry a small to medium sized nuclear weapon long distances, particularly since most such strikes are likely to be low-altitude one-way missions. (These were the mission profiles in both NATO and Warsaw Pact theater nuclear strike plans.) Several might conceivably be modified as drones or the equivalent of "cruise missiles" using autopilots, on-board computers, and add-on GPS.

Iran has moderate airlift capabilities for a regional power. The Iranian air force's air transport assets included 3 B-707 and 1 B-747 tanker transports, and five transport squadrons with 4 B-747Fs, 1 B-727, 18C-130E/Hs, 3 Commander 690s, 10 F-27s, 1 Falcon 20A, and 2 Jetstars. Iran will have 14 Xian Y-7 transports by 2006.<sup>30</sup> Its helicopter strength includes 2 AB-206As, 27-30 Bell 214Cs, and 2 CH-47, 30 Mi-17 and Iranian-made Shabaviz 206-1 and 2-75 transport helicopters.

The IRGC also has some air elements. It is not clear what combat formations exist within the IRGC, but the IRGC may operate Iran's 10 EMB-312 Tucanos.<sup>31</sup> It seems to operate many of Iran's 45 PC-7 trainers, as well as some Pakistani-made trainers at a training school near Mushhak, but this school may be run by the regular air force. It has also claimed to manufacture gliders for use in unconventional warfare. The IRGC has not recently expanded its air combat capabilities.<sup>32</sup>

## ***Iranian Aircraft Development***

Iran has made more ambitious claims about aircraft production than it cannot yet back up. Russian firms and the Iranian government tried to reach an agreement over license-production of

the MiG-29, but repeated attempts have failed. Likely, due to the difficulty the regime has had in procuring new aircraft, Iran has been developing three new attack aircraft. The indigenous design and specifics of one of the fighters in development, the Shafagh, were unveiled at the Iran Airshow in 2002. Engineers hope to have a prototype by 2008, though it is unclear what the production numbers will be and what the real-world timetable for deployment may be.<sup>33</sup>

Little is known about the other two fighters in development, the Saeghe and the Azarakhsh, other than they have been reportedly derived from the F-5F. Claims have been made that the Azarakhsh is in low rate production, and has had operational weapons tests. There are also some indications that Iran is experimenting with composites in the Azarakhsh, and is seeking to give it a locally modified beyond-visual-range radar for air-to-air combat.<sup>34</sup>

In practice, Iran is making light turboprop aircraft and a light utility helicopter. It is making enough progress so that it will probably be able to produce a jet trainer and heavier helicopters, but it is unclear how effective it can be in producing modern combat aircraft.<sup>35</sup>

Iran also has some indigenous capability to produce combat aircraft and drones. Iran has been developing three new attack aircraft. The indigenous design and specifics of one of the fighters in development, the Shafagh, were unveiled at the Iran Airshow in 2002. Engineers hope to have a prototype by 2008, though it is unclear what the production numbers will be and what the real-world timetable for deployment may be.<sup>36</sup> Only limited data are available on the other two fighters in development, the Saeghe and the Azarakhsh, other than they have been reportedly derived from the F-5F. Claims have been made that the Azarakhsh is in low rate production, and has had operational weapons tests. There are also some indications that Iran is experimenting with composites in the Azarakhsh, and is seeking to give it locally modified beyond-visual-range radar for air-to-air combat.<sup>37</sup>

### ***Iranian Land-based Air Defense***

Iran seems to have assigned about 12,000-15,000 men in its air force to land-based air defense functions, including at least 8,000 regulars and 4,000 IRGC personnel. It is not possible to distinguish clearly between the major air defense weapons holdings of the regular air force and IRGC, but the air force appeared to operate most major surface-to-air missile systems. Total holdings seem to include 30 Improved Hawk fire units (12 battalions/150+ launchers), 45-55 SA-2 and HQ-2J/23 (CSA-1) launchers (Chinese-made equivalents of the SA-2), and possibly 25 SA-6 launchers. The air force also had three Soviet-made long-range SA-5 units with a total of 10-15 launchers -- enough for six sites. Iran has developed and deployed its own domestically manufactured SAM dubbed the Shahab Thaqeb. The SAM requires a four-wheeled trailer for deployment and closely resembles the R440 SAM.<sup>38</sup>

Iran's holdings of lighter air defense weapons include five Rapier squadrons with 30 Rapier fire units, 5-10 Chinese FM-80 launchers, 10-15 Tigercat fire units, and a few RBS-70s. Iran also holds large numbers of man-portable SA-7s, HN-5s, and SA-14s, plus about 2,000 anti-aircraft guns - including some Vulcans and 50-60 radar-guided and self-propelled ZSU-23-4 weapons.<sup>39</sup> It is not clear which of these lighter air defense weapons were operated by the army, the IRGC, or the air force. The IRGC clearly had larger numbers of manportable surface-to-air launchers, including some Stingers that it had obtained from Afghanistan. It almost certainly had a number of other light air defense guns as well.

There are no authoritative data on how Iran deploys air defenses, but Iran seems to have deployed its new SA-5s to cover its major ports, oil facilities, and Tehran. It seems to have concentrated its Improved Hawks and Soviet and Chinese-made SA-2s around Tehran, Isfahan, Shiraz, Bandar Abbas, Kharg Island, Bushehr, Bandar Khomeini, Ahwaz, Dezful, Kermanshah, Hamadan, and Tabriz. Iran's air defense forces are too widely spaced to provide more than limited air defense for key bases and facilities, and many lack the missile launcher strength to be fully effective. This is particularly true of Iran's SA-5 sites, which provide long-range, medium-to-high altitude coverage of key coastal installations. Too few launchers are scattered over too wide an area to prevent relatively rapid suppression.

Iran also lacks the low altitude radar coverage, overall radar net, command and control assets, sensors, resistance to sophisticated jamming and electronic countermeasures, and systems integration capability necessary to create an effective air defense net. Its land-based air defenses must operate largely in the point defense mode, and Iran lacks the battle management systems and data links are not fast and effective enough to allow it to take maximum advantage of the overlapping coverage of some of its missile systems—a problem further complicated by the problems in trying to net different systems supplied by Britain, China, Russia, and the US. Iran's missiles and sensors are most effective at high-to-medium altitudes against aircraft with limited penetrating and jamming capability.

### ***Iranian Air Force Readiness and Effectiveness***

In spite of Iran's efforts, readiness and force quality remain major issues. The Iranian air force still has many qualitative weaknesses, and it is far from clear that its current rate of modernization can offset the aging of its Western-supplied aircraft and the qualitative improvements in US and Southern Gulf forces. The air force also faces serious problems in terms of sustainability, command and control, and training. Iran has a pilot quality problem. Many of its US-trained pilots were purged at some point during the Revolution. Its other US-trained pilots and ground-crew technicians are aging to the point where many should soon retire from service, and have not had advanced air-to-air combat and air attack training for more than 15 years.

While Iran practices realistic individual intercept training, it fails to practice effective unit or force-wide tactics and has shown only limited capability to fly large numbers of sorties with its US supplied aircraft on even a surge basis. It has limited refueling capabilities -- although it has four B-707 tanker/ transports and may have converted other transports. The Iranian air force lacks advanced training facilities, and has only limited capability to conduct realistic training for beyond-visual-range combat and standoff attacks with air-to-surface munitions. Ground crew training and proficiency generally seem mediocre -- although the layout of Iranian air bases, aircraft storage and parking, the deployment of equipment for maintenance cycles, and the other physical signs of air unit activity are generally better organized than those of most Middle Eastern air forces.

The Iranian air force must also deal with the fact that its primary challenge now consists of the US, British, and Saudi air forces. They are high technology air forces that operate the AWACS airborne control system, have some of the most advanced electronic warfare and targeting systems in the world, and have full refueling capability. They use sophisticated, computer-aided aggressor training and have all of the range and training facilities for beyond-visual-range combat and standoff attacks with air-to-surface munitions. Iran has no airborne control system, although it may be able to use the radars on its F-14s to support other aircraft from the rear. Its

overall C<sup>4</sup>I system is a totally inadequate mix of different sensors, communications, and data processing systems. It has limited electronic warfare capabilities by US standards, although it may be seeking to acquire two Beriev A-50 Mainstay AEW aircraft, and has converted some aircraft to provide a limited ELINT/SIGINT capability.

Iran is slowly improving its capability for joint land-air, and air-sea operations. Iranian exercises and statements provide strong indications that Iran would like to develop an advanced air defense system, the ability to operate effectively in long-range maritime patrol and attack missions, effective joint warfare capabilities, and strike/attack forces with the ability to penetrate deep into Iraq, the southern Gulf States, and other neighboring powers. Iran's exercises, military literature, and procurement efforts also make it clear that its air planners understand the value of airborne early warning and C<sup>4</sup>I systems, the value of airborne intelligence and electronic warfare platforms, the value of RPVs, and the value of airborne refueling. Iran has even sought to create its own satellite program.<sup>40</sup> Further, the air force's efforts at sheltering and dispersal indicate that it understands the vulnerability of modern air facilities and the standoff attack capabilities of advanced air forces like those of the United States.

**Figure 4: Iranian Air Force's Force Structure Trends, 1990-2006**

	1990	2000	2005	2006
<b>Manpower</b>	<b>35,000</b>	<b>50,000</b>	<b>52,000</b>	<b>52,000</b>
Active	35,000	50,000	52,000	52,000
Conscripts	0	0	0	0
<b>Fighter</b>	<b>15</b>	<b>114</b>	<b>74</b>	<b>74</b>
F-7	0	24	24	24
F-14	15	60	25	25
MiG-29	0	30	25	25
<b>Fighter Ground Attack</b>	<b>104</b>	<b>140</b>	<b>186</b>	<b>186+</b>
F-4D/E	35	50	65	65+
F-5E/F	45	60	60	60+
Ch J-6	24	0	0	0
Su-24	0	30	30	30
Su-25K	0	0	7	7
Mirage F1-E	0	0	24	24
<b>Maritime Reconnaissance</b>	<b>2</b>	<b>5</b>	<b>3</b>	<b>5</b>
P-3F	2	0	0	0
P-3MP	0	0	3	5
C-130H-MP	0	5	0	0
<b>Reconnaissance</b>	<b>8</b>	<b>15</b>	<b>6</b>	<b>6+</b>
F-5	5	0	0	0
RF-4E	3	15	6	6+

<b>Transport</b>	<b>59</b>	<b>63</b>	<b>64+</b>	<b>65+</b>
<i>Boeing 707</i>	14	3	3	3
<i>Boeing 747F</i>	9	7	5	5
<i>Boeing 727</i>	0	1	1	1
<i>C-130E/H</i>	20	18	18	17
<i>F-27</i>	9	15	10	10
<i>Commander 690</i>	3	3	3	3
<i>Falcon</i>	3	4	1	1
<i>PC-6B</i>	0	10	10	10
<i>Y-7</i>	0	2	2	9
<i>Y-12(II)</i>	0	0	9	3
<i>Jetstar</i>	0	0	2	2
<i>Il-76</i>	0	0	some	1+
<b>Utility</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>12</b>
<i>TB-21</i>	0	0	0	8
<i>TB-200</i>	0	0	0	4
<b>Helicopters</b>	<b>55 (0 armed)</b>	<b>53 (0 armed)</b>	<b>34 (0 armed)</b>	<b>34+</b>
<i>AB-206</i>	2	2	2	2
<i>Bell 214C</i>	39	39	30	30
<i>CH-47</i>	10	5	2	2+
<i>S-61A</i>	2	0	0	0
<i>Shabaviz 2-75</i>	0	0	0	some
<i>Shabaviz2061</i>	0	0	0	some
<b>Training</b>	<b>84</b>	<b>132</b>	<b>151</b>	<b>119</b>
<i>F-33A/V</i>	26	26	20	?
<i>T-33</i>	7	7	7	7
<i>PC-7</i>	46	40	40	40
<i>EMB-312</i>	5-6	15	15	?
<i>MiG-29B</i>	0	5	0	?
<i>FT-7</i>	0	5	15	?
<i>F-5B</i>	0	20	20	?
<i>TB-21</i>	0	8	8	?
<i>TB-200</i>	0	4	4	?
<i>MFI-17 Mushshaq</i>	0	0	22	?
<b>SAM</b>	<b>105</b>	<b>190+</b>	<b>220+</b>	<b>2,500+</b>

<i>I Hawk</i>	0	100	150	2,400
<i>Rapier</i>	30	30	30	30
<i>Tigercat</i>	25	15	15	15
<i>SA-2/HQ-2J</i>	50	45	15	45
<i>SA-5</i>	0	0	10	10
<i>SA-7</i>	0	some	some	some
<i>FM-80 (Crotale)</i>	0	some	some	some
<b>AAM</b>	<b>some</b>	<b>some</b>	<b>some</b>	<b>some</b>
<i>AIM-7 Sparrow</i>	some	some	some	some
<i>AIM-9 Sidewinder</i>	some	some	some	some
<i>AIM-54 Phoenix</i>	some	some	some	some
<i>AA-8</i>	0	some	some	some
<i>AA-10</i>	0	some	some	some
<i>AA-11</i>	0	some	some	some
<i>PL-2A</i>	0	0	some	0
<i>PL-7</i>	0	some	some	0
<b>ASM</b>	<b>some</b>	<b>some</b>	<b>some</b>	<b>some</b>
<i>AS-10</i>	0	some	some	some
<i>AS-11</i>	0	some	some	some
<i>AS-12</i>	some	0	0	0
<i>AS-14</i>	0	some	some	some
<i>C-801</i>	0	0	some	some
<i>AGM-65A</i>	0	some	3,000	some
<i>AGM-84 Harpoon</i>	some	0	0	0
<b>AD Guns</b>	<b>0</b>	<b>0</b>	<b>some</b>	<b>some</b>
<i>23mm</i>	0	0	some	some
<i>ZSU-23</i>	0	0	some	some
<i>37mm</i>	0	0	some	some
<i>Oerlikon</i>	0	0	some	some

Source: IISS, *Military Balance*, various editions including 1989-1990, 1999-2000, 2004-2005, 2005-2006.

## The Iranian Navy

The Iranian Navy had some 18,000 men in 2006. According to the IISS, this total included a two brigade marine force of some 2,600 men and a 2,000-man naval aviation force. It had bases at Bandar-e Abbas, Bushehr, Kharg Island, Bander-e Anzelli, Chah Bahar, Bander-e Mahshahar, and Bander-e Khomeini, most of them opposing the Saudi coast.

The naval forces had 3 submarines, 3 frigates, 2 corvettes, 10 missile patrol craft, 5 mine warfare ships, 52 coastal and inshore patrol craft, and 10 amphibious ships. Its naval aviation branch is one of the few air elements in any Gulf Navy, and had 5 maritime patrol aircraft, and 19 armed helicopters. When combined with the IRGC naval branch, this brought the total maritime strength of Iran to 38,000 men, with significant capabilities for both regular naval and asymmetric naval warfare.

Iran has given the modernization of its naval forces some priority, although its major surface ships are all old vessels with limited refits and aging weapons and fire control systems. Since the end of the Iran-Iraq War, Iran has obtained new anti-ship missiles and missile patrol craft from China, midget submarines from North Korea, submarines from Russia, and modern mines. Iran has expanded the capabilities of the naval branch of the IRGC, acquired additional mine warfare capability, and upgraded some of its older surface ships. Iran's exercises have included a growing number of joint and combined arms exercises with the land forces and air force.

Iran has also improved its ports and strengthened its air defenses, while obtaining some logistic and technical support from nations like India and Pakistan. In August 2000, the Islamic Republic announced that it had launched its first domestically produced light submarine, which is called the Al-Sabiha 15. It can be used for reconnaissance and laying mines.<sup>41</sup>

### *Iranian Anti-Ship Missiles and Missile Craft*

Iran's depends heavily on its ability to use anti-ship missiles to make up for its lack of airpower and modern major surface vessels. Iran's Western-supplied missiles are now all beyond their shelf life and their operational status is uncertain. Iranian forces are now operating four systems that Iran has obtained from China:

- **The Seersucker** is a long-range, mobile anti-ship missile, which is designated the HY-2 or Sea Eagle-2 by the People's Republic of China. It is a large missile with a 0.76-meter diameter and a weight of 3,000 kilograms. It has an 80-90 kilometer range and a 450-kilogram warhead. There are two variants. One uses radar active homing at ranges from the target of eight kilometers (4.5 nautical miles). The other is set to use passive IR homing and a radar altimeter to keep it at a constant height over the water.
- **The CS-801** anti-ship missile, also called the Yinji (Hawk) missile, is a solid fueled missile. It can be launched from land and ships. It has a range of approximately 74 kilometers in the surface-to-surface mode, and uses J-Band active radar guidance. It has a 512-kilogram warhead and cruises at an altitude of 20-30 meters.
- **The CS-802** is an upgraded CS-801. It uses a turbojet propulsion system with a rocket booster instead of the solid fueled booster in the CS-801. It has a range of 70-75 miles, has a warhead of up to 363 pounds, and can be targeted by a radar deployed on a smaller ship or aircraft operating over the radar horizon of the launching vessel.<sup>42</sup>
- **The CS-801K** is a Chinese-supplied, air-launched anti-ship missile and variant of the CS-801. It too is a sea-skimming, high-subsonic cruise missile and has a range in excess of 20 nautical miles. It has been test fired by Iran's F-4Es, but Iran may be able to use other launch aircraft. This air delivery capability gives



Iran what some analysts have called a “360 degree” attack capability, since aircraft can rapidly maneuver to far less predictable launch points than Iranian combat ships.<sup>43</sup>

Iran has sought to buy advanced anti-ship missiles from Russia, North Korea and China, to buy anti-ship missile production facilities, and possibly even Chinese-made missile armed frigates. Some sources have claimed that Iran has bought eight Soviet-made SS-N-22 "Sunburn" or "Sunburst" anti-ship missile launch units from Ukraine, and has deployed them near the Straits of Hormuz. However, US experts have seen no evidence of such a purchase and doubt that Iran has any operational holdings of such systems. The “SS-N-22” is a title that actually applies to two different modern long-range supersonic sea skimming systems -- the P-270 Moskit (also called the Kh-15 or 3M80) and P80 or P-100 Zubi/Onika.

Iran's main launch platforms for anti-ship missiles include three British-supplied Vosper Mark 5 Sa'am-class frigates -- called the *Alvand*, *Alborz*, and *Sabalan*. These ships date back to the time of the Shah, and each is a 1,100-ton frigate with a crew of 125-146 and maximum speeds of 39 knots. Each was originally armed with one five-missile Sea Killer Mark II surface-to-surface missile launcher and one Mark 8 4.5" gun mount. They have since had their Sea Killer's replaced with C-802 anti-ship missiles and new fire control radars. The Sea Killer has a relatively effective beam-riding missile with radio command or optical guidance, and a maximum range of 25 kilometers.

All three ships are active, but the *Sabalan* took serious damage from the US Navy during the tanker war of 1987-1988, and the ships have not had a total refit since the early 1990s. The ASW capabilities of these ships seem to be limited or non-functioning. Iran has two US PF-103 (Bayandor-class) corvettes called the *Bayandor* and the *Naghdi*. These ships are 900-ton vessels, with crews of 140, two 76 mm guns and a maximum speed of 18 knots. They were laid down in 1962 and delivered in 1964. The *Bayandor* and the *Naghdi* are probably the most active large surface ships in the Iranian navy. However, neither is equipped with anti-ship and anti-air missiles, sophisticated weapons systems, sonars, or advanced electronic warfare equipment and sensors.<sup>44</sup>

Iran is slowly building a 1,500-ton corvette, but its status is uncertain as is its equipment and armament. It has two old PF-103 class corvettes, the *Bayandor* and *Naghdi* that the US transferred to Iran in 1966. These are 900-ton vessels that are very active in the patrol role, but do not have modern radars and fire control, and are only armed with 76 mm guns and not with missiles. They lack any effective anti-aircraft and anti-missile defenses.<sup>45</sup>

The rest of Iran's major surface vessels consist of missile patrol boats. These include 10 68-ton Chinese-built Thnodor (Hudong)-class fast attack craft or missile patrol boats. The Hudong class fast attack craft are equipped with I-band search and navigation radars, but do not have a major anti-air missile system. Iran ordered these ships for the naval branch of its Iranian Revolutionary Guards Corps in 1992, and all 10 were delivered to Iran by March 1996. The vessels have a crew of 28. They carry four anti-ship missiles, and are armed with the CS-801 and CS-802 missile.

Iran now has at least 100 CS-801s and CS-802s. Iran's missile patrol boats also include 10 275-ton French-made Combattante II (Kaman-class) fast attack boats, out of an original total of twelve. These boats are armed with anti-ship missiles, one 76 mm gun, and have maximum speeds of 37.5 knots. They were originally armed with four US Harpoon missiles, but their Harpoons may no longer be operational. At least five had been successfully converted with launchers that can carry two to four CS-801/CS-802s.

Iran has a number of large patrol craft and fast attack craft. The operational ships of this type include: three North Korean-supplied 82-ton Zafar-class (Chaho-class) fast attack craft with I-band search radars and armed with 23 mm guns and a BM-21 multiple rocket launcher; two Kavian-class (US Cape-class) 148-ton patrol craft armed with 40 mm and 23 mm guns; and three Improved PGM-71 Parvin-class 98-ton patrol craft supplied in the late 1960s, armed with 40 mm and 20 mm guns.

There are more than 35 other small patrol boats plus large numbers of small boats operated by the IRGC. Most of these craft are operational and can be effective in patrol missions. They lack, however, sophisticated weapons systems or air defenses, other than machine guns and SA-7s and SA-14s. Iran has 5-6 BH-7 and 7-8 SRN-6 Hovercraft, believed to be operated by the IRGC. About half of these Hovercrafts may be operational. They are capable of speeds of up to 60-70 knots. They are lightly armed and vulnerable, but their high speed makes them useful for many reconnaissance and unconventional warfare missions, and they can rapidly land troops on suitable beaches.

### ***Iranian Mine Warfare Capabilities***

Mine warfare, amphibious warfare, anti-ship missiles, and unconventional warfare offer Iran ways of compensating for the weakness of its conventional air and naval forces. Iran's mine warfare vessels included 2-3 operational Shahrock-class MSC-292/268 coastal minesweepers (1 used for training in the Caspian Sea). Two of these three ships, the *Shahrock* and *Karkas*, were known to be operational. They are 378-ton sweepers that can be used to lay mines as well as sweep, but their radars and sonars date back to the late 1950s and are obsolete in sweeping and countermeasure activity against modern mines.

Iran had 1-2 operational Cape-class (Riazzi-class) 239-ton inshore minesweepers, and seems to have converted two of its indigenously produced Ajar-class LSTs for mine warfare purposes. Many of its small boats and craft can also lay mines. Both the Iranian Navy and the naval branch of the IRGC are expanding their capability for mine warfare. While Iran has only a limited number of specialized mine vessels, it can also use small craft, LSTs, Boghammers, helicopters, and submarines to lay mines. As a result, it is impossible to determine how many ships Iran would employ to plant or lay mines in a given contingency, and some of its mines might be air dropped or laid by commercial vessels, including dhows.

Iran has a range of Soviet, Western, and Iranian-made moored and drifting contact mines, and US experts estimate that Iran has at least 2,000 mines. Iran has significant stocks of anti-ship mines, and has bought Chinese-made and North Korean-made versions of the Soviet mines. It has claimed to be making its own non-magnetic, acoustic, free-floating and remote controlled mines, and has had Chinese assistance in developing the production facilities for such mines. It may have acquired significant stocks of non-magnetic mines, influence mines, and mines with sophisticated timing devices from other countries.<sup>46</sup>

There also are reports that Iran has negotiated with China to buy the EM-52 or MN-52 rocket-propelled mine. The EM-52 is a mine that rests on the bottom until it senses a ship passing over it, and then uses a rocket to hit the target. The maximum depth of the Straits of Hormuz is 80 meters (264 feet), although currents are strong enough to displace all but firmly moored mines.<sup>47</sup> Combined with modern submarine laid mines and anti-ship missile systems like the CS-801/802, and SS-N-22, the EM-52 would give Iran considerable capability to harass Gulf shipping and

even the potential capability to close the Gulf until US naval and air power could clear the mines and destroy the missile launchers and submarines.

Even obsolete moored mines have proven difficult to detect and sweep when intelligence does not detect the original laying and size of the minefield, and free floating mines can be used to present a constant hazard to shipping. Bottom-influence mines can use acoustic, magnetic, or pressure sensors to detect ships passing overhead. They can use multiple types of sensor/actuators to make it hard to deceive the mines and force them to release, can be set to release only after a given number of ships pass, and some can be set to attack only ships of a given size or noise profile. Such mines are extremely difficult to detect and sweep, particularly when they are spaced at wide intervals in shipping lanes.

### ***Iranian Amphibious Assets***

Iran has significant amphibious assets compared to other Gulf countries, and the regular Navy and naval branch of the IRGC operate independent marine forces. These assets are large enough to move a battalion-sized force relatively rapidly, and include: 3 Hengam-class (Larak-class) LST amphibious support ships (displacement of 2,940-tons loaded) that can carry up to six tanks, 600 tons of cargo, and 227 troops; 3 Iran Hormuz-class (South Korean) LSTs (2,014-tons loaded) that can carry up 9 tanks and berth 140 troops, and. 3 Hormuz-21 class 1,80-ton LSTs and 3 Fouque class 176-ton LSLs.

These capabilities are not large enough, however, to sustained large-scale operations across the Gulf. Iran's amphibious ships give it the capability to deploy about 1,000 troops, and theoretically about 30-40 tanks in an amphibious assault – but Iran has never demonstrated that it has an effective over-the-shore capability. Iran might use commercial ferries and roll on-roll off ships if it felt they could survive. Iran has also built up its capability to hide or shelter small ships in facilities on its islands and coastline along the Gulf, and the ability to provide them with defensive cover from anti-air and anti-ship missiles.

Iran has support ships, but these are generally insufficient to sustain "blue water" operations and support an amphibious task force. It has one Kharg-class 33,014 ton replenishment ship, two Bandar Abbas-class 4,673 ton fleet supply ships and oilers, one 14,410 ton repair ship, two 12,000 ton water tankers, seven 1,300 ton Delva-class support ships, 5-6 Hendijan-class support vessels, two floating dry-docks and 20 tugs, tenders, and utility craft to help support a large naval or amphibious operation.

Iran's training to date has focused on amphibious raiding, however, and not on operations using heavy weapons or larger operations. Iran lacks the air and surface power to move its amphibious forces across the Gulf in the face of significant air/sea defenses, or to support a landing in a defended area.

### ***Iranian Naval Air***

The Iranian Navy's air capability consists of two to three operational P-3F Orion maritime patrol aircraft out of an original inventory of five. According to reports from the Gulf, none of the surviving P-3Fs have fully operational radars and their crews often use binoculars. It also has up to 10 Sikorsky SH-3D ASW helicopters, three RH-53D mine laying helicopters, and seven Agusta-Bell AB-212 helicopters.

Iran uses air force AH-1J attack helicopters, equipped with French AS-12 missiles, in naval missions, and has adapted Hercules C-130 and Fokker Friendship aircraft for mine laying and patrol missions. The most significant recent development in Iran's capabilities to use airpower to attack naval targets has been the acquisition of the CS-801K for its regular air force.

### *Iran's Submarine Forces*

Iran has attempted to offset the weakness of its major surface forces by obtaining three Type 877 EKM Kilo-class submarines. The Kilo is a relatively modern and quiet submarine that first became operational in 1980. The Iranian Kilos are Type 877EKM export versions that are about 10 meters longer than the original Kilos and are equipped with advanced command and control systems. Each Type 877EKM has a teardrop hull coated with anechoic tiles to reduce noise. It displaces approximately 3,076 tons when submerged and 2,325 tons when surfaced. It is 72.6 meters long, 9.9 meters in beam, has a draught of 6.6 meters, and is powered by three 1,895 HP generator sets, one 5,900 SHP electric motor and one six-bladed propeller. It has a complement of 52 men and an endurance of 45 days. Its maximum submerged speed is 17 knots and its maximum surface speed is 10 knots.

Each Kilo has six 530 mm torpedo tubes, including two wired guided torpedo tubes. Only one torpedo can be wire-guided at a time. The Kilo can carry a mix of 18 homing and wire guided torpedoes or 24 mines. Russian torpedoes are available with ranges of 15-19 kilometers, speeds of 29-40 knots, and warheads with 100, 205, and 305-kilogram weights. Their guidance systems include active sonar homing, passive homing, wire guidance, and active homing. Some reports indicate that Iran bought over 1,000 modern Soviet mines with the Kilos, and that the mines were equipped with modern magnetic, acoustic, and pressure sensors. The Kilo has a remote anti-aircraft launcher with one pre-loaded missile in the sail and Soviet versions have 6 SA-N-5 (Iglu/SA-16) surface-to-air missiles stored inside. However, Russia only supplied Iran with the SA-14 (Strela). It can be modernized to carry Chinese YJ-1 or Russian Novator Alfa surface-to-surface missiles.<sup>48</sup>

The Kilo has a maximum surface speed of 10 knots, a maximum submerged speed of about 17 knots, a minimum submerged operating depth of about 30 meters, an operational diving depth of 240 meters, and a maximum diving depth of 300 meters. The submarine also has a surface cruise range of 3,000-6,000 nautical miles and a submerged cruise range of 400 nautical miles -- depending on speed and combat conditions.<sup>49</sup>

Iran's ability to use its submarines to deliver mines and fire long-range wake-homing torpedoes give it a potential capability to strike in ways that make it difficult to detect or attack the submarine. Mines can be laid covertly in critical areas before a conflict, and the mines can be set to activate and de-activate at pre-determined intervals in ways that make mining difficult to detect and sweep. Long-range homing torpedoes can be used against tanker-sized targets at ranges in excess of 10 kilometers, and to attack slow-moving combat ships that are not on alert and/or which lack sonars and countermeasures.

At the same time, many Third World countries have found submarines to be difficult to operate. For example, Russia delivered the first two Kilos with two 120-cell batteries designed for rapid power surges, rather than power over long periods. They proved to last only 1-2 years in warm waters versus 5-7 years for similar batteries from India and the UK. Iran had to turn to India for help in developing batteries that are reliable in the warm waters of the Gulf. Iran has also had problems with the air conditioning in the ships, and their serviceability has been erratic. There

are serious questions about crew capability and readiness, and all three submarines already need significant refits.

Iran faces significant operational problems in using its submarines in local waters. Many areas of the Gulf do not favor submarine operations. The Gulf is about 241,000 square kilometers in area, and stretches 990 kilometers from the Shatt al-Arab to the Straits of Hormuz. It is about 340 kilometers wide at its maximum width, and about 225 kilometers wide for most of its length. While heat patterns disturb surface sonars, they also disturb submarine sonars, and the advantage seems to be slightly in favor of sophisticated surface ships and maritime patrol aircraft.

The deeper parts of the Gulf are noisy enough to make ASW operations difficult, but large parts of the Gulf -- including much of the Southern Gulf on a line from Al Jubail across the tip of Qatar to about half way up the UAE -- are less than 20 meters deep. The water is deeper on the Iranian side, but the maximum depth of the Gulf -- located about 30 kilometers south of Qeys Island -- is still only 88 meters. This means that no point in the Gulf is deeper than the length of an SN-688 nuclear submarine. The keel to tower height of such a submarine alone is 16 meters. Even smaller coastal submarines have maneuver and bottom suction problems, and cannot hide in thermoclines, or take advantage of diving for concealment or self-protection. This may explain why Iran is planning to relocate its submarines from Bandar Abbas, inside the Gulf, to Chah Bahar in the Gulf of Oman and is deepening the navy facility at Chah Bahar.<sup>50</sup>

The Strait of Hormuz at the entrance to the Gulf is about 180 kilometers long, but has a minimum width of 39 kilometers, and only the two deep-water channels are suitable for major surface ship or submarine operations. Further, a limited flow of fresh water and high evaporation makes the Gulf extremely salty. This creates complex underwater currents in the main channels at the Straits of Hormuz and complicates both submarine operations, and submarine detection. There are some areas with considerable noise, but not of a type that masks submarine noise from sophisticated ASW detection systems of the kind operated by the US and UK. Further, the minimum operating depth of the Kilo is 45 meters, and the limited depth of the area around the Straits can make submarine operations difficult. Submarines are easier to operate in the Gulf of Oman, which is noisy enough to make ASW operations difficult, but such deployments would expose the Kilos to operations by US and British nuclear attack submarines. It is unlikely that Iran's Kilos could survive for any length of time if hunted by a US or British navy air-surface-SSN hunter-killer team.<sup>51</sup>

In any case, the effectiveness of Iran's submarines is likely to depend heavily on the degree of Western involvement in any ASW operation. If the Kilos did not face the US or British ASW forces, the Iranian Kilos could operate in or near the Gulf with considerable impunity. If they did face US and British forces, they might be able to attack a few tankers or conduct some mining efforts, but are unlikely to survive extended combat. This makes the Kilos a weapon that may be more effective in threatening Gulf shipping, or as a remote minelayer, than in naval combat. Certainly, Iran's purchase of the Kilos has already received close attention from the Southern Gulf states and convinced them that they must take Iran more seriously.

### ***The Role of the Naval Branch of the IRGC***

Iran's unconventional warfare capabilities include the naval branch of the Islamic Revolutionary Guards Corps that operates Iran's land-based anti-ship missiles and coastal defense artillery. In addition to its land and sea-based anti-ship missile forces, the naval guards can use large

numbers of small patrol boats equipped with heavy machine guns, grenade launchers, anti-tank guided weapons, manportable surface-to-air missies, and 106 mm recoilless rifles.

The IRGC also uses small launches, and at least 30 Zodiak rubber dinghies, to practice rocket, small arms, and recoilless rifle attacks. Its other small craft were armed with a mix of machine guns, recoilless rifles, and man and crew-portable anti-tank guided missiles. These vessels are difficult to detect by radar in anything but the calmest seas. Iran bases them at a number of offshore islands and oil platforms, and they can strike quickly and with limited warning. The Naval Branch of the IRGC also has naval artillery, divers, and mine-laying units. It had extensive stocks of Scuba equipment, and an underwater combat center at Bandar Abbas.<sup>52</sup> Iran is also improving the defenses and port capabilities of its islands in the Gulf, adding covered moorings, more advanced sensors, and better air defenses.

Iran can use IRGC forces to conduct the kind of low-intensity/guerrilla warfare that can only be defeated by direct engagement with land forces, and filter substantial reinforcements into a coastal area on foot or with light vehicles, making such reinforcement difficult to attack. Iran can use virtually any surviving small craft to lay mines and to place unmoored mines in shipping lanes. Its IRGC forces can use small craft to attack offshore facilities and raid coastal targets. Finally, it is important to note the US did not successfully destroy a single land-based Iraqi anti-ship missile launcher during the Gulf War, and the IRGC now has many dispersal launch sites and storage areas over a much longer coast. It also has a growing number of caves, shelters, and small hardened facilities. Such targets are sometimes difficult to detect until they are used, and present added problems because they usually are too small and too numerous to attack with high cost ordnance until it is clear they have valuable enough contents to merit such an attack.

### ***Naval Force Deployments***

The main forces of the Iranian navy are concentrated in the Gulf. Iran gives more importance to the security of its territorial sea in the Gulf area since in this direction it has highly complicated relations with various Arab nations, the United States, and Israel. After the collapse of the Soviet Union, however, Iran's policy towards the Caspian Sea area has changed. According to the contracts between the Soviet Union and Iran, Tehran was not allowed to station its navy in the Caspian Sea. After the disintegration of the USSR, however, the fourth naval regional forces started representing the Iranian navy in the Caspian.<sup>53</sup>

The Islamic Republic has almost 3,000 personnel in the Caspian. The forces include up to 50 fighting ships and support vessels, the Marine Corps, coastal guard forces, and the sea aircraft. There are also training vessels in the fleet, including one Shahrokh MSC minesweeper, 2 Hamzeh ships and others. Currently, Iran has the second largest fleet in the Caspian after Russia. The fleet, however, is outdated. This is why Tehran has been trying to strengthen its naval forces in the Caspian through various programs. It is reported that the government has numerous plans to modernize its fleet. According to these projects, the future fleet will include several divisions and separate battalions of ships and submarines.<sup>54</sup>

### ***Overall Naval Capabilities***

Iran's efforts have steadily improved Iran's capabilities to threaten Gulf shipping and offshore oil facilities, its capability to support unconventional warfare, and its ability to defend Iran's offshore facilities, islands, and coastline. They have not, however, done much to help Iran to act as an effective "blue water" navy.

At the same time, the military capability of Iranian naval forces should not be measured in terms of the ability to win a battle for sea control against US and British naval forces, or any combination of Southern Gulf states supported by US and British forces. For the near future, Iran's forces are likely to lose any such battle in a matter of days. As a result, it is Iran's ability to conduct limited or unconventional warfare, or to threaten traffic through the Gulf, that gives Iran the potential ability to threaten or intimidate its neighbors.

**Figure 5: Iranian Navy's Force Structure Trends, 1990-2006**

	1990	2000	2005	2006
<b>Manpower</b>	<b>14,500</b>	<b>20,600</b>	<b>18,000</b>	<b>18,000</b>
<i>Active</i>	14,500	20,600	18,000	18,000
<i>Conscripts</i>	0	0	0	0
<b>Submarines</b>	0	5	3	3
<i>SSK (RF Type 877)</i>	0	3	3	3
<i>SSI</i>	0	2	0	0
<b>Destroyers</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>
<i>Damavand (UK Battle)</i>	1	0	0	0
<i>Babr (US Sumner)</i>	2	0	0	0
Frigates	5	3	5	5
<i>Alvand (UK Vosper)</i>	3	3	3	3
<i>Bayandor (US PF-103)</i>	2	0	2	2
<b>Patrol and Coastal Combatants</b>	<b>34</b>	<b>64</b>	<b>56</b>	<b>250+</b>
<i>Patrol Missile Craft</i>	10	20	10	10
<i>Kaman (Fr Combattante II)</i>	10	10	10	10
<i>Houdong</i>	0	10	0	0
<b>Patrol Inshore</b>	<b>24</b>	<b>42</b>	<b>35+</b>	<b>85</b>
<i>Kaivan</i>	3	some	0	0
<i>Parvin</i>	3	3	3	3
<i>Chaho</i>	3	some	0	0
<i>Zafar</i>	0	3	3	3
<i>Bogomol</i>	0	1	0	0
<i>China Cat</i>	0	0	3	6
Hovercraft	15	9	14	?
<b>Mine Warfare</b>	<b>3</b>	<b>7</b>	<b>7</b>	<b>5</b>
<i>Sharokh (MSC)</i>	2	1	1	1
<i>Riazi (US Cape)</i>	0	1	2	2
<i>Harischi (MSI)</i>	1	1	0	0

<i>Hejaz (Minelayer)</i>	0	2	2	0
292 MSC	0	2	2	2
<b>Amphibious</b>	<b>7</b>	<b>9</b>	<b>10</b>	<b>10</b>
<i>Hengam (LST)</i>	4	4	4	4
<i>Iran Hormuz (LST)</i>	3	3	3	3
<i>Foque (LSL)</i>	0	2	3	3
<i>Landing craft</i>	4+	9+	200+	6
<b>Support</b>	<b>8</b>	<b>25</b>	<b>25</b>	<b>27</b>
<b>Maritime Reconnaissance</b>	<b>0</b>	<b>8</b>	<b>10</b>	<b>8</b>
<i>P-3F</i>	0	3	5	5
<i>Do-228</i>	0	5	5	5
<b>ASW</b>	<b>9</b>	<b>9</b>	<b>20</b>	<b>10</b>
<i>SH-3D Sea King</i>	3	3	10	10
<i>AB-212</i>	6	6	10	0
<b>MCM</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>
<i>RH-53D</i>	2	2	3	3
<b>Transport</b>	<b>29</b>	<b>29</b>	<b>18</b>	<b>13</b>
<i>Commander</i>	4	4	4	4
<i>Falcon</i>	1	1	3	3
<i>F-27</i>	4	4	4	4
<i>AB-205 (Heli)</i>	Some	Some	5	5
<i>AB-206 (Heli)</i>	Some	Some	2	2
<i>AB-212</i>	0	0	0	10

Source: IISS, *Military Balance*, various editions including 1989-1990, 1999-2000, 2004-2005, 2005-2006.



## Iran's WMD Program

There is no simple or reliable way to characterize Iran's ability to acquire weapons of mass destruction and the means to deliver them. Iran is clearly attempting to acquire long-range ballistic missiles and cruise missiles, but it has never indicated that such weapons would have chemical, biological, radiological, or nuclear (CBRN) warheads. Iran has never properly declared its holdings of chemical weapons, and the status of its biological weapons programs is unknown.

There have been strong indications of an active Iranian interest in acquiring nuclear weapons since the time of the Shah, and that Khomeini revived such efforts after Iraq invaded Iran and began to use chemical weapons. There is, however, no reliable history of such efforts or "smoking gun" that conclusively proves their existence.

The Iranian leadership has consistently argued that its nuclear research efforts are designed for peaceful purposes, although various Iranian leaders have made ambiguous statements about acquiring weapons of mass destruction and Iranian actions strongly suggest that Iran is trying to acquire nuclear weapons. Whether such Iranian deniability is plausible or not is highly questionable, but Iran has been able to find some alternative explanation for even its most suspect activities and there is no present way to disprove its claims with open source material.

### *Chemical Weapons*

The various claims and counter assertions about Iran's current chemical weapons capabilities are as hard to substantiate, as they are to rebut. Open sources are limited and conflicting, and Iranian claims go unchecked. Outside governments have provided some useful summary assessments of Iranian chemical weapons program, but few details.

#### **Official Estimates of Iranian Capability**

The CIA has reported that Chinese entities were still trying to supply Iran with CW-related chemicals between 1997 and 1998. The US sanctions imposed in May 1997 on seven Chinese entities for knowingly and materially contributing to Iran's CW program remain in effect. In addition, the CIA estimated in January 1999 that Iran obtained material related to chemical warfare (CW) from various sources during the first half of 1998. It already has manufactured and stockpiled chemical weapons, including blister, blood, and choking agents and the bombs and artillery shells for delivering them. However, Tehran is seeking foreign equipment and expertise to create a more advanced and self-sufficient CW infrastructure.

The last unclassified US formal assessment of this aspect of Iranian proliferation was released in 2001, and it provided only a broad summary:<sup>55</sup>

Iran has acceded to the Chemical Weapons Convention (CWC) and in a May 1998 session of the CWC Conference of the States Parties, Tehran, for the first time, acknowledged the existence of a past chemical weapons program. Iran admitted developing a chemical warfare program during the latter stages of the Iran-Iraq war as a "deterrent" against Iraq's use of chemical agents against Iran. Moreover, Tehran claimed that after the 1988 cease-fire, it "terminated" its program. However, Iran has yet to acknowledge that it, too, used chemical weapons during the Iran-Iraq War.

Nevertheless, Iran has continued its efforts to seek production technology, expertise and precursor chemicals from entities in Russia and China that could be used to create a more advanced and self-sufficient chemical warfare infrastructure. As Iran's program moves closer to self-sufficiency, the potential

will increase for Iran to export dual-use chemicals and related equipment and technologies to other countries of proliferation concern.

In the past, Tehran has manufactured and stockpiled blister, blood and choking chemical agents, and weaponized some of these agents into artillery shells, mortars, rockets, and aerial bombs. It also is believed to be conducting research on nerve agents. Iran could employ these agents during a future conflict in the region. Lastly, Iran's training, especially for its naval and ground forces, indicates that it is planning to operate in a contaminated environment.

In mid-May 2003, the Bush Administration released a statement to the Organization for Prohibition of Chemical Weapons in which the US accused Iran of continuing to pursue production technology, training, and expertise from abroad. The statement asserted that Iran was continuing to stockpile blister, blood, choking, and some nerve agents. This was followed by an unclassified report that the CIA released in November 2003 that stated that "Iran is a party to the Chemical Weapons Convention (CWC). Nevertheless, during the reporting period it continued to seek production technology, training, and expertise from Chinese entities that could further Tehran's efforts to achieve an indigenous capability to produce nerve agents. Iran likely has already stockpiled blister, blood, choking, and probably nerve agents—and the bombs and artillery shells to deliver them—which it previously had manufactured."<sup>56</sup>

John R. Bolton, then the Undersecretary of Arms Control and International Security at the US State Department, did report on Iran's a chemical program in testimony to the House International Relations Committee Subcommittee on the Middle East and Central Asia in 2005. He only reported, however, in summary terms:<sup>57</sup>

We believe Iran has a covert program to develop and stockpile chemical weapons. The U.S. Intelligence Community reported in its recent unclassified *Report to Congress on the Acquisition of Technology Relating to Weapons of Mass Destruction and Advanced Conventional Munitions*, also known as the "721 Report," that Iran continues to seek production technology, training, and expertise that could further its efforts to achieve an indigenous capability to produce nerve agents. A forthcoming edition of the 721 report is expected to state that, "Iran may have already stockpiled blister, blood, choking, and nerve agents -- and the bombs and artillery shells to deliver them -- which it previously had manufactured."

Iran is a party to the Chemical Weapons Convention (CWC). The CWC's central obligation is simple: no stockpiling, no development, no production, and no use of chemical weapons. The overwhelming majority of States Parties abide by this obligation. Iran is not, and we have made this abundantly clear to the Organization for the Prohibition of Chemical Weapons (OPCW). Although Iran has declared a portion of its CW program to the OPCW, it is time for Iran to declare the remainder and make arrangements for its dismantlement and for the destruction of its chemical weapons.

European assessments seem to agree with those of the US Department of Defense (DoD) and the Central Intelligence Agency (CIA), but there have only been limited public reports. The German Federal Customs Administration published a report in November 2004 that stated, "Iran has an emerging chemical industry. Its CW program obtains support, according to accounts received, from China and India. It probably possesses chemical agents such as sulphur mustards, Tabun, and hydrogen cyanide, possibly also sari and VC. Iran is attempting to acquire chemical installations and parts thereof, as well as technology and chemical precursors."<sup>58</sup>

## **Arms Control Estimates of Iranian Capability**

Arms control efforts have not provided meaningful transparency, and ratifying the CWC has not guaranteed the end of Tehran's CW programs; it has only meant that if Iran is violating the treaty, it is an "illegal" activity.

Unfortunately, there have been no meaningful inspections or of independent analysis of Iran's chemical weapons program. Iran did submit a statement in Farsi to the CWC secretariat in 1998, but this statement only consisted of questions as to the nature of the required compliance. It has not provided the CWC with detailed data on its chemical weapons program. Iran also stridently asserted its right to withdraw from the Convention at any time.

## NGO Estimates of Iranian Capability

Some NGO reporting does provide more detail. A study by the Monterey Institute indicates that are a number of sites in Iran that may be related to Iran's chemical warfare effort:<sup>59</sup>

- **Abu Musa Island:** Iran holds a large number of chemical weapons, principally 155mm artillery shells, in addition to some weaponized biological agents.
- **Bandar Khomeini:** Allegedly the location of a chemical weapons facility, run by the Razi chemical corporation, established during the Iran-Iraq war to manufacture chemical weapons.
- **Damghan:** Either a chemical weapons plant or warhead assembly facility. Primarily involved in 155mm artillery shells and SCUD warheads.
- **Isfahan:** Suspected location of a chemical weapons facility, possibly operated by the Poly-Acryl Corporation.
- **Karaj:** Located about 14km from Tehran, this is the site of an alleged storage and manufacturing facility for chemical weapons. Reports suggest that this facility was built with Chinese assistance.
- **Marvdasht:** The Chemical Fertilizers Company is suspected to have been a manufacturing facility for mustard agents during the Iran-Iraq War.
- **Parchin:** The location of at least one munitions factory and is suspected of being a major chemical weapons production facility. Reports of uncertain reliability indicate that the plant was in operation no later than March 1988. In April 1997, a German newspaper reported that, according to the German Federal Intelligence Service, the factories at Parchin were producing primary products for chemical warfare agents.
- **Qazvin:** A large pesticide plant at this location is widely believed to produce nerve gas.
- **Mashar:** Iranian opposition groups have made allegations, of uncertain reliability, that a warhead filling facility is operated at this location.

The Nuclear Threat Initiative summarized what is and is not known about the status of Iran's chemical weapons as follows in January 2006:<sup>60</sup>

Despite its acquisition of precursors from abroad, Iran is allegedly working to develop an indigenous CW production capability. The CIA believes that "Teheran is rapidly approaching self-sufficiency and could become a supplier of CW-related materials to other nations." As of 1996, the Department of Defense claimed that Iran had stockpiled almost 2000 tons of toxic chemical agents and was continuously working on expanding its CW program. Iran has several advanced research institutions employing various chemicals for a variety of reasons, including pesticide production, pharmaceutical research, and other medical studies. Iran has also conducted several military exercises to date that have included defensive chemical and biological weapons maneuvers.

Iran continues to deny any allegations that it is actively pursuing an offensive CW program. In 1996, it held the first regional seminar on the national implementation of the CWC in Tehran so that government authorities could familiarize themselves with their duties and obligations under the treaty. It also held a mock "trial inspection" at the Shahid Razkani chemical factory to allow inspectors to see how such a procedure was conducted. Iran submitted a declaration on its chemical facilities and its past CW stockpile, it has destroyed chemical weapons production equipment in the presence of OPCW inspectors, and it has undergone a number of OPCW inspections of its chemical industrial facilities. Iran continues to play an active role at the Organization for the Prohibition of Chemical Weapons (OPCW), is recognized as a

member in good standing, and currently serves on its executive council. Although US and Israeli intelligence agencies continue to insist Iran maintains a stockpile of chemical weapons, no challenge inspections of Iranian facilities have been requested, and none of the allegations made regarding the stockpiling of CW can be verified in the unclassified domain. However, Iran continues to retain a strong incentive for developing a defensive CW program.

### ***Biological Weapons***

Any analysis of Iran's biological weapons effort must be even more speculative. In 1997, US Department of Defense asserted that the Iranian BW program "is in the research and development stage, [but] the Iranians have considerable expertise with pharmaceuticals, as well as the commercial and military infrastructure needed to produce basic biological warfare agents."<sup>61</sup>

The Department updated its findings in 2001 as:<sup>62</sup>

Iran has a growing biotechnology industry, significant pharmaceutical experience and the overall infrastructure to support its biological warfare program. Tehran has expanded its efforts to seek considerable dual-use biotechnical materials and expertise from entities in Russia and elsewhere, ostensibly for civilian reasons. Outside assistance is important for Iran, and it is also difficult to prevent because of the dual-use nature of the materials and equipment being sought by Iran and the many legitimate end uses for these items.

Iran's biological warfare program began during the Iran-Iraq war. Iran is believed to be pursuing offensive biological warfare capabilities and its effort may have evolved beyond agent research and development to the capability to produce small quantities of agent. Iran has ratified the BWC.

Since that time, the US has not significantly updated its unclassified estimates, except to state that such Iranian R&D efforts continue. The problem is whether such statements are a suspicion, a strong probability, or a fact. Iran does have extensive laboratory and research capability, and steadily improving industrial facilities with dual-use production capabilities. Whether it has an active weapons development program, however, is a controversial matter.

The reality is that many nations now have the biotechnology, industrial base, and technical expertise to acquire biological weapons. Not only does most civil technology have "dual use" in building weapons, but the global dissemination of biological equipment has made control by supplier nations extremely difficult. Even when such controls do still apply to original sellers, they have little or no impact on the sellers of used equipment, and a wide range of sensitive equipment is now available for sale to any buyer on the Internet.

This makes it almost impossible to disprove a nation's interest in biological weapons. Moreover, there is little meaningful distinction between a "defensive" and "offensive" capability. Nations can claim to be conducting defensive research, acquiring key gear for defensive purposes, and practicing "defensive" training and maneuvers.

So far, Iran has not demonstrated any such "defensive" activities, but there is an active debate over whether it has a biological weapons program.

### **Possible Early Indicators that Iran Might Have a BW Program**

There is a long history of indicators that Iran *might* have some form of BW program. Reports first surfaced in 1982 -- during the Iran-Iraq War -- that Iran had imported suitable type cultures from Europe and was working on the production of mycotoxins -- a relatively simple family of biological agents that require only limited laboratory facilities for small-scale production. Many experts believe that the Iranian biological weapons effort was placed under the control of the

Islamic Revolutionary Guards Corps (IRGC), which is known to have tried to purchase suitable production equipment for such weapons.

US intelligence sources reported in August 1989, that Iran was trying to buy two new strains of fungus from Canada and the Netherlands that can be used to produce mycotoxins. German sources indicated that Iran had successfully purchased such cultures several years earlier. Some universities and research centers may be linked to biological weapons program. The Imam Reza Medical Center at Mashhad Medical Sciences University and the Iranian Research Organization for Science and Technology were identified as the end users for this purchasing effort, but it is likely that the true end user was an Iranian government agency specializing in biological warfare.

Since the Iran-Iraq War, various reports have surfaced that Iran may have conducted research on more lethal active agents like Anthrax, hoof, and mouth disease, and biotoxins. Iranian groups have repeatedly approached various European firms for equipment and technology that could be used to work with these diseases and toxins.

Unclassified sources of uncertain reliability have identified a facility at Damghan as working on both biological and chemical weapons research and production, and believe that Iran may be producing biological weapons at a pesticide facility near Tehran.

Reports also surfaced in the spring of 1993 that Iran had succeeded in obtaining advanced biological weapons technology in Switzerland and containment equipment and technology from Germany. According to these reports, this led to serious damage to computer facilities in a Swiss biological research facility by unidentified agents. Similar reports indicated that agents had destroyed German bio-containment equipment destined for Iran. More credible reports by US experts indicate that Iran might have begun to stockpile anthrax and Botulinum in a facility near Tabriz, can now mass manufacture such agents, and has them in an aerosol form. None of these reports, however, can be verified.

### **The Uncertain Nature of Iran's BW Program since the Mid-1990s**

The CIA reported in 1996 that, "We believe that Iran holds some stocks of biological agents and weapons. Tehran probably has investigated both toxins and live organisms as biological warfare agents. Iran has the technical infrastructure to support a significant biological weapons program with little foreign assistance." It also reported that Iran has, "sought dual-use biotech equipment from Europe and Asia, ostensibly for civilian use," and that Iran might be ready to deploy biological weapons. Beyond this point, little unclassified information exists regarding the details of Iran's effort to "weaponize" and produce biological weapons.

#### ***Continuing Alarms and Excursions***

Iran announced in June 1997 that it would not produce or employ chemical weapons including biological toxins. However, the CIA reported in June 1997 that Iran had obtained new dual use technology from China and India during 1996.

Furthermore, the CIA reported in January 1999 that Iran continued to pursue dual-use biotechnical equipment from Russia and other countries, ostensibly for civilian uses. Its biological warfare (BW) program began during the Iran-Iraq war, and Iran may have some limited capability for BW deployment. Outside assistance is both important and difficult to prevent, given the dual-use nature of the materials and equipment being sought and the many legitimate end uses for these items.

In 2001, an allegation from the former director of research and development at the Cuban Center for Genetic Engineering and Biotechnology surfaced that claimed Cuba had assisted the Iranian bio-weapons program from 1995-1998. The authenticity of the director's claims has not been established.<sup>63</sup>

A report produced by the Iranian insurgent group, the Mujahedin-e Khalq (MEK) Organization, asserted in 2003 that Iran had started producing weaponized anthrax and was actively working with at least five other pathogens, including small pox. The MEK (Mujahedin-e Khalq) was the same organization that produced early evidence of Iran's non-compliance with the terms of the Nuclear Nonproliferation Treaty. Iran issued a vehement denial of these charges in a May 16, 2003 press release. The accuracy of either set of statements remains uncertain.

### ***The Possible Role of Outside Suppliers***

Russia has been a key source of biotechnology for Iran. Russia's world-leading expertise in biological weapons also makes it an attractive target for Iranians seeking technical information and training on BW agent production processes. This has led to speculation that Iran may have the production technology to make dry storable and aerosol weapons. This would allow it to develop suitable missile warheads, bombs, and covert devices.

In testimony to the Senate Committee on Foreign Relations, John A. Lauder, the Director of Nonproliferation Center at the CIA, asserted in 2000 that:<sup>64</sup>

Iran is seeking expertise and technology from Russia that could advance Tehran's biological warfare effort. Russia has several government-to-government agreements with Iran in a variety of scientific and technical fields.

--Because of the dual-use nature of much of this technology, Tehran can exploit these agreements to procure equipment and expertise that could be diverted to its BW effort.

--Iran's BW program could make rapid and significant advances if it has unfettered access to BW expertise resident in Russia.

The CIA reported in November 2003 that, "Even though Iran is part of the Biological Weapons Convention (BWC), Tehran probably maintained an offensive BW program. Iran continued to seek dual-use biotechnical materials, equipment, and expertise. While such materials had legitimate uses, Iran's biological warfare (BW) program also could have benefited from them. It is likely that Iran has capabilities to produce small quantities of BW agents, but has a limited ability to weaponize them."<sup>65</sup> John R. Bolton, then the Undersecretary of Arms Control and International Security at the US State Department testified to the House International Relations Committee in 2004 that:<sup>66</sup>

The U.S. Intelligence Community stated in its recent 721 Report that, "Tehran probably maintains an offensive BW program. Iran continued to seek dual-use biotechnical materials, equipment, and expertise. While such materials had legitimate uses, Iran's biological warfare (BW) program also could have benefited from them. It is likely that Iran has capabilities to produce small quantities of BW agents, but has a limited ability to weaponize them."

Because BW programs are easily concealed, I cannot say that the United States can prove beyond a shadow of a doubt that Iran has an offensive BW program. The intelligence I have seen suggests that this is the case, and, as a policy matter therefore, I believe we have to act on that assumption. The risks to international peace and security from such programs are too great to wait for irrefutable proof of illicit activity: responsible members of the international community should act to head off such threats and demand transparency and accountability from suspected violators while these threats are still emerging. It would be folly indeed to wait for the threat fully to mature before trying to stop it.

Iran is a party to the Biological Weapons Convention (BWC) and the 1925 Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare. Like the CWC, the central obligation of the BWC is simple: no possession, no development no production and, together with the 1925 Protocol, no use of biological weapons. The overwhelming majority of States Parties abide by these obligations. We believe Iran is not abiding by its BWC obligations, however, and we have made this abundantly clear to the parties of this treaty. It is time for Iran to declare its biological weapons program and make arrangements for its dismantlement.

### ***Possible CBW Warfighting Capability***

These factors make it almost impossible to how Iran may use any capabilities it does possess. It does not overtly train its forces for offensive chemical warfare, and its current and future war fighting capabilities are unknown.

Iran has stated its objection to the use of CBW in war on religious grounds—based on Khomeini's statements in the 1980s—and legal obligation under international conventions. Most experts do, however, believe that Iran at least used confiscated Iraqi chemical shells against Iraqi forces. It had definitely instituted its own program to produce chemical weapons, and may have used its weapons. The International Institute of Strategic Studies (IISS) pointed out in its 2005 study of Iran's weapons that, "Despite a similar record with respect to nuclear weapons and the NPT, Iran conducted undeclared nuclear activities in violation of the treaty for over 20 years. Whether Iran has carried similar activities in violation of its CWC and BWC obligations cannot be determined definitively from the available public information."<sup>67</sup>

It does seem likely that Iran at least retains some capability to make chemical weapons, and it may have inactive or mothballed facilities. There have been no public reports of active production, but this is possible. Iraq produced small lots of mustard gas weapons at the laboratory level before its major production facilities came on line, and showed that it could produce at the batch level with relatively small and easy to conceal facilities. Iran's purchases also indicate that it could have a significant stock of precursors; and some less lethal weapons can be made out of refinery and petrochemical byproducts.

Any assessment of Iranian capabilities must also take account of the fact that Iraq began to use chemical weapons against Iran in the early 1980s, and that Iran has had at least a quarter of a century in which to react to a real-world threat, six years of which were spent dealing with a nation seeking to acquire chemical, biological, and nuclear weapons to destroy it. Iranian military literature also has extensively reprinted Western and other literature on chemical, biological, radiological, and nuclear (CBRN) weapons, and Iran actively collects such literature on a global basis.

It seems clear that Iran has the technology base to produce mustard gas and non-persistent nerve agents -- including reasonable stable agents and binary weapons -- and may have the technology to produce persistent nerve agents as well. It probably had technical knowledge of "third generation" and "dusty" agents. It has had the opportunity to reverse engineer captured Iraqi weapons, and may have received aid in weapons design from Russian, Chinese, and North Korean sources. It certainly has monitored UN reporting on the Iraqi chemical and biological programs, and may have acquired considerable detail on these programs, their strengths and weaknesses, and Iraq's sources abroad.

Iran almost certainly has the ability to make effective chemical artillery shells and bombs, and unitary rocket and missile warheads. It can probably design effective cluster bombs and warheads. It may have sprayers for use by aircraft, helicopters, and UAVs. Iran's ability to

develop lethal missile warheads is far more problematic. The timing and dissemination problems are far more difficult and may be beyond Iran's current technical skills.

The past history of Iranian efforts at complex program management and systems integration, however, has shown that Iran has serious problems in translating its technical expertise into practice. The knowledge of how to do things rarely leads to similar capability to actually do them, particularly when programs remain concealed, and are largely "mothballed" or have low levels of activity.

Testing chemical weapons presents serious problems when the test goes beyond static tests or relative crude measurements of how well given weapons disseminate the agent. It is particularly difficult in the case of missile warheads. It is possible to determine lethality in rough terms from residues, but this requires repeated testing using actual weapons in a variety of real-world conditions. There are no reports of such testing, but it is more than possible that they could be successfully concealed. Unlike most biological weapons, the operational lethality of chemical weapons can be safely tested against live animals. Again, there are no reports of such testing, but it is more than possible that they could be successfully concealed.

The history of actual chemical warfare, however, indicates that the results of such tests can be extremely unrealistic, and that operational lethality has rarely approached anything like engineering and test predictions. The "scale-up" of individual weapons results into predictions of real-world results from using large numbers of weapons has produced particularly misleading results. Moreover, as is the case with biological weapons, temperature, weather, sunlight, wind, surface conditions, and a number of external factors can have a major impact on lethality.

These factors, coupled to the difficulty in measuring incapacity or deaths in less than hours to days, also means Iran and other users would have to carry out any chemical campaign with little ability to predict its actual lethality or carry out effective battle damage assessment. Such considerations might not be important, however, when the goal was terror, panic, area denial, forcing an enemy to don protection gear and decontaminate, or accept casualties in addition to other casualties from military operations.

At the same time, all of these factors combine to indicate that even if Iran does have plans and doctrine for using chemical weapons, and has made serious efforts to estimate their lethality and effectiveness; such plans are unlikely to survive engagement with reality. Iran's past reports on its military exercises may be propaganda-driven, but some of Iran's conventional warfighting exercises do have a strong element of ideology and wishful thinking, and a lack of demanding realism. This could lead military officers and civilian decision makers to make serious miscalculations based on the war they want to fight rather than the war they can fight.

Such considerations would have less impact if Iran chose to use proxies or covert means of attack to strike at high value targets or for the purposes of terrorism and intimidation. The Islamic Revolutionary Guards Corps (IRGC) has conducted the kind of conventional exercises that could be adapted to such ends and Iran has long supplied conventional weapons to movements like Hezbollah and Hamas.

Any broader Iran military use of chemical weapons would present a number of problems:

- Chemical weapons are not individually lethal enough to have a major impact on ground battles, and take time to be effective. They are best suited to relatively static battles, dominated by ground forces that do not have armored and protected vehicles and which cannot mass airpower effectively. This describes Iran and Iraq in 1980-1988. It does not describe the US or most of Iran's opponents today. Airpower and seapower



are largely immune to the kind of chemical attack Iran could launch, with the possible exception of fixed, targetable area targets -- many of which could only be denied for any significant time by large numbers of accurate attacks. Rapidly maneuvering ground forces would be a difficult target for Iran's much more static forces. Nations like the US would have extensive amounts of detection, protection, and decontamination gear. They also would not have large, static, rear area and support operations near the forward edge of the battle area (FEBA).

- Iranian artillery tends to be slow moving, and lack the ability to rapidly target and switch fires. It relies heavily on static massed fires. This requires relatively short-range engagement against an equally slow moving or static opponent. In practice, Iran will probably face opponents that maneuver more quickly and with superior intelligence, surveillance, and reconnaissance (IS&R) assets. A repetition of the battlefield conditions of the Iran-Iraq War seems unlikely.
- Chemical weapons could be more effective as area weapons that forced enemy forces to abandon positions, denied the ability to use rear areas, or acted as a barrier to movement. The tactical and maneuver effects were more important in the Iran-Iraq War than using CW as a killing mechanism. They again, however, tend to be most useful against relatively static opponents that do not have air superiority or supremacy.
- Iran has a number of potential long-range artillery rockets and missiles. A single chemical warhead, however, is more a terror weapon than a killing mechanism. Such systems have limited accuracies, and Iran has limited long-range targeting capability against mobile targets. The use of a few chemical rounds would be highly provocative, and justify massive escalation by an enemy. As such, it might do more to provoke than terrify, intimidate, or damage. Iran might, however, be able to use persistent nerve and mustard agents to deny the use of a key facility like an air base, key supply facility, mobilization center, oil export facility or desalination or power plants.
- Effective air strikes require high confidence in the ability to penetrate enemy air defenses, and good IS&R assets. In many cases, a chemical weapon would only have marginally greater lethality than a conventional precision guided weapon or cluster weapon. Again, such use might do more to might do more to provoke than terrify, intimidate, or damage.
- The use of chemical weapons against targets at sea presents significant targeting and meteorological problems. These are certainly solvable, but do require exceptional planning and skill. Similarly, firing against coastal targets requires high volumes of CW fire or good meteorological data.
- Covert or proxy use presents serious problems in wartime. Plausible deniability is doubtful, and an opponent simply may not care if it can prove Iran is responsible for any given use of CW.
- Operation lethality is dependent on an opponent's CW defense and decontamination facilities, level of depth, and speed of maneuver. Iran may be dealing with much more sophisticated opponents that the Iraq of the 1980s.

None of these problems and issues mean that Iran could not use chemical weapons effectively under some conditions. They might, however, deter Iran from stockpiling such weapons or using them except under the most drastic conditions. Iran has to understand that their use would tend to make Iran lose the political and information battle, and act as a license to its opponent to escalate. While such might concerns well deter Iran under most circumstances, it is also important to understand that wars and drastic crises are not "most circumstances. One inherent problem in any such analysis is that even the most prudent decision-maker in peacetime can panic, overreact, or drastically miscalculate in war.

### ***Possible Nuclear Weapons Programs***

There is more information available on Iran's nuclear programs than on its chemical and biological programs, but this scarcely eliminates major areas of uncertainty. Estimating Iranian nuclear capabilities is complicated by three key factors:

- First, the US, the EU, and the UN all agree that Iran has the right to acquire a full nuclear fuel cycle for peaceful purposes under Nuclear Nonproliferation Treaty (NPT) but there is no clear way to distinguish many of the efforts needed to acquire a nuclear weapon from such “legitimate” activities or pure research.
- Second, Iran has never denied that it carries out a very diverse range of nuclear research efforts. In fact, it has openly claimed that it is pursuing nuclear technology and has a “national” right to get access to nuclear energy. This has given it a rationale for rejecting Russia’s offer to provide Iran nuclear fuel without giving Tehran the technology and the expertise needed to use it for weaponization purposes, and the US agrees with this position, and,
- Third, it has never been clear whether Iran does have a “military” nuclear program that is separate from its “civilian” nuclear research. America and French officials have argued that they believe that Iran’s nuclear program would only make sense if it had military purposes. Both governments have yet to provide evidence to proof these claims.

If Iran is a proliferator, it has shown that it is a skilled one that is highly capable of hiding many aspects of its programs, send confusing and contradictory signals, exploiting both deception and the international inspection process, rapidly changing the character of given facilities, and pausing and retreating when this is expedient. It has also shown that denial can be a weapon, that consistently finding an alternative explanation for all its actions, including concealment and actions that are limited violations of the Nuclear Nonproliferation Treaty (NPT) can maintain some degree of “plausible deniability” for a long chain of ambiguous actions and events.

### **Problems in Analyzing Iran’s WMD Program: A Case Study**

Iran also presents major problems in intelligence collection and analysis. The details of U.S., British, and other intelligence efforts to cover Iran remain classified. At the same time, studies of US and British intelligence failures in covering Iraq have provided considerable insights into the difficulties in covering a nation like Iran, and background discussions with intelligence analysts and users reveal the following general problems in analyzing the WMD threat:

- The uncertainties surrounding collection on virtually all proliferation and weapons of mass destruction programs are so great that it is impossible to produce meaningful point estimates. As the CIA has shown in some of its past public estimates of missile proliferation, the intelligence community must first develop a matrix of what is and is not known about a given aspect of proliferation in a given country, with careful footnoting or qualification of the problems in each key source. It must then deal with uncertainty by creating estimates that show a range of possible current and projected capabilities—carefully qualifying each case. In general, at least three scenarios or cases need to be analyzed for each major aspect of proliferation in each country—something approaching a “best,” “most likely,” and “worst case.”<sup>68</sup>
- Even under these conditions, the resulting analytic effort faces serious problems. Security compartmentation within each major aspect of collection and analysis severely limits the flow of data to working analysts. The expansion of analytic staffs has sharply increased the barriers to the flow of data, and has brought large number of junior analysts into the process that can do little more than update past analyses and judgments. Far too little analysis is subjected to technical review by those who have actually worked on weapons development, and the analysis of delivery programs, warheads and weapons, and chemical, biological, and nuclear proliferation tends to be compartmented. Instead of the free flow of data and exchange of analytic conclusions, or “fusion” of intelligence, analysis is “stovepiped” into separate areas of activity. Moreover, the larger staffs get, the more stovepiping tends to occur.
- Analysis tends to focus on technical capability and not on the problems in management and systems integration that often are the real world limiting factors in proliferation. This tends to push analysis towards exaggerating the probable level of proliferation, particularly because technical capability is often assumed if collection cannot provide all the necessary information.

- Where data are available on past holdings of weapons and the capability to produce such weapons—such as data on chemical weapons feedstocks and biological growth material—the intelligence effort tends to produce estimates of the maximum size of the possible current holding of weapons and WMD materials. While ranges are often shown, and estimates are usually qualified with uncertainty, this tends to focus users on the worst case in terms of actual current capability. In the case of Iraq, this was compounded by some 12 years of constant lies and a disbelief that a dictatorship obsessed with record keeping could not have records if it had destroyed weapons and materials. The end result, however, was to assume that little or no destruction had occurred whenever UNSCOM, UNMOVIC, and the IAEA reported that major issues still affected Iraqi claims.
- Intelligence analysis has long been oriented more towards arms control and counterproliferation rather than war fighting, although DIA and the military services have attempted to shift the focus of analysis. Dealing with broad national trends and assuming capability is not generally a major problem in seeking to push nations towards obeying arms control agreements, or in pressuring possible suppliers. It also is not a major problem in analyzing broad military counterproliferation risks and programs. The situation is very different in dealing with war fighting choices, particularly issues like preemption and targeting. Assumptions of capability can lead to preemption that is not necessary, overtargeting, inability to prioritize, and a failure to create the detailed collection and analysis necessary to support warfighters down to the battalion level. This, in turn, often forces field commanders to rely on field teams with limited capability and expertise, and to overreact to any potential threat or warning indicator.
- The intelligence community does bring outside experts into the process, but often simply to provide advice in general terms rather than cleared review of the intelligence product. The result is often less than helpful. The use of other cleared personnel in U.S. laboratories and other areas of expertise is inadequate and often presents major problems because those consulted are not brought fully into the intelligence analysis process and given all of the necessary data.
- The intelligence community does tend to try to avoid explicit statements of the shortcomings in collection and methods in much of its analysis and to repeat past agreed judgments on a lowest common denominator level—particularly in the form of the intelligence products that get broad circulation to consumers. Attempts at independent outside analysis or “B-Teams,” however, are not subject to the review and controls enforced on intelligence analysis, and the teams, collection data, and methods used are generally selected to prove given points rather than provide an objective counterpoint to finished analysis.<sup>69</sup>

Few of these problems have been explicitly addressed in open source reporting on Iran, and it is uncertain from the reporting on past intelligence failures in the intelligence analysis of Iraq before the 2003 invasion that the intelligence community has covered them at the classified level.

Part of the problem lies with the user. Policy-level and other senior users of intelligence tend to be intolerant of analysis that consists of a wide range of qualifications and uncertainties even at the best of times and the best of times do not exist when urgent policy and warfighting decisions need to be made. Users inevitably either force the intelligence process to reach something approaching a definitive set of conclusions, or else they make such estimates themselves.

Intelligence analysts and managers are all too aware of this fact. Experience has taught them that complex intelligence analysis—filled with alternative cases, probability estimates, and qualifications about uncertainty—generally go unused or make policy makers and commanders impatient with the entire intelligence process. In the real world, hard choices have to be made to provide an estimate that can actually be used and acted upon, and these choices must either be by the intelligence community or by the user.<sup>70</sup>

## Uncertainty and Credibility of Sources

If one looks at other sources of reporting on Iran, there have been many claims from many corners. First, from opposition groups that are largely associated with Mujahedin-e Khalq (MEK). Their information has proved to be useful at times, yet some of the data they provided has been “too good to be true.” The National Council of Resistance of Iran (NCRI) revelations about Iran’s secret nuclear program did prove to be the trigger point in inviting the IAEA into Tehran for inspections, but their claims about “5,000 centrifuges” were seen by many as an exaggeration or at least an unconfirmed allegation.<sup>71</sup>

The source of such claims must be taken into account. As noted earlier, Mr. Alireza Jafarzadeh is the former president of NCRI, which is associated with MEK—an organization that is considered by the US State Department as a terrorist organization. Its motives are well known, and its information must be considered with a certain level of skepticism. As a former CIA counterintelligence official said “I would take anything from them with a grain of salt.”<sup>72</sup>

NCRI claimed that it relied on human sources, including scientists and civilians working in the facilities or locals who live near the sites. In addition, the NCRI claimed at times that their sources are inside the Iranian regime, and added that “Our sources were 100 percent sure about their intelligence.”<sup>73</sup> The NCRI did not provide any confirmation about their sources, and their information is considered by some in the US and European governments as less than credible. Another example was NCRI’s claim in September 2004 that Tehran allocated \$16 billion to building a nuclear bomb by mid 2005. This again was proven inaccurate.<sup>74</sup>

Second, US officials have cited “walk in” sources to prove the existence of an Iranian nuclear program. It is unclear who those sources are, but the US insisted that they were not associated with the NCRI. In November 2004, US officials claimed that a source provided US intelligence with more than 1,000 pages worth of technical documents on Iranian “nuclear warhead design” and missile modifications to deliver an atomic warhead. In addition, it was reported that the documents also included “specific” warhead design based on implosion and adjustments, which was thought to be an attempt at fitting a warhead to Iranian ballistic missiles.<sup>75</sup>

According to the *Washington Post*, the “walk-in” source that provided the documents was not previously known to US intelligence. In addition, it was not clear if this source was connected to an exile group. The same source was, apparently, the basis for the comments by then Secretary of State, Colin Powell, on November 17, 2004 when he said “I have seen some information that would suggest that they have been actively working on delivery systems... You don't have a weapon until you put it in something that can deliver a weapon... I'm not talking about uranium or fissile material or the warhead; I'm talking about what one does with a warhead.”<sup>76</sup>

Press reports indicate that “walk-in” documents came from one source and were without independent verifications. The uncertainty about this source, reportedly, stopped many in the US government from using the information, and some expressed their surprise when Secretary Powell expressed confidence in the information provided. Some saw it as reminder of the problems in his presentation to the UN regarding Iraqi WMDs, and hoped that he had not made those remarks before they were confirmed. Some US officials even went as far as saying that Powell “misspoke” when he was talking about the information.<sup>77</sup>

Other US officials described the intelligence as “weak.”<sup>78</sup> Other press reports claimed that the source, who was “solicited with German help,” provided valuable intelligence that referred to a “black box,” which US officials claim was a metaphor to refer to nuclear warhead design. One

US official was quoted by the *Wall Street Journal* as saying the documents represented “nearly a smoking gun,” yet the same official claimed that this was not a definitive proof.<sup>79</sup>

Third, there are sources within Iran that have cooperated with the IAEA. According to IAEA reports, Iranian nuclear scientists were interviewed on specific questions. For example, in November 2003, the Agency requested clarification on the bismuth irradiation. The IAEA reported that in January 2004, it “was able to interview two Iranian scientists involved in the bismuth irradiation. According to the scientists, two bismuth targets had been irradiated, and an attempt had been made, unsuccessfully, to extract polonium from one of them.”<sup>80</sup>

The credibility of these scientists depend on how much freedom they have to talk about specific issues, their level of involvement, and the nature of the questions posed to them. The nature of access and the type of information provided to the IAEA by Iranian scientists remain uncertain.

Fourth, independent intelligence gathered by the US, the EU, and regional powers have no obvious substitute. The IAEA and the UN do not have their own intelligence and have to rely on member states to provide them with the necessary information. These include satellite images, electronic intercepts, human intelligence, and various forms of information gathering and intelligence analysis. The history of the US and UK intelligence provided to UN inspectors in Iraq, however, showed the limited ability of many intelligent agencies to get a full picture of a country’s nuclear, biological, chemical, and missile programs.

## **Key Uncertainties in Iran’s Nuclear Developments**

While Iran and Iraq are very different cases, much the same level of uncertainty exists. Almost no one believes that Iran has nuclear weapons, is so close to acquiring them, or presents a time-urgent threat. Many believe, however, that it is a matter of when rather than if before Tehran acquires nuclear weapons. That is once Iran gets the capability to produce the materials necessary to producing a nuclear cycle; Iran would acquire the capabilities to produce a full nuclear weapons.

The previous history has also revealed to acquire nuclear technology long before the 1979 revolution. It is also clear from IAEA discoveries that Iran has pursued two key tracks: uranium enrichment and production of plutonium.<sup>81</sup> Both of these tracks can produce the materials that can be used for nuclear reactors and for nuclear weapons. The IAEA, however, does not believe that Iran has yet been successful in achieving either goal. Mohamed ElBaradei, the director general of the IAEA, was quoted as saying “To develop a nuclear weapon, you need a significant quantity of highly enriched uranium or plutonium, and no one has seen that in Iran.”<sup>82</sup>

### ***Plutonium Production***

Tehran has given them enough importance to take two different tracks to achieve the capacity to produce plutonium. First, it is building heavy-water production plants, which US officials claim that their only purpose is to supply heavy water that is optimal for producing weapons grade plutonium. The Iranian government, on the other hand, has claimed that their purpose is for isotope production for its civilian nuclear energy program.<sup>83</sup>

The second track followed the production of light-water power reactors. The main reactor is at Bushehr, which is designed to produce civilian nuclear technology. Bushehr is also the reactor that Russia agreed to supply its fuel and recover the spent fuel from the reactor. The US Undersecretary for Arms Control and International Security, John, R. Bolton, claimed that Bushehr would produce enough plutonium per year to manufacture nearly 30 nuclear weapons.<sup>84</sup>

The following chronology by the International Atomic Energy Agency (IAEA) shows the history of Iran's plutonium separation experiments:<sup>85</sup>

- **1987–1988:** The separation process was simulated using imported unirradiated UO<sub>2</sub> (DU); dissolution and purification took place in the Shariaty Building at TNRC; pressed and sintered pellets were manufactured using imported UO<sub>2</sub> (DU) at FFL; the UO<sub>2</sub> pellets were further manipulated into aluminum and stainless steel capsules at FFL
- **1988–1993:** The capsules (containing a total of 7 kg of UO<sub>2</sub> in the form of powder, pressed pellets and sintered pellets) were irradiated in TRR
- **1991–1993:** Plutonium was separated from some of the irradiated UO<sub>2</sub> targets in the capsules (about 3 kg of the 7 kg of UO<sub>2</sub>) and plutonium solutions produced; these activities were carried out at the Shariaty Building and, after the activities were transferred in October/November 1992, at the Chamaran Building at TNRC; the research and development related irradiation and separation of plutonium were terminated in 1993
- **1993–1994:** The unprocessed irradiated UO<sub>2</sub> was initially stored in capsules in the spent fuel pond of TRR, and later transferred into four containers and buried behind the Chamaran Building
- **1995:** In July, purification of the plutonium solution from the 1988–1993 period was carried out in the Chamaran Building; a planchet (disk) was prepared from the solution for analysis
- **1998:** In August, additional purification of plutonium from the 1988–1993 period was carried out in the Chamaran Building; another planchet (disk) was prepared from the solution for analysis
- **2000:** The glove boxes from the Chamaran Building were dismantled and sent to ENTC for storage; one glove box was moved to the Molybdenum Iodine Xenon Facility
- **2003:** Due to construction work being carried out behind the Chamaran building, two containers holding the unprocessed irradiated UO<sub>2</sub> were dug up, moved and reburied

In September 2005, the IAEA analysis of Iran's plutonium separation experiments concluded that the solutions that were tested were 12-16 years old, which seemed to corroborate Iran's claims. In addition, the IAEA carried out verification tests for unprocessed irradiated UO<sub>2</sub> targets stored in four containers, and these results also conformed to Iranian claims, although the IAEA argued that the number of targets provided by Iran was much lower than the actual ones. The IAEA reported in September 2005 that, "A final assessment of Iran's plutonium research activities must await the results of the destructive analysis of the disks and targets."<sup>86</sup>

### ***Uranium Enrichment***

Many weapons experts believe that the Iranian uranium enrichment program is much more advanced and does not rely on Iran's nuclear reactors. Former Chief UN weapons inspector in Iraq, Hans Blix, has said that Tehran's plans to build a 40-megawatt research reactor at Bushehr, which is considered Iran's main plutonium production facility, should not be the main concern. He argued that the light-water reactor was not ideal for plutonium production. He added "What is uncomfortable and dangerous is that they have acquired the capacity to enrich uranium of their own uranium that they dig out of the ground...If you can enrich to five percent you can enrich it to 85 percent."<sup>87</sup>

These concerns were further exacerbated following Mahmoud Ahmadinejad, the Iranian President, announcement on April 11, 2006 that Iran was successful at enriching uranium. "At this historic moment, with the blessings of God almighty and the efforts made by our scientists, I declare here that the laboratory-scale nuclear fuel cycle has been completed and young scientists produced enriched uranium needed to the degree for nuclear power plants [on April 9]." The

head of the Atomic Energy Agency of Iran (AEOI) and Iran's Vice President, Gholamreza Aghazadeh, Iranian nuclear scientists, stated that Iran had:<sup>88</sup>

- Started enriching uranium to a level—3.5 percent—needed for fuel on a research scale using 164 centrifuges, but not enriched enough to build a nuclear bomb;
- Produced 110 tons of uranium hexafluoride (UF<sub>6</sub>)—this amount is nearly double the amount that Iran claimed to have enriched in 2005;
- Aim to produce a gas high with an increased percentage of U-235, the isotope needed for nuclear fission, which is much rarer than the more prevalent isotope U-238; and
- Plan to expand its enrichment program to be able to use 3,000 centrifuges at the nuclear center at Natanz by the end of 2006.

Mohammad Saeedi, Iran's Deputy Nuclear Chief, reiterated that Iran aimed to expand uranium enrichment to industrial scale at Natanz. In addition to installing 3,000 centrifuges at Natanz by 2006, Saeedi claimed that Iran aims at expanding the total number of centrifuges to 54,000, which would be used to fuel 1000-megawatt nuclear power plant.<sup>89</sup>

While some believe that Iran's claims are credible, others speculated that Iran made the announcement to send a message that military strikes or sanctions would not deter Iran from achieving a full nuclear cycle. Much also depended on what the announcement really meant. Iran had previously obtained at least 2% enrichment from the experimental use of centrifuges and possibly significantly higher levels. The IAEA had previously made it clear that it lacked the data to determine how far Iran had actually progressed. Iran also had reached enrichment levels as high as 8% making experimental use of laser isotope separation, although it seemed far from being able to scale such efforts up beyond laboratory tests.

The Iranian claims also said nothing about how efficient the claimed use of a small 164-centrifuge chain was, what its life cycle and reliability was, and about the ability to engineer a system that could approach weapons grade material. As the following chapters show, it is at best possible to speculate on how many centrifuges of the P1-type centrifuge derivative involved Iran would need to get a nuclear device and then move on to develop a significant weapons production capability. It would, however, probably be in the thousands in terms of continuously operating machine equivalents to slowly get the fissile material for a single device or "bomb in the basement," and tens of thousands to support a serious nuclear weapons delivery capability.

One thing was already clear long before these Iranian claims. There was nothing the UN or US could do to deny Iran the technology to build a nuclear weapon. The IAEA's discoveries had made it clear Iran already had functioning centrifuge designs, reactor development capability, and plutonium separation capability. It had experimented with Polonium in ways that showed it could make a neutron initiator, had the technology to produce high explosive lenses and beryllium reflectors, could machine fissile material, and had long had a technology base capable of performing the same non-fissile of actual weapons designs used by Pakistan in its nuclear weapons design efforts. It also seemed highly likely that it had acquired P2 centrifuge designs and the same basic Chinese design data for a fissile weapon suitable for mounting on a ballistic missile that North Korea had sold to Libya.

As a result, both the claims of the Iranian president that Iran had made a major breakthrough, and President Bush's responding statement that Iran would not be allowed to acquire the technology to build a nuclear weapon, seemed to be little more than vacuous political posturing. Ahmadinejad's statement seemed to be an effort to show the UN that it could not take

meaningful action and exploit Iranian nationalism. The Bush statement a combination of basic technical ignorance on the part of his speech writers and an effort push the UN towards action and convince Iran that it could face the threat of both serious sanctions and military action if diplomacy and sanctions failed. It effectively ignored the fact that Iran not only already had the technology, but could disperse it to the point where it was extremely unlikely that any UN inspection effort could find it, even if Iran allowed this, or any military option could seriously affect Iran's technology base – as distinguished from its ability to create survivable large-scale production facilities and openly deploy nuclear-armed delivery systems.

In reality, such developments were at most evolutionary and had been expected. Diplomats and officials from the IAEA were quick to point out that the announcement by Iran should not be a sign of concern and that Iran may face many technical hurdles before it can enrich enough quantities of uranium at high levels to produce a nuclear weapon. One European official said that while the 164-machine centrifuges were more industrial, "...it's not like they haven't come close to achieving this in the past." This assessment has been reflected in reports by the IAEA, which argue that Iran has used centrifuges and laser to enrich uranium throughout the 1990s and even before.<sup>90</sup>

To put such rhetoric in context, most of Tehran's uranium conversion experiments took place between 1981 and 1993 at Tehran Nuclear Research Center (TNRC) and at the Isfahan Nuclear Technology Center (ENTC). In this case, however, it is clear that some of these activities continued throughout 2002. According to the IAEA, Iran's uranium enrichment activities also received some foreign help in 1991.

The IAEA outlined its findings regarding Tehran's uranium enrichment as follows:<sup>91</sup>

In 1991, Iran entered into discussions with a foreign supplier for the construction at Esfahan of an industrial scale conversion facility. Construction on the facility, UCF, was begun in the late 1990s. UCF consists of several conversion lines, principal among which is the line for the conversion of UOC to UF<sub>6</sub> with an annual design production capacity of 200 t uranium as UF<sub>6</sub>. The UF<sub>6</sub> is to be sent to the uranium enrichment facilities at Natanz, where it will be enriched up to 5% U-235 and the product and tails returned to UCF for conversion into low enriched UO<sub>2</sub> and depleted uranium metal. The design information for UCF provided by Iran indicates that conversion lines are also foreseen for the production of natural and enriched (19.7%) uranium metal, and natural UO<sub>2</sub>. The natural and enriched (5% U-235) UO<sub>2</sub> are to be sent to the Fuel Manufacturing Plant (FMP) at Esfahan, where Iran has said it will be processed into fuel for a research reactor and power reactors. ...

In March 2004, Iran began testing the process lines involving the conversion of UOC into UO<sub>2</sub> and UF<sub>4</sub>, and UF<sub>4</sub> into UF<sub>6</sub>. As of June 2004, 40 to 45 kg of UF<sub>6</sub> had been produced. A larger test, involving the conversion of 37 t of yellowcake into UF<sub>4</sub>, was initiated in August 2004. According to Iran's declaration of 14 October 2004, 22.5 t of the 37 t of yellowcake had been fed into the process and that approximately 2 t of UF<sub>4</sub>, and 17.5 t of uranium as intermediate products and waste, had been produced. There was no indication as of that date of UF<sub>6</sub> having been produced during this later campaign.

The IAEA inspections found traces of contamination from advanced enrichment effects at Natanz. Iran claimed that these contaminations were from equipments it purchased in the 1980s from aboard (presumably from Pakistan). Reports by the IAEA, however, showed that Iran may have started its enrichment program in the 1970s, and that the Iranians were already partially successful at uranium conversion.

Iran has tried two different methods to enrich uranium ever since the time of the Shah. First, Iran's nuclear research has facilities that are dedicated to manufacturing and testing centrifuges. This includes its ultimate goal of producing 50,000 centrifuges in Natanz. Second, Iran also



pursued enriching uranium through laser enrichment. According to Mohamed ElBaradei, the Director General of the IAEA, Iran was able to enrich up to 1.2% using centrifuges and up to 15% using lasers.<sup>92</sup>

Some of Iran's gas centrifuge program depended on help Tehran got from Pakistan. Although reports by the Director General of the IAEA do not mention Pakistan by name, Iran's gas centrifuges could be traced back to the mid 1990s when AQ Khan approached an Iranian company and offered P-1 documentations and components for 500 centrifuges. Iran claimed that it only got the P-1 and not the P-2 design (the P-1 and P-2 refer to two designs for centrifuges by Pakistan). Both Iran and Pakistan would later admit to this transaction and provide the documents to support these allegations.<sup>93</sup>

According to the IAEA, Tehran received P-1 components and documentations in January 1994. Tehran, however, claimed that it did not receive the first of these components until October 1994. Regardless of the month of delivery, there is one more important element that remains unresolved. The IAEA refers to this as the "1987 offer," which reportedly provided Iran with a sample machine, drawings, descriptions, and specifications for productions, and materials for 2,000 centrifuge machines.<sup>94</sup>

In addition, Iran received the P-2 design in 1994/1995 from Pakistan, but that all of its components were designed and manufactured in Iran. Furthermore, Iran claimed that it did not pursue any work on the P-2 design between 1995 and 2002 due to shortages in staff and resources at the Atomic Energy Organization of Iran (AEOI), and that Tehran focused on resolving outstanding issue regarding the P-1 design. The IAEA, however, was not convinced that Iran did not pursue further development of the P-2 design and called on Iran in September 2005 to provide more information on the history of its P-2 developments.<sup>95</sup>

This helps explain why experts have argued that Iran's goal of producing 50,000 centrifuges in Natanz should be considered a sign of serious concern for the international community. For example, David Albright and Corey Hinderstein of the Institute for Science and International Security (ISIS) argued that Iran planned in January 2006 to install centrifuges in modules of 3,000 machines that were designed to produce low enriched uranium (LEU) for civilian power reactors. If half of these machines, however, were to be used to create highly enriched uranium (HEU), they could produce enough HEU for one nuclear weapon a year. Furthermore, if the Iranians do achieve their ultimate goal of 50,000 centrifuges, Albright and Hinderstein argued, "At 15-20 kilograms per weapon, that would be enough for 25-30 nuclear weapons per year."<sup>96</sup>

A much smaller facility might, however, be adequate. A study by Frank Barnaby for the Oxford Research Group estimates Iran's current centrifuges could produce about 2.5 separative work units (SWUs) a year, with a range of 1.9-2.7 SWUs. If Iran had the P-2, each centrifuge would produce roughly 5 SWU a year. A fully operational 3,000 centrifuge facility could then produce some 7,500 SWU or about 40 kilograms of heavily enriched Uranium a year, and it would probably take a total capacity of 5,000 machines to keep 3,000 on-line at all times.<sup>97</sup> As is discussed later, the 1,500 centrifuge pilot facility that Iran is now seeking to operate could conceivably produce a single weapon in 2-3 years.

As for the other enrichment route, Iran acknowledged it had started a laser enrichment program in the 1970s. Iran claimed that it used two different tracks in using laser enrichment: 1) atomic vapor laser isotope separation (AVLIS) and 2) molecular isotope separation (MLIS). Iran,

however, depended on key contracts with four (unnamed) different countries to build its laser enrichment program. The following chronology was presented by the IAEA:<sup>98</sup>

- **1975:** a contract for the establishment of a laboratory to study the spectroscopic behavior of uranium metal; this project had been abandoned in the 1980s as the laboratory had not functioned properly.
- **Late 1970s:** a contract with a second supplier to study MLIS, under which four carbon monoxide (CO) lasers and vacuum chambers were delivered, but the project had ultimately been terminated due to the political situation before major development work had begun.
- **1991:** a contract with a third supplier for the establishment of a “Laser Spectroscopy Laboratory “ (LSL) and a “Comprehensive Separation Laboratory” (CSL), where uranium enrichment would be carried out on a milligram scale based on the AVLIS process. The contract also provided for the supply of 50 kg natural uranium metal.
- **1998:** a contract with a fourth supplier to obtain information related to laser enrichment, and the supply of relevant equipment. However, due to the inability of the supplier to secure export licenses, only some of the equipment was delivered (to Lashkar Ab’ad).

The IAEA seems to be more confident about its findings regarding Iran’s laser enrichment developments than gas centrifuges. This is largely due to Iranian cooperation, but it also stems from the fact that Iran had nothing to hide since its foreign contractors failed to deliver on the four contracted Tehran signed between the 1970s and the 1990s.

According to the IAEA, Iran claimed that the laser spectroscopy laboratory and the MLIS laboratory (the first two contracts) were never fully operational.

As for the third contract, the IAEA estimated the contract was finished in 1994, but that CSL and LSL had technical problems and were unsuccessful between 1994 and 2000. Iran responded by claiming that the two labs were dismantled in 2000. In addition, the IAEA concluded that “As confirmed in an analysis, provided to the Agency, that had been carried out by the foreign laboratory involved in the project, the highest average enrichment achieved was 8%, but with a peak enrichment of 13%.”

Finally, the fourth contract was signed in 1998, but failed due to the supplier’s inability to obtain export licenses. Tehran claimed that it attempted to procure these equipments and parts, but it was unsuccessful.<sup>99</sup>

These failures almost certainly did strain Tehran's ability to effectively use the laser enrichment track to advance its uranium enrichment activities. This may explain why Iran did less to try to conceal its laser enrichment program than conceal the details of its centrifuge program. According to the IAEA, Tehran’s declarations largely tracked with the IAEA inspectors' findings. For example, Iran claimed that its enrichment level was 0.8% U235, and the IAEA concluded that Iran reached an enrichment level of  $0.99\% \pm 0.24\%$  U235.<sup>100</sup>

The IAEA findings regarding this aspect of Tehran’s enrichment program are summarized in the following two paragraphs:<sup>101</sup>

The Agency has completed its review of Iran’s atomic vapor laser isotope separation (AVLIS) program and has concluded that Iran’s descriptions of the levels of enrichment achieved using AVLIS at the Comprehensive Separation Laboratory (CSL) and Lashkar Ab’ad and the amounts of material used in its past activities are consistent with information available to the Agency to date. Iran has presented all known key equipment, which has been verified by the Agency. For the reasons described in the Annex to this report, however, detailed nuclear material accountancy is not possible.

It is the view of the Agency's AVLIS experts that, while the contract for the AVLIS facility at Lashkar Ab'ad was specifically written for the delivery of a system that could achieve 5 kg of product within the first year with enrichment levels of 3.5% to 7%, the facility as designed and reflected in the contract would, given some specific features of the equipment, have been capable of limited HEU production had the entire package of equipment been delivered. The Iranian AVLIS experts have stated that they were not aware of the significance of these features when they negotiated and contracted for the supply and delivery of the Lashkar Ab'ad AVLIS facility. They have also provided information demonstrating the very limited capabilities of the equipment delivered to Iran under this contract to produce HEU (i.e. only in gram quantities).

The accuracy of such finding is critical because isotope separation is far more efficient than centrifuge separation, much less costly once mature, uses far less power, and is much harder to detect.<sup>102</sup>

Other aspects of Iranian activity were less reassuring. Following Iran's announcement that it converted 37 tons of yellowcake into UF<sub>4</sub> in May 2005, experts believed estimated that this amount of uranium could "theoretically" produce more than 200 pounds of weapon-grade uranium, which would be enough to produce 5-6 crude nuclear weapons. The head of Iran's Supreme National Security Council, Hasan Rowhani, was quoted as saying in 2005 that "Last year, we could not produce UF<sub>4</sub> and UF<sub>6</sub>. We didn't have materials to inject into centrifuges to carry out enrichment, meaning we didn't have UF<sub>6</sub>... But within the past year, we completed the Isfahan facility and reached UF<sub>4</sub> and UF<sub>6</sub> stage. So we made great progress."<sup>103</sup>

In February 2006, ahead of the IAEA board meeting, it was reported in the press that a report was circulated to IAEA member states regarding what press reports called "the Green Salt Project." The report largely used information provided by US intelligence. The project name was derived from "green salt," or uranium tetrafluoride. The materials are considered intermediate materials in uranium conversion ore into uranium hexafluoride, UF<sub>4</sub>, which is central to producing nuclear fuel.<sup>104</sup>

This project was reportedly started in spring of 2001 by an Iranian firm, Kimeya Madon, under the auspices of the IRGC. US officials believe that Kimyea Madon completed drawings and technical specifications for a small uranium conversion facility (UCF), and argue that the drawings provide "pretty compelling evidence" for Iran's clandestine uranium conversion program. In addition, there was evidence that the Iranians envisioned a second UCF. It remains uncertain why the operation of Kimeya Mado stopped in 2003. Some speculated that this was a plan to replace Esfahan in case of a military strike against it. Another view is that Iran scratched the plan after it was revealed that the new UCF was not "as good as what they had" at Esfahan.<sup>105</sup>

Another important development in Iranian activities was the IAEA's discovery of "a document related to the procedural requirements for the reduction of UF<sub>6</sub> to metal in small quantities, and on the casting and machining of enriched, natural and depleted uranium metal into hemispherical forms," as the IAEA February 4, 2006 resolution emphasized.<sup>106</sup>

The description of this document first appeared in the IAEA November 15, 2005 reports. This "one page document" apparently was related to the Pakistani offer in 1987, and the IAEA made the following assessment:<sup>107</sup>

As previously reported to the Board, in January 2005 Iran showed to the Agency a copy of a hand-written one-page document reflecting an offer said to have been made to Iran in 1987 by a foreign intermediary for certain components and equipment. Iran stated that only some components of one or two disassembled centrifuges, and supporting drawings and specifications, were delivered by the procurement network, and

that a number of other items of equipment referred to in the document were purchased directly from other suppliers. Most of these components and items were included in the October 2003 declaration by Iran to the Agency.

The documents recently made available to the Agency related mainly to the 1987 offer; many of them dated from the late 1970s and early to mid-1980s. The documents included: detailed drawings of the P-1 centrifuge components and assemblies; technical specifications supporting component manufacture and centrifuge assembly; and technical documents relating to centrifuge operational performance. In addition, they included cascade schematic drawings for various sizes of research and development (R&D) cascades, together with the equipment needed for cascade operation (e.g. cooling water circuit needs and special valve consoles). The documents also included a drawing showing a cascade layout for 6 cascades of 168 machines each and a small plant of 2000 centrifuges arranged in the same hall. Also among the documents was one related to the procedural requirements for the reduction of UF<sub>6</sub> to metal in small quantities, and on the casting and machining of enriched, natural and depleted uranium metal into hemispherical forms, with respect to which Iran stated that it had been provided on the initiative of the procurement network, and not at the request of the Atomic Energy Organization of Iran (AEOI).

As noted earlier, the foreign intermediary is believed to have been AQ Khan, the Pakistani nuclear scientist. The United Kingdom argued that the document, on casting uranium into hemispheric form, had no other application other than nuclear weapons. Experts agreed with this assessment.<sup>108</sup> IAEA officials, however, were more cautious. One senior IAEA official was quoted as saying that the document “is damaging,” but he argued that the hand-written document was not a blueprint for making nuclear weapons because it only dealt with one aspect of the process.<sup>109</sup>

Many experts believe that in order to understand Iran’s nuclear program, one must understand its gas centrifuge program—particularly whether Tehran’s ability to establish a test run of 1,500 centrifuges at Natanz would give Iran enough capacity to produce high-enriched uranium (HEU). David Albright and Corey Hinderstein, of the ISIS argued that Iran may well be on its way to achieving this capacity:

Each P1 centrifuge has an output of about 3 separative work units (swu) per year according to senior IAEA officials. From the A. Q. Khan network, Iran acquired drawings of a modified variant of an early-generation Urenco centrifuge. Experts who saw these drawings assessed that, based on the design’s materials, dimensions, and tolerances, the P1 in Iran is based on an early version of the Dutch 4M centrifuge that was subsequently modified by Pakistan. The 4M was developed in the Netherlands in the mid-1970s and was more advanced than the earlier Dutch SNOR/CNOR machines. Its rotor assembly has four aluminum rotor tubes connected by three maraging steel bellows.

With 1,500 centrifuges and a capacity of 4,500 swu per year, this facility could produce as much as 28 kilograms of weapon-grade uranium per year, assuming a tails assay of 0.5 percent, where tails assay is the fraction of uranium 235 in the waste stream. This is a relatively high tails assay, but such a tails assay is common in initial nuclear weapons programs. As a program matures and grows, it typically reduces the tails assay to about 0.4 percent and perhaps later to 0.3 percent to conserve uranium supplies.

By spring 2004, Iran had already put together about 1,140 centrifuge rotor assemblies, a reasonable indicator of the number of complete centrifuges. However, only about 500 of these rotors were good enough to operate in cascades, according to knowledgeable senior IAEA officials. The November 2004 IAEA report stated that from the spring to October 10, 2004, Iran had assembled an additional 135 rotors, bringing the total number of rotors assembled to 1,275. As mentioned above, a large number of these rotors are not usable in an operating cascade.

Iran is believed to have assembled more centrifuges prior to the suspension being re-imposed on November 22, 2004. Without more specific information, it is assumed that Iran continued to assemble centrifuges at a constant rate, adding another 70 centrifuges, for a total of 1,345 centrifuges. However, the total number of good centrifuges is estimated at about 700.<sup>110</sup>

These developments also led some observers to question whether Iran received more help from Pakistan than it admitted. Some experts argued that the AQ Khan network tended to hand over the “whole package” as was the case with Libya, and they question whether Iran received only the few pages that it shared with the IAEA.<sup>111</sup> These revelations showed how little is known about how advanced Iran’s uranium enrichment program.

Most experts, however, believe that Iran’s uranium enrichment program is far more dangerous and far more advanced than its plutonium production activities. They argue that the danger of the enrichment program is that regardless how high Iran’s enrichment level of uranium, if they were able to enrich it at low level, they will have the know how to enrich it at higher levels and produce the weapons grade uranium to produce nuclear weapons.<sup>112</sup>

In addition, experts are concerned that Iran may acquire uranium from other nations. For example, during a visit by the Iranian parliament Speaker, Gholam Ali Haddad-Adel, in early 2006, Iran and Venezuela signed a deal that allowed Iran to explore Venezuela’s strategic minerals. Venezuelan opposition figures to President Hugo Chavez claimed that the deal could involve the production and transfer of uranium from Venezuela to Iran. The United States, however, downplayed such reports. A State Department official was quoted as saying “We are aware of reports of possible Iranian exploitation of Venezuelan uranium, but we see no commercial activities in Venezuela.”<sup>113</sup>

### **A Continuing Process of Discovery**

It is also clear that there is still much more to learn. As noted earlier, in early 2006, the *New York Times* reported on new US intelligence estimates that suggested Iran’s “peaceful” program included a “military-nuclear dimension.” This assessment was reportedly based on information provided by the US to the IAEA and referred to a secret program called “the Green Salt Project.” This project was started to work on uranium enrichment, high explosives, and on adapting nuclear warheads to Iranian missiles. The report suggested that there was evidence of “administrative interconnections” between weaponization and nuclear experts in Iran’s nuclear program. Tehran argued that these claims were “baseless,” and promised to provide further clarifications on the matter.<sup>114</sup>

These claims that there was a link between civilian and military nuclear tracks seem to support the comments made by then Secretary of State Collin Powell in November 2004, yet it remains uncertain if the sources of intelligence were the same. Mr. Powell argued that the US intelligence had information that showed Iranian efforts to adapt their nuclear research to fit their Shahab-3 missile. He argued that it made no sense that Iran would work on advancing its delivery systems unless they were also working on the warheads. Other US officials, however, argued that the information Collin Powell used came from unconfirmed sources with uncertain information, and should not be seen as a definitive proof.<sup>115</sup>

The source for this information seems to be a stolen laptop computer, which contained designs of a small-scale uranium gas production facility by Kimeya Madon, an Iranian company. In addition, the documents contained modification to the Shahab-3 missile in a way, US officials believe, to fit a nuclear warhead. U.S. intelligence, reportedly, believe that the files on the computer were authentic, but they argue that there was no way to prove it. They argue that while there was the possibility that the document were forged by Iranian opposition groups or fabricated by a third country like Israel, it was unlikely. In addition, the authenticity of the document also seemed to have been confirmed by British intelligence.<sup>116</sup>

What concerns US officials is that while nowhere on the laptop was there a mention of the word “nuclear,” the documents mentioned the names of military officers that were linked to Mohsen Fakrizadeh, who is believed to direct “Project 111.” US intelligence believes that this project has been responsible for weaponizing Iran’s nuclear research efforts and missiles developments. In addition, the US believes that this project is the successor to Project 110, which used to be the military arm of Iran’s nuclear research program. These revelations, however, are “cloaked” with uncertainty and the US believes that that only way to know is if Fakrizadeh cooperate with IAEA inspectors.<sup>117</sup>

These concerns about Iranian weaponization efforts were exacerbated by the IAEA’s discovery of a document relating to the requirement of reducing UF<sub>6</sub> to small quantities of metal as well as casting enriched and natural depleted uranium into hemispherical forms.<sup>118</sup> This is believed to be the first link the IAEA has shown between Iran’s military and civilian nuclear program. Many argue that this discovery was the turning point in the IAEA negotiation efforts with Tehran, and that the failure to disclose this document early in the inspections was a cause for concern for the Agency.

Press reports have also claimed that there was further evidence of Iran’s effort to weaponize its nuclear research. A US intelligence assessment was leaked to the *Washington Post*. According to US officials, Iran’s nuclear researchers have completed the drawing of “a deep subterranean shaft.” The drawings outlined the plans for a 400-meter underground tunnel with remote controlled sensors to measure pressures and temperatures. US experts believed that the tunnel was being prepared for an underground nuclear test. One US official was quoted as saying “The diagram is consistent with a nuclear test-site schematic.” This assessment was based on the fact that the drawings envisioned a test control team to be so far away—10 kilometers—from the test site, but the US believes that the tunnel was still in the drawing stage and no developments have taken place. The evidence for this tunnel and Iranian weaponization efforts were the closest thing to a “smoking gun” in proving Iranian nuclear weapons program.<sup>119</sup>

This illustrates the point that Iran can gain as much from concealing and obfuscating its weaponization activities as from hiding or obfuscating the nature of its nuclear program. As long as Iran does not actually test a full nuclear explosion, it can develop and test potential weapons and warhead designs in a wide range of ways. It can also prepare for underground testing, and test simulated weapons underground to validate many aspects of the test system -- including venting -- without exploding a bomb until it is ready for the international community to know it has actually tested a weapon.

It can develop and deploy its missile program with conventional warheads, and create considerable confusion over the nature of its warhead and bomb tests, concealing whether it has carried out extensive research on CBRN weaponization as part of what it claims is the testing of conventional weapons. Telemetry can be encrypted, avoided, and made deliberately misleading. The same is true of static explosive testing or the use of air-delivered warheads and bombs. So far, for example, the international community and outside experts have generally failed to explore the rationale for Iran’s missile efforts and other weaponization activities. The IAEA and CWC lack any clear mandate for inspection and analysis of such activities, and the BWC does not address the issue.

## **Iran’s Long-Range Missile Arsenal**

Iran continues to deploy surface-to-surface missiles, and has its own systems in development. The number assigned to the army versus the Islamic Revolutionary Guards Corps (IRGC) is unclear, but the IRGC seems to hold and operate most long-range missiles rather than the Army. As **Figure 6** shows, Iran seems to have some 12-18 SCUD-B/C launchers and 250-350 missiles, and 30 land-based CSS-8 launchers with 175 missiles. Iran refers to the SCUD-B as the Shahab-1 and the Scud C as the Shahab-2.

The Iranian government stated as early as 1999, that it was developing such a large missile body or launch vehicle for satellite launch purposes, however, and repeatedly denied that it is upgrading the Shahab series (especially the Shahab-3) for military purposes. Iran also continued to claim that the 'Shahab-4' program is aimed at developing a booster rocket for launching satellites into space. In January 2004, Iran's Defense minister claimed that Iran would launch a domestically built satellite within 18 months. This had still not taken place in June 2006.<sup>120</sup>

In December 2005, the US government announced its belief that Iran had built underground missile factories that were capable of producing Shahab-1, Shahab-2, and Shahab-3 as well as testing new missile designs. It was also believed that Karimi industries was housed at one of the secret bases, which is where they were working on perfecting Iran's nuclear warheads.<sup>121</sup>

US officials insisted that this information did not come from Iranian opposition sources like the MEK, and that it was reliable. They feel Iran has made significant strides in recent years using North Korean, Chinese, and Russian technology. If Iran begins work on the Shahab-5 and the Shahab-6 series, they may acquire delivery systems with the range to make them a global nuclear power, instead of merely a regional one.

**Figure 6: Estimated Iranian Missile Profiles, 2006**

Designation	Stages	Progenitor Missiles	Propellant	Range (Kilometers)	Payload (Kilograms)	IOC (Year)	Inventory
<b>Fateh A-110</b>	1	?	?	210	500	?	?
<b>Ghadr-110</b>	?	?	?	2,500-3,000	?	?	?
<b>M-9 variant</b>	1	CSS-6	?	800	320	?	?
<b>M-11 variant</b>	1	CSS-7	?	400	?	?	?
<b>Mushak-120</b>	1	CSS-8, SA-2	Solid	130	500	2001	200
<b>Mushak-160</b>	1	CSS-8, SA-2	Liquid	160	500	2002	?
<b>Mushak-200</b>	1	SA-2	Liquid	200	500	NA	0
<b>Shahab-1</b>	1	Soviet SSN-4, N Korean SCUD B	Liquid	300	987-1,000	1995	250-300
<b>Shahab-2</b>	1	Soviet SSN-4, N Korean SCUD C	Liquid	500	750-989	?	200-450
<b>Shahab-3</b>	1	N Korea Nodong-1	Liquid	1,300	760-1,158	2002	25-100
<b>Shahab-4</b>	2	N Korea Taep'o-dong-1	Liquid	3,000	1,040-1,500	NA	0
<b>Ghadr 101</b>	multi	Pakistan Shaheen-1	Solid	2,500	NA	NA	0
<b>Ghadr 110</b>	multi	Pakistan Shaheen-2	Solid	3,000	NA	NA	0
<b>IRIS</b>	1	China M-18	Solid	3,000	760-1,158	2005	NA
<b>Kh-55</b>	1	Soviet AS-15 Kent, Ukraine	jet engine	2,900-3,000	200kgt nuclear	2001	12
<b>Shahab-5</b>	3	N Korea Taep'o-dong-2	Liquid	5,500	390-1,000	NA	0
<b>Shahab-6</b>	3	N Korea Taep'o-dong-2	Liquid	10,000	270-1,220	NA	0
<b>Zelifal-1/2/3</b>	?	?	?	?	?	?	?

Source: Adapted from GlobalSecurity.org, available at: <http://www.globalsecurity.org/wmd/world/iran/missile.htm>; the Federation of American Scientists, available at: <http://www.fas.org/nuke/guide/iran/missile>; The Claremont Institute: *Ballistic Missiles of the World*, <http://www.missilethreat.com/missiles/index.html>.

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## ***Shahab-1/SCUD-B***

The Soviet-designed SCUD-B (17E) guided missile currently forms the core of Iran's ballistic missile forces. The missile was used heavily in the latter years of the Iran-Iraq war. In 2006, it was estimated that Iran had between 50 and 300 Shahab-1's in its inventory.<sup>122</sup>

The SCUD-B missile is a tactical missile Iran first acquired in 1985. It has an approximate range between 280-330 miles, and carries a 987-1,000 kg warhead. It has a diameter of 0.885 meter, a height of 11 meters, a launch weight 5,860 kg, a stage mass of 4,873 kg, a dry mass of 1,100 kg, and a propellant mass of 3,760-3,671 kg.<sup>123</sup>

Iran acquired its Scuds in response to Iraq's invasion. It obtained a limited number from Libya and subsequently a larger numbers from North Korea. It deployed these units with a special Khatam ol-Anbya force attached to the air element of the Pasdaran. Iran fired its first Scuds in March 1985. It fired as many as 14 Scuds in 1985, 8 in 1986, 18 in 1987, and 77 in 1988. Iran fired 77 Scud missiles during a 52-day period in 1988, during what came to be known as the "war of the cities." Sixty-one were fired at Baghdad, nine at Mosul, five at Kirkuk, one at Tikrit, and one at Kuwait. Iran fired as many as five missiles on a single day, and once fired three missiles within 30 minutes. This still, however, worked out to an average of only about one missile a day and Iran was down to only 10-20 Scuds when the war of the cities ended.

Iran's missile attacks were initially more effective than Iraq's attacks. This was largely a matter of geography. Many of Iraq's major cities were comparatively close to its border with Iran, but Tehran and most of Iran's major cities that had not already been targets in the war were outside the range of Iraqi Scud attacks. Iran's missiles, in contrast, could hit key Iraqi cities like Baghdad. This advantage ended when Iraq deployed extended range Scuds.

The SCUD-B is a relatively old Soviet design that first became operational in 1967, designated as the R-17E or R-300E. Its thrust is 13,160 Kg f, and its burn time is between 62-64 seconds, and it has an Isp 62-S1 due to vanes steering drag loss of 4-5 seconds. The SCUD-B possesses 1 thrust chamber and is a one-stage rocket (it does not break into smaller pieces). Its fuel is TM-185, and its oxidizer is the AK-27I.<sup>124</sup>

The SCUD-B has a range of 290-300 kilometers with its normal conventional payload. The export version of the missile is about 11 meters long, 85-90 centimeters in diameter and weighs 6,300 kilograms. It has a nominal CEP of 1,000 meters. The Russian versions can be equipped with conventional high explosive, fuel air explosive, runway penetrating, sub-munitions, chemical, and nuclear warheads. Its basic design comes from the old German V-2 rocket design of WWII. It has moveable fins and is guided only during powered flight.

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-B" missile later appeared on the transporter-erector-launcher based on the MAZ-543 (8x8) truck. The introduction of this new cross-country wheeled vehicle gave this missile system greater road mobility and reduces the number of support vehicles required.

The export version of the SCUD-B comes with a conventional high explosive warhead weighing about 1,000 kilograms, of which 800 kilograms are the high explosive payload and 200 are the warhead structure and fusing system. It has a single stage storable liquid rocket engine and is usually deployed on the MAZ-543--an eight-wheel transporter-erector-launcher (TEL). It has a

strap-down inertial guidance, using three gyros to correct its ballistic trajectory, and uses internal graphite jet vane steering. The warhead hits at a velocity above Mach 1.5.

The following timeline tracks the history of the Shahab-1 (SCUD-B) after it was first introduced in Iran in 1985:

- **1985:** Iran began acquiring SCUD-B (Shahab-1) missiles from Libya for use in the Iraq war.<sup>125</sup>
- **1986:** Iran turned to Libya as a supplier of SCUD-B's.<sup>126</sup>
- **1987:** A watershed year. Iran attempted to produce its own SCUD-B missiles, but failed. Over the next 5 years, they purchased 200-300 SCUD-B missiles from North Korea.<sup>127</sup>
- **1988:** Iran began producing its own SCUD-B's, though not in large quantities.<sup>128</sup>
- **1991:** It is estimated that at approximately the time of the Gulf War, Iran stopped producing its own SCUD-B's, and began purchasing the more advanced SCUD-C's (Shahab-2).<sup>129</sup>
- **1993:** Iran sent 21 missile specialists, led by Brig. Gen. Manteghi, to North Korea for training.<sup>130</sup>

Experts estimate Iran bought 200-300 SCUD-Bs from North Korea between 1987 and 1992, and may have continued to buy such missiles after that time. Israeli experts estimated that Iran had at least 250-300 Scud-B missiles and at least 8-15 launchers on hand in 1997. Most current estimates indicate that Iran now has 6-12 SCUD launchers and up to 200 SCUD-B (R-17E) missiles with 230-310 kilometer range. Some estimates give higher figures. The IISS estimated in 2006 that Tehran had 18 launchers, and 300 SCUD missiles.<sup>131</sup> It is, however, uncertain how many of those are SCUD-B and how many are SCUD-C's.

US experts also believe that Iran can now manufacture virtually all of the SCUD-B, with the possible exception of the most sophisticated components of its guidance system and rocket motors. This makes it difficult to estimate how many missiles Iran has in inventory and can acquire over time, as well as to estimate the precise performance characteristics of Iran's missiles, since it can alter the weight of the warhead and adjust the burn time and improve the efficiency of the rocket motors

### ***Shahab-2/SCUD-C***

Iran served as a transshipment point for North Korean missile deliveries during 1992 and 1993. Some of this transshipment took place using the same Iranian B-747s that brought missile parts to Iran.

Others moved by sea. For example, a North Korean vessel called the Des Hung Ho, bringing missile parts for Syria, docked at Bandar Abbas in May, 1992. Iran then flew these parts to Syria. An Iranian ship coming from North Korea and a second North Korean ship followed, carrying missiles and machine tools for both Syria and Iran. At least 20 of the North Korean missiles have gone to Syria from Iran, and production equipment seems to have been transferred to Iran and to Syrian plants near Hama and Aleppo.

The SCUD-C is an improved version of the SCUD-B. With superior range and payload, it is another tactical missile first acquired by Iran in 1990. It has an approximate range between 500-700 miles, a CEP of 50m, and it carries a 700-989kg warhead. It has a diameter of .885m, a height of 11-12m, a launch weight 6,370-6,500kg, an unknown stage mass, an unknown dry mass, and an unknown propellant mass. In terms of propelling ability, its thrust is unknown, its burn time is unknown, and it has an effective Isp of 231. The SCUD-C possesses one thrust

chamber and is a one-stage rocket (it does not break into smaller pieces). Its fuel is Tonka-250, and its oxidizer is the AK 20P.<sup>132</sup>

SCUD-C missile development was successfully completed and ready for production by 1987 (mainly by North Korea), and then distributed to Iran several years later. According to some reports, Iran has created shelters and tunnels in its coastal areas that it could use to store Scuds and other missiles in hardened sites to reduce their vulnerability to air attack.

The missile is more advanced than the SCUD-B, although many aspects of its performance are unclear. North Korea seems to have completed development of the missile in 1987, after obtaining technical support from the China. While it is often called a “SCUD-C,” it seems to differ substantially in detail from the original Soviet SCUD-B. It seems to be based more on the Chinese-made DF-61 than on a direct copy of the Soviet weapon.

Experts estimate that the North Korean missiles have a range of around 310 miles (500 kilometers), a conventional warhead with a high explosive payload of 700 kilograms, and relatively good accuracy and reliability. While some experts feel the payload of its conventional warhead may be limited for the effective delivery of chemical agents, Iran might modify the warhead to increase payload at the expense of range and restrict the using of chemical munitions to the most lethal agents such as persistent nerve gas. It might also concentrate its development efforts on arming its SCUD-C forces with more lethal biological agents.

It is currently estimated that Iran has 50-150 SCUD-C’s in its inventory.<sup>133</sup> The following timelines tracks the development of Iranian SCUD-C missiles since the Gulf war:

- **1990:** It is estimated that at approximately the time of the Persian Gulf War, Iran stopped producing large quantities of SCUD-B’s, and began purchasing the more advanced SCUD-C’s (Shahab 2).<sup>134</sup>
- **1993:** Iran sent 21 missile specialists, led by Brigadier Gen. Manteghi, to North Korea for training in missile technology.<sup>135</sup>
- **1994:** By this year, Iran had purchased 150-200 SCUD-C’s from North Korea.<sup>136</sup>
- **1997:** Iran began production of its own SCUD-C missiles. This is generally considered a technological leap for Iran, and it is believed that a large portion of their production capability and technology came from North Korea.<sup>137</sup>

In spite of the revelations during the 1990s about North Korean missile technology transfers to Tehran, Iran formally denied the fact it had such systems long after the transfer of these missiles became a fact. Hassan Taherian, an Iranian foreign ministry official, stated in February 1995, “There is no missile cooperation between Iran and North Korea whatsoever. We deny this.”<sup>138</sup>

A senior North Korean delegation did, however, traveled to Tehran to close the deal on November 29, 1990, and met with Mohsen Rezaei, the former commander of the IRGC. Iran either bought the missile then, or placed its order shortly thereafter. North Korea then exported the missile through its Lyongaksan Import Corporation. Iran imported some of these North Korean missile assemblies using its B-747s, and seems to have used ships to import others.

Iran probably had more than 60 of the longer-range North Korean missiles by 1998, although other sources report 100, and one source reports 170. Iran may have 5-10 SCUD-C launchers, each with several missiles. This total seems likely to include four North Korean TELs received in 1995.

Iran is seeking to deploy enough missiles and launchers to make its missile force highly dispersed and difficult to attack. Iran began to test its new North Korean missiles. There are reports it fired them from mobile launchers at a test site near Qom about 310 miles (500 kilometers) to a target area south of Shahroud. There are also reports that units equipped with such missiles have been deployed as part of Iranian exercises like the Saeqer-3 (Thunderbolt 3) exercise in late October 1993.

In any case, such missiles are likely to have enough range-payload to give Iran the ability to strike all targets on the southern coast of the Gulf and all of the populated areas in Iraq, although not the West. Iran could also reach targets in part of eastern Syria, the eastern third of Turkey, and cover targets in the border area of the former Soviet Union, western Afghanistan, and western Pakistan.

Accuracy and reliability do remain major uncertainties, as does the missile's operational CEP. Much would depend on the precise level of technology Iran deployed in the warhead. Neither Russia nor the People's Republic of China seems to have transferred the warhead technology for biological and chemical weapons to Iran or Iraq when they sold them the SCUD-B missile and CSS-8. However, North Korea may have sold Iran such technology as part of the Scud-C sale. If it did so, such a technology transfer would save Iran years of development and testing in obtaining highly lethal biological and chemical warheads. In fact, Iran would probably be able to deploy far more effective biological and chemical warheads than Iraq had at the time of the Gulf War.

Iran can now assemble SCUD-C missiles using foreign-made components. It may soon be able to make entire missile system and warhead packages in Iran. Iran may be working with Syria in such development efforts, although Middle Eastern nations rarely cooperate in such sensitive areas.

### ***Shahab-3***

Iran appears to have entered into a technological partnership with North Korea after years of trading with the North Koreans for SCUD-C's throughout the 1990's. The visit to North Korea in 1993 by General Manteghi and his 21 specialists seems a possible date when Iran shifted from procurement to development.

Iran did not have the strike capability to attack Israel with their limited range Scuds. As a result, the Iranians seem to have begun using some of the designs for the North Korean No Dong MRBM in attempt to manufacture their own version of the missile, the Shahab-3. Between 1997 and 1998, Iran began testing the Shahab-3. While Iran claimed Shahab-3's purpose was to carry payloads of sub-munitions, it is more likely that Iran would use the Shahab-3's superior range to carry a chemical, nuclear, or biological weapon.

### **Missile Development**

Iran's new Shahab-3 series is a larger missile that seems to be based on the design of the North Korean No Dong 1/A, and No Dong B missiles, which some analysts claim were developed with Iranian financial support. It also has strong similarities to the Ghauri. It is based on North Korean designs and technology, but being developed and produced in Iran. This development effort is controlled and operated by the IRGC. Iranian officials, however, claimed that the production of the Shahab-3 missiles was entirely domestic. The Iranian Defense Minister, Ali Shamkhani,

argued in May 2005 that the production was compromised of locally made parts, and that the production was continuing.<sup>139</sup>

As the following timeline shows, the Shahab-3 is a relatively young and constantly evolving system, but it has been tested several times:

- **October 1997:** Russia began training Iranian engineers on missile production for the Shahab-3.<sup>140</sup>
- **1998:** Iran began testing its own Shahab-3s. Problems with finding or making an advanced guidance system hindered many of their tests, however. Meanwhile, Iran begins experimenting with the Shahab-4.<sup>141</sup>
- **July 23, 1998:** Iran launched its first test flight of the Shahab-3. The missile flew for approximately 100 seconds, after which time it was detonated. It is not known if it malfunctioned, or because the Iranians did not want to risk discovery.<sup>142</sup>
- **July 15, 2000:** Iran had its first successful test of a Shahab-3.<sup>143</sup>
- **Summer, 2001:** Iran began production of the Shahab-3.<sup>144</sup>
- **July 7, 2003:** Iran completes final test of Shahab-3. Allegations emerged that Chinese companies like Tai'an Foreign Trade General Corporation and China North industries Corporation had been aiding the Iranian's in overcoming the missile's final technical glitches.<sup>145</sup> The missile is seen in Iranian military parades and displayed openly.
- **August 11, 2004:** Iran decreases the size of the Shahab-3 warhead, making a move towards being able to mount a nuclear warhead to a Shahab-3. At this point, the modified Shahab-3 is often referred to as the Shahab-3M.<sup>146</sup> The missile had a new, smaller, and "bottle neck" warhead. This kind of warhead has a slower reentry than a cone shaped warhead and has advantages using warheads containing chemical and biological agents.
- **September 19, 2004:** Another test took place and the missile was paraded on the 21st covered in banners saying "we will crush America under our feet" and "wipe Israel off the map."<sup>147</sup>
- **May 31, 2005:** Iranian Defense Minister, Ali Shamkhani, claimed that Iran successful tested a new missile motor using solid-fuel technology with a range of 2000 km. Shamkhani was quoted as saying "Using solid fuel would be more durable and increase the range of the missile."<sup>148</sup> It remains uncertain if this referred to the Shahab-3 or the modified Shahab-3, the IRIS missile.

As of early 2006, there had been some 10 launches at a rate of only 1-2 per year. Roughly 30% had fully malfunctioned, and six launches had had some malfunction. Iran had also tested two major payload configurations.<sup>149</sup>

### **Uncertain Performance<sup>150</sup>**

Discussions of the Shahab-3's range-payload, accuracy and reliability are uncertain will remain speculative until the system is far more mature. A long-range ballistic missile requires at least 10-30 tests in its final configuration to establish its true payload and warhead type, actual range-payload, and accuracy. While highly detailed estimates of the Shahab 3's performance are available, they at best are rough engineering estimates and are sometimes speculative to the point of being sheer guesswork using rounded numbers.

Its real-world range will depend on both the final configuration of the missile and the weight of its warhead. Various sources now guess that the Shahab-3 has range between 1,300 and 2,000 kilometers but the longer-range estimate seems to be based on Iranian claims and assumptions about an improved version, not full-scale operational tests.<sup>151</sup>

US experts believe that the Shahab-3 missile still has a nominal range of 1,300 kilometers. Iran, however, has claimed that the Shahab-3 had a range of 2,000 kilometers. Nasser Maleki, the head of Iran's aerospace industry, stated on October 7, 2004 that, "Very certainly we are going to improve our Shahab-3 and all of our other missiles." Tehran then claimed in September that the Shahab-3 could now reach targets up to 2,000 km away, presumably allowing the missiles to be deployed a greater distance away from Israel's air force and Jericho-2 ballistic missiles.<sup>152</sup>

IRGC political bureau chief, Yadollah Javani, stated in September 2004 that the modified Shahab – sometimes called the Shahab 3A or Shahab-3M - could be used to attack Israel's Dimona nuclear reactor.<sup>153</sup> Iran performed another test on October 20, 2004, and Iran's Defense Minister, Ali Shamkani, claimed it was part of an operational exercise. Iran's Defense Minister also claimed that Iran was now capable of mass-producing the Shahab-3 on November 9, 2004 and that Iran reserved the option of pre-emptive strikes in defense of its nuclear sites. Shamkani claimed shortly afterwards that the Shahab-3 now had a range of more than 2,000 kilometers (1,250 miles).<sup>154</sup>

One leading German expert stresses the uncertainty of any current estimates and notes that range payload trade-offs would be critical. He puts the range for the regular Shahab 3 at 820 kilometers with a 1.3-ton payload and 1,100 kilometers with a 0.7-ton payload. (An analysis by John Pike of Global Security also points out that missiles-like combat aircraft-can make trade-offs between range and payload. For example, the No Dong B has a range of 1,560 kilometers with a 760-kilogram warhead and 1,350 kilometers with a 1,158-kilogram warhead.<sup>155</sup>

He feels that an improved Shahab could use a combination of a lighter aluminum airframe, light weight guidance, reduced payload, increased propellant load, and increased burn time to increase range. He notes that little is really known about the improved Shahab 3, but estimates the maximum range of an improved Shahab 3 as still being 2,000 kilometers, that a 0.7-0.8 ton warhead would limit its range to 1,500 kilometers and that a 0.8-0.9-1.0 ton warhead would reduce it to 1,200 kilometers. A 1.2-ton warhead would limit it to around 850 kilometers. He feels Iran may have drawn on Russian technology from the R-21 and R-27. Photos of the system also show progressive changes in cable duct position, fins, and length in 2004 and 2005.<sup>156</sup>

The difference in range estimates may be a matter of Iranian propaganda, but a number of experts believe that Iranian claims refer to the modified Shahab-3D or the Shahab-3M and not the regular Shahab 3. There are reports that such modified versions use solid fuel, and could have a range of up to 2,000 kilometer. They also indicate that the standard Shahab-3 remains in production, but the improved Shahab was now called the Shahab-3M.<sup>157</sup>

Much also depends on the missile warhead. In 2004, then Secretary of State Collin Powell accused Iran of modifying its Shahab-3 to carry a nuclear warhead based on documents the US government had received from a "walk-in" source. While experts argued that this information was yet to be confirmed, others claimed that Iran obtained "a new nosecone" for its Shahab-3 missile.<sup>158</sup> In addition, other US officials claimed that the source of the information provided "tens of thousands of pages of Farsi-language computer files" on Iranian attempts to modify their Shahab-3 missile to deliver a "black box," which US officials believed to "almost certainly" referred to a nuclear warhead. These documents were said to include diagrams and test results, weight, detonation height, and shape, but did not include warhead designs.<sup>159</sup>

Media reporting indicates that the US, was able to examine drawings on a stolen laptop from Iran, and found that Iran had developed 18 different ways to adapt the size, weight, and diameter

of the new nosecone on it Shahab-3 missile. It was also reported, however, that Iran's effort to expand the nosecone would not work and that Iran did not have the technological capabilities to adapt nuclear weapons into its Shahab-3 missile. US nuclear experts claimed that one reason for this failure was that the project "wasn't done by the A-team of Iran's program."<sup>160</sup>

Some experts believe that new "bottle neck" warhead tested in 2004 was for the Shahab-3M, and makes it more accurate and capable of air-burst detonations, which could be used to more effectively spread chemical weapons. Others believe a smaller warhead has increased its range.

As for other aspects of performance, it is again easy to be precise, but difficult to be correct. One source, for example reports that the Shahab 3 has a CEP of 190 meters and carries a 750-989-1,158kg warhead). The same source reports that the Shahab 3 has a height of 16m, a stage mass of 15,092, a dry mass of 1,780-2,180, and a propellant mass of 12,912. In terms of propelling ability, its thrust is between 26,760-26,600, its burn time is 110 seconds, and it has an effective Isp of 226 and a drag loss of 45 seconds. According to this source, the Shahab-3 possesses one thrust chamber. Its fuel is TM-185, and its oxidizer is the AK 27I.<sup>161</sup>

High levels of accuracy are possible, but this remains to be seen. If the system uses older guidance technology and warhead separation methods, its CEP could be anywhere from 1,000 to 4,000 meters. If it uses newer technology, such as some of the most advanced Chinese technology, it could have a CEP as low as 190-800 meters. In any case, such CEP data are engineering estimates based on the ratios from a perfectly located target.

This means real-world missile accuracy and reliability cannot be measured using technical terms like circular error of probability (CEP) even if they apply to a fully mature and deployed missile. The definition of the term is based on the assumption the missile can be perfectly targeted at launch and performs perfectly through its final guidance phase, and then somewhat arbitrarily define CEP as the accuracy of 50% of the systems launched in terms of distance from a central point on the target. True performance can only be derived from observing reliability under operational conditions, and correlating actual point of impact to a known aim point.

A German expert notes, for example, that the operational CEP of the improved Shahab 3 is likely to be around three kilometers, but the maximum deviation could be 11 kilometers.<sup>162</sup> In short, unclassified, estimates of the Shahab 3's accuracy and reliability available from public sources are matters of speculation, and no unclassified source has credibility in describing its performance in real-world, war-fighting terms.

This is not a casual problem, since actual weaponization of a warhead requires extraordinarily sophisticated systems to detonate a warhead at the desired height of burst and to reliably disseminate the munitions or agent. Even the most sophisticated conventional sub-munitions are little more than area weapons if the missile accuracy and target location has errors in excess of 250-500 meters, and a unitary conventional explosive warhead without terminal guidance is little more than a psychological or terror weapon almost regardless of its accuracy.

The effective delivery of chemical agents by either spreading the agent or the use of sub-munitions generally requires accuracies less than 1,000 meters to achieve lethality against even large point targets. Systems with biological weapons are inherently area weapons, but a 1,000-kilogram nominal warhead can carry so little agent that accuracies less than 1,000 meters again become undesirable. Nuclear weapons require far less accuracy, particularly if a "dirty" ground burst can be targeted within a reliable fall out area. There are, however, limits. For example, a



regular fission weapon of some 20 kilotons requires accuracies under 2,500-3,000 meters for some kinds of targets like sheltered airfields or large energy facilities.

What is clear is that the Shahab could carry a well-designed nuclear weapon well over 1,000 kilometers, and Iran may have access to such designs. As noted earlier, the Shahab-3 missile tested in its final stages in 2003, and in ways that indicate it has a range of 2,000 km, which is enough to reach the Gulf and Israel. AQ Khan sold a Chinese nuclear warhead design to Libya with a mass of as little as 500 kg and 1 meter diameter. It is highly probable such designs were sold to Iran as well.

## **Mobility and Deployment**

The Shahab-3 is mobile, but requires numerous launching support vehicles for propellant transport and loading and power besides its Transport Erector Launcher (TEL).<sup>163</sup> It is also slow in setting up, taking several hours to prepare for launch.<sup>164</sup> Its deployment status is highly uncertain.

Some reports have claimed that the Shahab-3 was operational as early as 1999. Reports surfaced that development of the Shahab-3 was completed in June 2003, and that it underwent “final” tests on July 7, 2003. However, the Shahab-3 underwent a total of only nine tests from inception through late 2003, and only four of them could be considered successful in terms of basic system performance. The missile’s design characteristics also continued to evolve during these tests. A CIA report to Congress, dated November 10, 2003, indicated that upgrading of the Shahab-3 was still underway, and some sources indicated that Iran was now seeking a range of 1,600 kilometers.

There is an argument among experts as to whether the system has been tested often enough to be truly operational. The CIA reported in 2004 that Iran had “some” operational Shahab 3s with a range of 1,300 kilometers. Some experts feel the missile has since become fully operational and Iran already possesses 25-100 Shahab-3’s in their inventory.<sup>165</sup> Iranian opposition sources have claimed that Iran has 300 such missiles. According to other sources, the IRGC operated six batteries in the spring of 2006, and was redeploying them within a 35 kilometer radius of their main command and control center every 24 hours because of the risk of a US or Israeli attack. The main operating forces were deployed in the West in Kermanshah and Hamadan provinces with reserve batteries further east in Fars and Isfahan provinces.<sup>166</sup>

A substantial number of experts, however, believe the Shahab-3 may be in deployment, but only in “showpiece” or “test-bed” units using conventional warheads and with performance Iran cannot accurately predict.

## ***Shahab-3A/3M/3D/IRIS***

In October 2004, the Mujahedin-e Khalq (MEK) claimed that Iran was developing an improved version of the Shahab with a 2,400-kilometer range (1,500 miles). The MEK has an uncertain record of accuracy in making such claims, and such claims could not be confirmed. Mortezar Ramandi, an official in the Iranian delegation to the UN denied that Iran was developing a missile with a range of more than 1,250 miles (2,000 kilometers);<sup>167</sup>

This new range for the Shahab-3 may have marked a significant move in Iranian technological capability, as some experts believe Iran switched the fuel source from liquid fuel to solid. The

possible existence of a Shahab-3 with a solid fuel source created yet another variant of the Shahab-3 series, the Shahab-3D, or IRIS missile.

Such a development of a solid fuel source might enable the Shahab-3D to enter into space, and serve as a potential satellite launch vehicle. Perfecting solid fuel technology would also move Iran's missile systems a long way towards the successful creation of an LRICBM, which is what the Shahab-5 and Shahab-6 are intended to accomplish.<sup>168</sup>

If there is an IRIS launch vehicle, it apparently consists of the No-dong/Shahab-3 first stage with a bulbous front section ultimately designed to carry the IRIS second stage solid motor, as well as a communications satellite or scientific payload.<sup>169</sup> The IRIS solid fuel missile itself may be the 3<sup>rd</sup> stage portion of the North Korean Taep'o-dong 1.<sup>170</sup>

The Shahab-3D alone is not capable of launching a large satellite probe into space by itself, and it is possible that it is a test for the second and third stage portions of the upcoming IRBM Ghadr designs and the LRICBM Shahab-5 and Shahab-6.<sup>171</sup>

No test flights of the Shahab-3D have been recorded on video, but it is believed that they have taken place at a space launch facility.<sup>172</sup> The following timeline shows the reported tests of the Shahab-3D/IRIS:

- **July 22, 1998:** First test flight (explodes 100 seconds after takeoff)
- **July 15, 2000:** First successful test flight (range of 850km).
- **September 21, 2000:** Unsuccessful test flight (explodes shortly after take off).
- **May 23, 2002:** Successful test flight.
- **July 2002:** Unsuccessful test flight (missile did not function properly).
- **June 2003:** Successful test flight. Iran declares this was the final test flight before deployment.
- **August 11, 2004:** Successful test flight of Shahab-3M. Missile now has bottleneck warhead
- **October 20, 2004:** Another Successful test flight of Shahab-3M. Iran now claims the modified missile has a range of 2,000 km.<sup>173</sup>

## *Shahab-4*

Iran seems to be developing much larger designs with greater range-payload using a variety of local, North Korean, Chinese, and Russian technical inputs. These missiles have been called the Shahab-4, Shahab-5, and Shahab-6. As of January 2006, none of these missiles were being produced, and the exact nature of such programs remained speculative.

Some experts believe the "Shahab-4" has an approximate range between 2,200 and 2,800 kilometers. Various experts have claimed that the Shahab-4 is based on the North Korean No Dong 2, three stage Taepodong-1 missile, Russian SS-N-6 SERB, or even some aspects of the Russian SS-4, but has a modern digital guidance package rather than the 2,000-3,000 meter CEP of early missiles like the SS-4.

Russian firms are believed to have sold Iran special steels for missile development, test equipment, shielding for guidance packages, and other technology. Iran's Shahid Hemmet Industrial Group is reported to have contracts with the Russian Central Aerohydrodynamic

Institute, Rosvoorouzhnie, the Bauman Institute, and Polyus. It is also possible that Iran has obtained some technology from Pakistan.

One source has provided a precise estimate of some performance characteristics. This estimate of “Shahab-4 gives it an estimated height of 25 meters, a diameter of 1.3 meter, and a launch weight of 22,000 kilograms. In terms of propelling ability, its thrust is estimated to around 26,000 kg f and its burn time around 293 seconds. It is said to be a 2/3-stage rocket that possesses three-thrust chambers, one for each stage. Its fuel for the first stage is Heptyl, and its oxidizer is the IRFNA.<sup>174</sup>

Iran has sent mixed signals about the missile development status. In October 2003, Iran claimed it was abandoning its Shahab-4 program, citing that the expected increase in range (2,200 to 3,000km) would cause too much global tension.<sup>175</sup> Some speculate that Iran may scraped its Shahab-4 program, because it either was not innovative and large enough and/or to avoid controversy. The reason some Iranians have announced for creating a missile like the Shahab-4 was for satellite launches. The IRIS/Shahab-3D, with its solid fuel source, however, has shown potential in for space launch. The improved range and bottleneck warhead design offered by the Shahab-3M (which began testing in August of 2004) may make the Shahab-4 simply not worth the effort or controversy.<sup>176</sup>

According to German press reports, however, Iran is moving ahead in its development of the Shahab-4. In February 2006, the German news agency cited “Western intelligence services” as saying that Iran successfully tested the Shahab-4 missile with a range of 2,200 kilometers on January 17, 2006, and the test was announced on Iranian television several days later by the commander of the Islamic Revolutionary Guards Corps (IRGC).<sup>177</sup> These reports remain unverifiable.

### ***Shahab-5 and Shahab-6***

Israeli intelligence has reported that Iran is attempting to create a Shahab-5 and a Shahab-6, with a 3,000-5,000 kilometer range. These missiles would be based on the North Korean Taep'o-dong-2, and would be three-stage rockets. If completed, the Shahab-5 and the Shahab-6 would take Iran into the realm of limited range ICBM's, and enable Iran to target the US eastern seaboard. The Shahab-5 and Shahab-6 would possess a solid fuel 3<sup>rd</sup> stage for space entry and liquid fuel for the first stage take units.

It is alleged that Russian aerospace engineers are aiding the Iranians in their efforts. It is believed that the engineers will employ a version of Russia's storable liquid propellant RD-216 in the missile's first stage. The RD-216 is an Energomash engine originally used on the Skean/SS-5/R-14, IRBM, Saddler/SS-7/R-16, ICBM and Sasin/R-26 ICBM missiles used in the cold war. These reports remain uncertain, and Israeli media and official sources have repeatedly exaggerated the nature and speed of Iranian efforts.<sup>178</sup>

Neither the Shahab-5 nor the Shahab-6 have been tested or constructed. While no description of the Shahab-6 is yet available, extrapolations for the Shahab-5 have been made based on the North Korean Taep'o-dong 2. The Shahab-5 has an approximate range between 4,000 km and 4,300km. The Shahab-5 has an unknown CEP, and its warhead capacity is between 700-1,000kg. It has a height of 32m, a diameter of 2.2m, and a launch weight of 80,000-85,000.

In terms of propelling ability, some experts estimate its thrust to be 31,260 Kg f and its burn time is 330 seconds. The Shahab-5 is a three-stage rocket that possesses 6 thrust chambers, 4 for stage

one, and one for the two remaining stages. The Shahab-5 and Shahab-6 would be considered long-range ICBM's.<sup>179</sup>

As of January 2006, Iran had not completed its plans for these missiles, and it had none in its inventory. In February 2006, German press reports, however, claimed that the Federal German Intelligence Service (BND) estimated that it was possible for Iran to acquire the Shahab-5 as early as 2007 with a range of 3,000-5,000 kilometers.<sup>180</sup> These estimates, however, are speculative and remain unconfirmed.

### ***Ghadr 101 and Ghadr 110***

The uncertainties surrounding Iran's solid fuel problem and the existence or non-existence of the Shahab 3 are compounded by reports of a separate missile development program. The Iranian exile group, National Council of Resistance in Iran (NCRI), claimed in December 2004, that the Ghadr 101 and Ghadr 110 were new missile types that used solid fuel and were, in fact, IRBMs. Their existence has never been confirmed, and conflicting reports make an exact description difficult.

At the time, US experts indicated that the Ghadr is actually the same as the Shahab-3A/Shahab M/Shahab 4, which seemed to track with some Israel experts who felt that Iran was extending the range/payload of Shahab 3, and that reports of both the Ghadr and Shahab 4 were actually describing the Shahab 3A/3M.<sup>181</sup>

In May 2005, Iran tested a solid fuel motor for what some experts call the Shahab-3D, possibly increasing the range to 2,500km, making space entry possible, and setting the stage for the Shahab-5 and Shahab-6, are 3 stage rockets resembling ICBMs.<sup>182</sup> This test showed that Iran had developed some aspects of a successful long-range, solid fuel missile design, but did not show how Iran intended to use such capabilities.

NCRI again claimed in March 2006, that Iran was moving forward with the Ghadr solid fuel IRBM. It also claimed that Iran had scrapped the Shahab 4 because of test failures and performance limitations. It reported that Iran had substantial North Korean technical support for the Ghadr, that it was 70% complete, and had a range of 3,000 kilometers. One Israel expert felt that NCRI was confusing a solid-state, second stage for the liquid-fueled Shahab 4 with a separate missile.<sup>183</sup>

Work by Dr. Robert Schmucker indicates that Iran is working on solid fueled systems, building on its experience with solid fuel artillery rockets like its Fateh 110A1 and with Chinese support in developing solid fuel propulsion and guidance. The Fateh, however, is a relatively primitive system with strap down gyro guidance that is not suited for a long-range ballistic missile.<sup>184</sup>

As is the case with longer-range variants of the Shahab, it is probably wise to assume that Iran is seeking to develop options for both solid and liquid fueled IRBMs, and will seek high range-payloads to ensure it can deliver effective CBRN payloads even if it cannot produce efficient nuclear weapons. It is equally wise to wait for systems to reach maturity before reacting to vague possibilities, rather than real-world Iranian capabilities.

### ***Raduga KH-55 Granat/Kh-55/AS-15 Kent***

The Raduga KH-55 Granat is a Ukrainian/Soviet-made armed nuclear cruise missile first tested in 1978 and completed in 1984.<sup>185</sup> The Russian missile carries a 200-kiloton nuclear warhead, it has a range of 2,500-3,000 kilometers. It has a theoretical CEP of about 150 meters, and a speed

of Mach 0.48-0.77. Its guidance system is reported to combine inertial-Doppler navigation and position correction based on in-flight comparison of terrain in the assigned regions with images stored in the memory of an on-board computer. It was designed to deliver a high yield nuclear weapon against fixed area targets, and has little value delivering conventional warheads. While it was originally designed to be carried by a large bomber, and its weight makes it a marginal payload for either Iran's Su-24s or F-14As, it has land and ship launch capability. It can also be adapted to use a much larger nuclear or other CBRN warhead by cutting its range, and may be a system that Iran can reverse engineer for production.<sup>186</sup>

Russian President Boris Yeltsin made further manufacture of the missile illegal in 1992.<sup>187</sup> Still, the Ukraine had 1,612 of these missiles in stock at the end of 1991, and it agreed to give 575 of them to Russia and scrap the rest.<sup>188</sup> The plans to give the missiles to Russia in the late 1990's proved troublesome, however, and an organization was able to forge the documents regarding 20 missiles and listed them as being sold to Russia, while in fact 12 seem to have been distributed to Iran and 6 to China (the other two are unaccounted for).<sup>189</sup> It was estimated that the missiles were smuggled to Iran in 2001.<sup>190</sup>

Ukrainian officials confirmed the illegal sale on March 18, 2005, but the Chinese and Iranian governments were silent regarding the matter. While some US officials downplayed the transaction, the US State Department expressed concern that the missiles could give each state a technological boost.<sup>191</sup> The missiles did not contain warheads at the time of their sale, and they had passed their service life in 1995, and were in need of maintenance.<sup>192</sup> It is, however, feared that Iran could learn from the cruise missiles technology to improve their own missile program and the missiles could be fitted to match Iran's Su-24 strike aircraft.<sup>193</sup>

## Paramilitary, Internal Security, and Intelligence Forces

Iran has not faced a meaningful threat from terrorism. Its internal security forces are focused on countering political opposition. **Figure 7** shows the force structure of Iran's paramilitary and internal security services. Since 1990, Iran has maintained the same force structure, and its key agencies have not changed since the early years of the revolution.

The U.S. Department of State described the role of Iran's internal security apparatus as follows:<sup>194</sup>

Several agencies share responsibility for law enforcement and maintaining order, including the ministry of intelligence and security, the law enforcement forces under the interior ministry, and the IRGC. A paramilitary volunteer force known as the Basiji and various informal groups known as the Ansar-e Hizballah (Helpers of the Party of God) aligned with extreme conservative members of the leadership and acted as vigilantes. The size of the Basij is disputed, with officials citing anywhere from 11 to 20 million, and a recent Western study claiming there were 90 thousand active members and up to 300 thousand reservists. Civilian authorities did not maintain fully effective control of the security forces. The regular and paramilitary security forces both committed numerous, serious human rights abuses. According to HRW since 2000 the government's use of plainclothes security agents to intimidate political critics became more institutionalized. They were increasingly armed, violent, and well equipped, and they engaged in assault, theft, and illegal seizures and detentions.

Iran maintains an extensive network of internal security and intelligence services. The main parts of the domestic security apparatus are made up of the Ministry of Intelligence and Security (MOIS), the Basij Resistance Force, the Intelligence unit of the IRGC, and the Law Enforcement forces within the Ministry of Interior who largely are responsible for providing police and border

control. The leadership of each of these organizations appears to be fragmented and dispersed among several, often competing, political factions. Public information on all Iranian security and intelligence forces is extremely limited and subject to political manipulation.

Key to most paramilitary and intelligence forces in Iran is the IRGC, as it holds control over several other organizations or parts thereof. All security organizations without exception report to the Supreme National Security Council (SNSC), as the highest body in the political chain of command. The phenomenon of the fragmented leadership of the security organizations is reflected in their relationship to the SNSC as different security organizations maintain special ties to certain elements of the SNSC.

In addition, it has to be assumed that other state organizations, most notably the police services, exert varying control over internal security. As with virtually all other organizations, the IRGC is believed to have considerable leverage over these services.<sup>195</sup> The effectiveness of the internal security organizations is unclear and the political will to use them is hard to predict. After local unrest in the Iranian province of Baluchistan in May 2006, police were unable to seize control of the situation against regional tribal forces.<sup>196</sup>

**Figure 7: Iran's Paramilitary Forces' Force Structure, 1990-2006**

	1990	2000	2005	2006
<b>Manpower</b>	<b>1,045,000</b>	<b>1,040,000</b>	<b>1,040,000</b>	<b>1,040,000</b>
<i>Active (interior ministry officers)</i>	45,000	40,000	40,000	40,000
<i>Reserve (includes rev. conscripts, BASU)</i>	1,000,000	1,000,000	1,000,000	1,000,000
<b>Patrol and Coastal Combatants</b>	<b>136</b>	<b>130</b>	<b>130</b>	<b>130</b>
<i>Misc Boats and Craft</i>	40	40	40	40
<i>PCI</i>	96	90	90	90
<b>Aircraft</b>	?	?	?	?
<i>Cessna 185/Cessna 310</i>	?	?	?	?
<b>Helicopters</b>	?	<b>24</b>	<b>24</b>	<b>24</b>
<i>UTL Bell/205/206</i>	?	24	24	24

Source: IISS, *Military Balance*, various editions including 1989-1990, 1999-2000, 2004-2005, 2005-2006.

### ***The Ministry of Intelligence and Security (MOIS)***

The Ministry of Intelligence and Security (MOIS), or Vezarat-e Ettela' at va Aminat-e Keshvar (VEVAK), was installed following the revolution to replace the now-disbanded National Organization for Intelligence and Security (SAVAK), which in return was created under the leadership of U.S. and Israeli officers in 1957. SAVAK fell victim to political leadership struggles with the intelligence service of the IRGC during the Iran-Iraq war. A compromise solution resulted in the creation of MOIS in 1984.

In 2006, the MOIS employed about 15,000 civilian staff. Its major tasks included intelligence about the Middle East and Central Asia, and domestic intelligence and monitoring of clerical and government officials<sup>197</sup> as well as work on preventing conspiracies against the Islamic Republic.<sup>198</sup> It can therefore be assumed that the ministry maintains an elaborate domestic service network.

The MOIS staff is believed to maintain a professional service loyalty and therefore is not subject to easy mobilization by military, clergy or other political forces. Some, however, believe that during President Khatami's rule the MOIS actively sought to rid the organization of hard-line officials.<sup>199</sup> Within Iran's political system there is constant argument about limiting parliamentary control over MOIS, indicating that the control over MOIS can be used as a powerful political instrument. Recently, there were efforts in Iran to extract the counterintelligence unit of MOIS and make it a separate entity. This proposal seems to be favored by Supreme Leader Ayatollah Khamenei and some hard-line legislators.<sup>200</sup>

Until recently, the organization has remained under very limited public disclosure. In the 1990s, ministry personnel were accused of killing political dissidents in Iran. Ensuing investigations have been covered up systematically. Apparently, MOIS has a comparatively large budget at its disposal and operates under the broader guidance of Ali Khamenei.<sup>201</sup> And it seems likely that the details about the ministry's resources are partly undisclosed even to Iranian political officials.

### ***The IRGC Intelligence Branch***

As part of the Islamic Revolution Guard Corps, the roughly 2,000 staff of its intelligence force are a largely politicized force with a political mission. According to *Jane's*, their conformity and loyalty to the regime are unquestionable.<sup>202</sup>

The main task of the IRGC Intelligence Branch is to gather intelligence in the Muslim world. As far as domestic security is concerned, the organization targets the enemies of the Islamic revolution and also participates in their prosecution and trails.<sup>203</sup> In addition, it works closely with the IRGC's Qods corps, which also operates covertly outside Iran.

### ***The Basij Resistance Force***

The IRGC oversaw the creation of a people's militia, a volunteer group, named the Basij Resistance Force (which means Mobilization of the oppressed), in 1980. Numbering over 1,000,000<sup>204</sup> members, the Basij is a paramilitary force, mostly manned by elderly men, youth, and volunteers who have completed their military service. This force is organized in a regional and decentralized command structure. It has up to 740 regional battalions each is organized into 3 battalions or four platoons. Each battalion has 300-350 men. It maintains a relatively small active-duty staff of 90,000 and relies on mobilization in the case of any contingency.<sup>205</sup>

The Basij has a history of martyr-style suicide attacks dating back to the Iran-Iraq War, 1980-1988. Today, its main tasks are thought to assist locally against conventional military defense as well as quell civil uprisings. In addition, one of the force's key roles has been to maintain internal security including monitoring internal threats from Iranian citizens and acting as "a static militia force." The state of training and equipment readiness for the Basij is believed to be low. No major weapon systems have been reported for the inventory of the Basij. The Basij derives its legitimization from Article 151 of the Iranian constitution, which calls upon the government to fulfill its duty according to the Quran to provide all citizens with the means to defend themselves.

The IRGC maintains tight control over the leadership of the Basij and imposes strict Islamic rules on its members. Recent comments by Iranian leaders indicate that the mission of the Basij is shifting away from traditional territorial defense to "defending against Iranian security threats." Furthermore, there are reports of an increased interest in improving the Basij under the

leadership of President Ahmadinejad.<sup>206</sup> At the same time, the IRGC leadership questions the effectiveness of the Basij and might loosen its ties to the organization.<sup>207</sup>

In 1993, the Ashura Brigades were created from IRGC and Basij militia units as a response to anti-government riots. This unit is composed of roughly 17,000 men and women and its primary purpose is to keep down civil unrest, although there has been some discontent expressed by senior leaders about using IRGC units for domestic contingencies.<sup>208</sup>

### ***The Uncertain Role of The Ministry of Interior***

The police forces, which comprise about 40,000 police under the Ministry of Interior, participate in internal security as well as border protection. The Police-110 unit specializes in rapid-response activities in urban areas to disperse potentially dangerous public gatherings. The maritime police have 90 inshore patrol and 40 harbor boats. In 2003, some 400 women became the first female members of the police force since the 1978–79 Revolution.<sup>209</sup>

The role of Iran's MoI is unclear, and open source information regarding its structure and forces is limited. The same is true of other organization in Iran's internal security apparatus. The Ansar-e Hezbollah is a paramilitary force that has gained questionable notoriety. It remains unclear to what extent they are attached to government bodies. Reportedly, the political right in government has repeatedly made use of them to fight and intimidate liberal forces in society. The Ansar-e Hezbollah's military level of training appears to be very poor.<sup>210</sup>

## **Iran's Continuing Strategic Challenges**

Iran has experienced many serious strategic challenges over the past three decades, which continue to have repercussions until the present time. After the Islamic revolution of 1979, Iran was left without one of its formerly closest allies, the United States, which has considered Iran an adversarial power since the hostage taking in 1979. In addition to the domestic turmoil created by the revolution, Iranian oil production and income dropped sharply. Iran went from earning some 17% of all OPEC revenues in the late 1970s to an average of around 10% from 1980 to the present.<sup>211</sup> It had to fight a bloody war against Iraq that lasted eight years, and came at a great cost to Iran both in terms of human life, strategic prestige, military capability, and economic development.

Following the Iran-Iraq War, the Iranian government failed to manage the nation's finances effectively and implement even basic reforms to develop its economy. Moreover, Iran suffered from low oil prices during much of the 1990s. This caused Iran's military readiness to decline and its economy to stagnate. While the Gulf War of 1990-1991, and the sanctions on Iraq that followed, greatly weakened a once victorious Iraq, it also triggered a major expansion in the US presence in the Gulf. Iran faced a different threat from the Taliban, which drove millions of Afghans into Iran as refugees and was violently anti-Shi'ite. While the American military campaigns in Afghanistan and Iraq in 2001 and 2003 largely eliminated such threats, they also led to a massive American military presence on two of Iran's borders.

The "nuclearization" of India and Pakistan did not create a direct threat to Iran, but did change the nature of the balance of power in the region. More significantly, the rise of Neo-Salafi Islamic fundamentalism created a direct religious and political challenge to Iran and all Shi'ites. While movements like Al Qa'ida divide over how openly they attack Shi'ites, some key leaders lead Zaraqawi have called for a Sunni Jihad against Shi'ites, and others have called Shi'ites



polytheists and apostates. Iran increasingly faced a struggle for the future of Islam, and one that affected all Shi'ites, including those in Iraq, Lebanon, and Syria -- where Iran had direct strategic interests.

The failure of the Israeli-Palestinian peace process and Israeli-Syrian negotiations made it impossible for Iranian "moderates" to back away from hostility to Israel, and allowed hard-liners to make the Israeli-Palestinian war of attrition that began in 2000 a rallying call for support of the Hezbollah in Lebanon and anti-peace Palestinian groups like Hamas and the PIJ. It was sometimes unclear how sincere Iran's motives were, and whether some of their attacks on Israel were posturing to defuse Arab hostility to Iran. Iran's more extreme statements and actions, however, paralyzed efforts to restore relations with the US and led President Bush to label Iran part of the "axis of evil," and the US to call Iran the leading terrorist nation. The election of Ahmadinejad as president in August 2005 made this situation much worse when he questioned the existence of the holocaust and called for the end of Israel.

Today, Iran faces several severe strategic challenges. Some of these challenges directly impact its internal stability, while others have indirect impact on its overall strategic posture in the Gulf and beyond. The following list outlines key challenges that Iran faces today, and may face in the foreseeable future:

- **Nuclear program:** Since 2002, Iran has been facing international pressure to stop its uranium enrichment program. The difficulty of this challenge to Iran and the international community is that Iran claims that its nuclear program is aimed for peaceful purposes (nuclear energy). While the Islamic republic has the right to achieve a full nuclear cycle under the Nuclear Non-Proliferation Treaty, the United States, the IAEA, and the EU-3 (Britain, Germany, and France) have argued that there are many unknowns about Iran's nuclear intentions. Iran's nuclear program was referred to the United Nations Security Council in early 2006. This pressure could lead the international community to further isolate Iran through diplomatic or economic sanctions or could provoke preemptive military strikes by the United States or Israel.
- **Iran's involvement in Iraq's internal affairs:** Like all neighboring states, Iran has stakes in insuring Iraq's stable future. Regional, U.S. and British officials have accused Iran of meddling in Iraq's internal affairs, of supporting Shi'ite militias such as al-Mahdi army and the Bader Brigade through its intelligence and security services, and of aiming to create a "Shi'ite Crescent." From an Iranian perspective, the challenge is not only to answer these allegations, but it must be prepared to deal with Iraq. The threat from Saddam Hussein has been replaced with an insurgency that aims to start a civil war between Iraq's sectarian factions.
- **The U.S. presence in the region:** many in the region feel that Iran is the clear winner in the case of Iraq, since the Shi'ite majority in Iraq came to power and they are more likely to be more sympathetic to Iran than to their Arab neighbors. While Iran is seen as the winner in removing two enemies on its borders (the Taliban in Afghanistan and Saddam Hussein in Iraq), Iran has more than 100,000 U.S. troops on two of its borders (Iraq and Afghanistan). The presence of the U.S. troops in the Gulf is not new, and Iran has to deal with U.S. support of the GCC states since the revolution, but the U.S. power projection does act as a deterrent despite the difficulty the United States is facing with the post-war conflict in Iraq.
- **Support of proxy groups:** The United States the Israel has accused Iran of supporting proxy groups beyond Iraq. Since the revolution, Iran has had close relations with groups such Hezbollah, Hamas, and Palestinian Islamic Jihad. In the "Global War on Terror," while Iran is happy to see the infrastructure of groups such al-Qa'ida to be destroyed, Iran sees Palestinian and Lebanese groups as freedom fighters. This had led to condemnation and became a hot issue to extend the U.S. sanctions against Iran.
- **Internal political uncertainty:** Iran's political dynamics have been characterized by several factions including reformist, hardliners, the clerical establishment, and the youth movements. The two key factions, however, that are often talked about as the two rivals are the reformists vs. the hardliners. The election of Mohammad Khatami as president of the republic in 1997 was seen by many as a turning point in Iran's internal political trends. However, the election of Mahmoud Ahmadinejad in 2005 was a wake up call to

many experts. His political platform had several themes, but chief amongst them were supporting Iran's right to acquire nuclear technology, Persian nationalism, and populism that has not been seen in Iran since the time of Mohammad Mosadeq in the 1950. It is too early to predict the result of this struggle between the reformists and the hardliners, and it largely depends on Ahmadinejad's ability to deal with the international scrutiny regarding Iran's nuclear program and domestic economic prosperity.

- **Economic challenges:** Despite high oil prices, Iran's economy is not growing at its potential growth rate. There are several factors behind this. First, the government controls an estimated 80% of the economy, and this discourages the growth of a vibrant private sector, puts greater pressure on the government to support a welfare state, and prevents the growth of a business middle class that can demand further economic and political reforms. Second, Iran's energy sector suffers from a lack of foreign investment. This is a result of several years of sanction, mismanagement by Iran's government, and the rigid foreign investment laws, which tend to be nationalistic in nature. This has led to massive declines in its oil production capacity, which in 2006 was lower than it was during the 1970s. Third, despite its efforts for the last twenty years, Iran's economy is heavily dependent on oil and oil export revenues. Fourth, while many people associate Iran with being an oil producer, it imports nearly 40% of its refined products, and this goes back to Iran's inability and at times unwillingness to attract enough private domestic and foreign investment.
- **Military reforms:** As the previous sections have shown, Iran's armed services have quantity in Gulf standards, but they don't have the quality. This is due to several reasons including mismanagement, the arms embargo by the United States, and the lack of enough funds to maintain and purchase new weapons systems. Iran cannot hope to be a viable conventional military power, if it continues with the same defense policies. Even smaller countries such as the UAE have surpassed Iran in military spending.
- **The threat from al-Qa'ida and other neo-Salafists extremist groups:** The struggle between Sunnis and Shi'ites is not new in the Gulf, but statements and actions by al-Qa'ida leaders such as Abu Musab al-Zarqawi has led many Shi'ites to see neo-Salafists groups as a key threat. As noted earlier, Iran has not suffered from the threat of terrorism, but such groups can become a threat to Iran's internal stability. The threat from such groups, however, does not have to be direct. An escalation of the attacks that took place in Iraq against Shi'ites' holy sites, religious rituals, or leaders that spillover into neighboring states may force Iran to get involved to protect Shi'ites and their holy shrines against such attacks.

This list is not exhaustive, and Iran faces many other internal and external challenges that do not have the same magnitude or strategic importance. The fact remains, however, that Iran now exists between two war theaters (Iraq and Afghanistan), that its politics has led to steadily more concern inside and outside the Gulf, and the US and its neighbors see it as a potential threat to security of the Strait of Hormuz, one of the most important strategic waterways in the world and a region with 60% of world proven conventional oil reserves exist. Iran also faces two immediate strategic challenges that will preoccupy it for the next several years: Dealing the consequence of its nuclear ambitions and its role in Iraq's future.

### *Iran's Nuclear Program and Its Strategic Consequences*

Iran faces major strategic problems because of an increasingly hostile international reaction to its nuclear enrichment program and failure to fully comply with IAEA inspection. Iran's nuclear file had become a major issue in the UN Security Council by mid-2006, and seemed to be three different options for international action against Iran: diplomatic, punitive sanctions, or military strikes. No one knows which options is more likely or if any of them will work, but Iran is likely to face this challenge for next few years—if it does not end its nuclear program.

#### **Economic Sanctions**

Iran's traditional economy of Iran (carpets, caviars, pistachio, etc.) is another unlikely area for sanctions, since the impact would largely affect farmers and small business without major

implications on the Iranian government. Such sectors are also self-sustained, since they are not dependent on imports.

Other sectors, however, are dependent on imports and would be more impacted by economic sanctions. Sectors such as industry, for example, play a major role in Iran's economy. It is estimated that Iran's GDP is 11.8% dependent on agriculture, 43.3% on industry, and 44.9% on services.<sup>212</sup> UNSC members would find it hard to justify the use of sanctions against agricultural products--except for dual use technologies and fertilizers that can be used in the production of WMD--but industrial sanctions might be a different story.

Iran's heavier industries rely on refined products imports and would suffer from economic sanctions. Iran is an importer of refined products. Since 1982, Iran's dependence on imports of gasoline surged due the fact the refineries were damaged by the Iran-Iraq War, the mismanagement of these refineries, and the lack of foreign investment in its refinery sector. According to the IEA, Iran's refining sector is inefficient. For example, only 13% of the refinery output is gasoline—which is estimated to be half of what European refineries produce.<sup>213</sup>

In 2004, Iran imported an estimated 0.160 million barrels a day of oil equivalent (MMBD) of gasoline (40% of its domestic consumption). Iran's dependence on gasoline import steadily increased in 2005 and 2006. Iran imported an estimate 0.170 MMBD of gasoline (41% of its domestic consumption) in 2005, and 0.196 MMBD (43% of its domestic consumption) in 2006. It is equally noteworthy that 60% of Iran's gasoline is imported from Europe, 15% from India, and the rest from elsewhere (Middle East and Asia).<sup>214</sup>

These trends are likely to continue. Iran's domestic demand for gasoline is estimated to increase at approximately 9% per year, and the costs of gasoline imports are also steadily increasing. For example, Iran paid an estimated \$2.5-\$3.0 billion for its gas imports in 2004 and is estimated to pay \$4.5 billion in 2005.<sup>215</sup> Other experts, however, estimate that the cost of importing refined products was as high a \$10 billion in 2005.<sup>216</sup> This is likely to include jet fuels, diesel, residual oil, kerosene, and other products.

Iran's dependence on gasoline imports are unlikely to change in the near future. It is estimated that Iran is planning to spend \$16 billion between 2003 and 2030 to expand its refinery capacity from 1.5 MMBD in 2004 to 1.7 MMBD in 2010, 2.2 MMBD in 2020, and 2.6 MMBD in 2030. However, its total energy demand and consumption of refined products are also estimated to increase at higher rates.<sup>217</sup>

Sanctioning refined products exports to Iran would certainly have an impact on the Iranian economy, but the effectiveness of such a sanctions regime would be uncertain. Iran can get around the imposed sanctions through unofficial deals and smuggling. In addition, Iran is enjoying high oil revenues, and may well use them to fast track its plans to expand refining capacity. Tehran might use such deals to attract foreign companies, and to further complicate a UNSC resolution, since some of these contracts might go to Chinese, Russian, French, German, and British firms.

Some have argued that the first round of sanctions against Iran should target Iranian officials directly. This would include restricting Iranian officials including the President, Mahmoud Ahmadinejad, from traveling outside Iran as well as other top officials and clerics.

These sanctions would have little impact on the general population. They might affect the mobility of Iranian officials, but their impact would be limited. They are hard to enforce outside

the EU and the US. This may be further complicated by stopping Iranian officials from attending UN meetings in the US or the EU. Middle Eastern and Asian countries might find it hard to comply with these travel restrictions—given the fragile strategic situation in the region.

If the goal is to send a message to the Iranian government and the world that the world does not approve of Iran's nuclear weapons, then such sanctions might do that. It is questionable, however, whether travel restrictions would change the attitudes or actions of the Iranian government or Iranian public attitudes toward acquiring nuclear technology. The Iranian nuclear research program does not depend on the ability of the Iranian president to visit Paris, and the impact of such sanctions will be symbolic in the case of Iran.

The historical precedents also are not reassuring. The EU has maintained travel restrictions and financial sanctions against Zimbabwe. The EU imposed targeted sanctions that included travel bans, oil embargo, and freezing of financial assets of President Robert Mugabe and 100 other senior Zimbabwean officials. The ban has been extended several times since its inception in February 2002, and is expected to run out in February 2007. These extensions make either the point that these travel restrictions did not work or that they need a long time to work.

Travel restrictions and financial sanctions combined are also an option that might have more impact. This may, in fact, be the set of sanctions that would arouse the least amount of resistance by UNSC members. Most of the financial assets held in the West belong to the government or the ruling elite of Iran. The combination of freezing assets held in Western banks and travel restrictions can have the least impact on the general population and the maximum amount of pressure on the ruling elites.

While US capital markets have been closed to the Iranian government since the revolution, Iran had alternative sources. Iran relies on loans particularly from European and Asian banks to finance domestic projects in its energy sector.<sup>218</sup> For example, Iran's shipbuilding and car making sectors are growing faster than Iranian domestic financial institutions. These industries have relied on European banks for investment loans. Other European banks stopped doing business with Tehran, but many other banks continue to finance projects in Iran including major European banks such as HSBC, BNP Paribas, Deutsche Bank, Commerzbank, Standard Chartered, and Royal Bank of Scotland. Observers have argued that targeting loans from European banks can have major impact on the Iranian economy, particularly since the Iranian capital market is still small and key industries in Iran cannot survive without investment loans from the outside.<sup>219</sup>

Another option to target Iranian finances is to freeze Iranian assets in European and Asian banks. Iran's financial assets in the US have been frozen since the revolution, but Tehran has significant amounts of financial assets in European financial institutions. There are no reliable estimates for how much Iran's hard currency deposits are. It is, however, safe to assume that it is a large amount given the recent surge in oil. Some estimates put it at \$36 billion in 2005.

The significance of this can be seen through the reaction of the Iranian government following the IAEA referral of Iran's case to the UNSC. In January 2006, the governor of Iran's Central Bank announced that Iran had started transferring its assets out of European banks. It is unclear where the funds have been moved, but there are indications and initial admission that they may have been transferred to Southeast Asia.<sup>220</sup>

It has also been reported that Iranian government figures have started to move their money from European financial institutions to Dubai, Hong Kong, Malaysia, Beirut, and Singapore. Iranian officials were quoted as saying that as high as \$8 billion were moved out of Europe.<sup>221</sup>

Sanctions can reach beyond European financial institutions to include Asian banks and international NGOs such as the World Bank and the International Monetary Fund. This will drain another key source of financial support to the Iranian government. For example, in May 2005, the World Bank approved \$344 million loan to Iran to support Caspian Provinces in managing scarce water resources, \$200 million for rebuilding following the Bam earthquake in October 2004, and \$359 million in loans to the Government of Iran in order to improve housing, sanitation, and access to clean water in Ahwaz and Shiraz.<sup>222</sup> These loans, however, are focused toward humanitarian projects, but that does not mean that they can be delayed to force Iran back to the bargaining table.

It is important, however, to keep it in mind that the global economy offers many options to Iran, and enforcing such sanctions is not perfect. Iran is not confined to European private and central banks or international organizations to finance its domestic projects. If Iran does build enough incentives for direct foreign investment, no amount of sanctions can stop the flow of money into the country, particularly in its energy sector.

All of these scenarios are hypothetical at this point. It is unclear if the UNSC actually agrees to impose financial restrictions on Iran. In addition, no one can fully predict the response of the Iranian government, the ruling elite in Iran, or the Iranian general population. It is all too clear that freezing the money and restricting the travel of key regime figures is far less disagreeable than preventing investment in Iran's energy sector and causing further tightness in the global energy market. It is also clear that the regime might be more impacted with these restrictions than any broad economic sanctions that have direct implications on the Iranian population.

## **Military Strikes**

Official US policy is to leave all options on the table, and emphasize diplomatic activity through the EU3 and the UN. Vice President Richard Cheney reiterated the United States policy on March 7, 2006:<sup>223</sup>

The Iranian regime needs to know that if it stays on its present course, the international community is prepared to impose meaningful consequences. For our part, the United States is keeping all options on the table in addressing the irresponsible conduct of the regime...And we join other nations in sending that regime a clear message: We will not allow Iran to have nuclear weapons.

Other United States officials also reiterated that preventive military options are still on the table. The national security advisor, Stephen J. Hadley, reiterated that Iran poses a grave threat to the United States national security. During a presentation of the United States national security strategy in March 2006, he said, "We face no greater challenge from a single country than from Iran." Mr. Hadley added "The doctrine of preemption remains sound...We do not rule out the use of force before an attack occurs."<sup>224</sup>

The US estimates of timelines for Iran's nuclear and missile efforts also leave at least several years in which to build an international consensus behind sanctions and diplomatic pressure, and a consensus behind military options if diplomacy fails.

The US would also have the potential advantage of finding any Iranian "smoking gun," improving its targeting and strike options, and being able to strike targets in which Iran had

invested much larger assets. The fact Iran can exploit time as a weapon in which to proliferate, does not mean that the US cannot exploit time as a weapon with which to strike Iran.

### ***Iranian Defense Against US Strikes***

Iran would find it difficult to defend against US forces using cruise missiles, stealth aircraft, stand-off precision weapons, and equipped with a mix of vastly superior air combat assets and the IS&R assets necessary to strike and restrike Iranian targets in near real time. For example, each US B-2A Spirit stealth bomber could carry eight 4,500lb enhanced BLU-28 satellite-guided bunker-busting bombs – potentially enough to take out one hardened Iranian site per sortie. Such bombers could operate from flying from Diego Garcia in the Indian Ocean, RAF Fairford in Gloucestershire and Whiteman USAF base in Missouri.<sup>225</sup>

The US also has a wide range of other hard target killers, many of which are in development or classified. Systems that are known to be deployed include the BLU-109 Have Void “bunker busters,” a “dumb bomb” with a maximum penetration capability of 4 to 6 feet of reinforced concrete. An aircraft must overfly the target and launch the weapon with great precision to achieve serious penetration capability.<sup>226</sup> It can be fitted with precision guidance and converted to a guided glide bomb. The Joint Direct Attack Munition (JDAM) GBU-31 version a nominal range of 15 kilometers with a Circular Error Probable (CEP) of 13 meters in the GPS-aided INS modes of operation and 30 meters in the INS-only modes of operation.<sup>227</sup>

More advanced systems include the BLU-116 Advanced Unitary Penetrator [AUP], GBU-24 C/B (USAF), or GBU-24 D/B (Navy) which has about three times the penetration capability of the BLU-109.<sup>228</sup> It is not clear whether the US has deployed the AGM-130C with an advanced earth penetrating/hard target kill system. The AGM-130 Surface Attack Guided Munition was developed to be integrated into the F-15E, so it could two such missiles, one on each inboard store station. It is retargetable, precision guided standoff weapon using inertial navigation aided by Global Positioning System (GPS) satellites and has a 15 - 40 NM range.<sup>229</sup>

It is not clear such weapons could destroy all of Iran’s most hardened underground sites, although it seems likely that the BLU-28 could do serious damage at a minimum. Much depends on the accuracy of reports that Iran has undertaken a massive tunneling project with some 10,000 square meters of underground halls and tunnels branching off for hundreds of meters from each hall. Iran is reported to be drawing on North Korean expertise, and to have created a separate corporation (Shahid Rajaei Company) for such tunneling and hardening efforts under the IRGC, with extensive activity already underway in Natanz and Isfahan. The facilities are said to make extensive use of blast-proof doors, extensive divider walls, hardened ceilings, 20 cm-thick concrete walls, and to use double concrete ceilings with earth fill between layers to defeat earth penetrates.<sup>230</sup> Such passive defenses could have a major impact, but reports of such activity are often premature, exaggerated, or report far higher construction standards than are actually executed.

At the same time, the B-2A could be used to deliver large numbers of precision-guided 500-lb bombs against dispersed surface targets or a mix of light and heavy precision guided weapons. Submarines and surface ships could deliver cruise missiles for such strikes, and conventional strike aircraft and bombers could deliver stand-off weapons against most suspect Iranian facilities without suffering a high risk of serious attrition. The challenge would be to properly determine what targets and aim points were actually valuable, not to inflict high levels of damage.

Iran has "quantity," but its air defenses have little "quality." It has assigned some 12,000-15,000 men in its air force to land-based air defense functions, including at least 8,000 regulars and 4,000 IRGC personnel. It is not possible to distinguish clearly between the major air defense weapons holdings of the regular air force and IRGC, but the air force appeared to operate most major surface-to-air missile systems.

Total holdings seem to include 30 Improved Hawk fire units (12 battalions/150+ launchers), 45-55 SA-2 and HQ-2J/23 (CSA-1) launchers (Chinese-made equivalents of the SA-2), and possibly 25 SA-6 launchers. The air force also had three Soviet-made long-range SA-5 units with a total of 10-15 launchers—enough for six sites. Iran has developed and deployed its own domestically manufactured SAM dubbed the Shahab Thaqeb. The SAM requires a four-wheeled trailer for deployment and closely resembles the R440 SAM.<sup>231</sup>

Iran's holdings of lighter air defense weapons include five Rapier squadrons with 30 Rapier fire units, 5-10 Chinese FM-80 launchers, 10-15 Tigercat fire units, and a few RBS-70s. Iran also holds large numbers of man-portable SA-7s, HN-5s, and SA-14s, plus about 2,000 anti-aircraft guns -- including some Vulcans and 50-60 radar-guided and self propelled ZSU-23-4 weapons.<sup>232</sup> It is not clear which of these lighter air defense weapons were operated by the army, the IRGC, or the air force. The IRGC clearly had larger numbers of manportable surface-to-air launchers, including some Stingers that it had obtained from Afghanistan. It almost certainly had a number of other light air defense guns as well.

There are no authoritative data on how Iran now deploys its land-based air defenses, but Iran seems to have deployed its new SA-5s to cover its major ports, oil facilities, and Tehran. It seems to have concentrated its Improved Hawks and Soviet and Chinese-made SA-2s around Tehran, Isfahan, Shiraz, Bandar Abbas, Kharg Island, Bushehr, Bandar Khomeini, Ahwaz, Dezful, Kermanshah, Hamadan, and Tabriz.

Although Iran has made some progress in improving and updating its weapons, sensors, and electronic warfare capability, and has learned much from Iraq's efforts to defeat US enforcement of the "no-fly zones" from 1992-2003, its current defenses are outdated and poorly integrated. All of its major systems are based on technology that is now more than 35 years old, and all are vulnerable to US use of active and passive countermeasures.

Iran's air defense forces are too widely spaced to provide more than limited air defense for key bases and facilities, and many lack the missile launcher strength to be fully effective. This is particularly true of Iran's SA-5 sites, which provide long-range, medium-to-high altitude coverage of key coastal installations. Too few launchers are scattered over too wide an area to prevent relatively rapid suppression. Iran also lacks the low altitude radar coverage, overall radar net, command and control assets, sensors, resistance to sophisticated jamming and electronic countermeasures, and systems integration capability necessary to create an effective air defense net.

Its land-based air defenses must operate largely in the point defense mode, and Iran lacks the battle management systems and data links are not fast and effective enough to allow it to take maximum advantage of the overlapping coverage of some of its missile systems—a problem further complicated by the problems in trying to net different systems supplied by Britain, China, Russia, and the US. Iran's missiles and sensors are most effective at high-to-medium altitudes against aircraft with limited penetrating and jamming capability.

This situation may, however, change in the future, and improvements in Iran's land-based air defenses could be a factor in the timing of any US or Israeli strikes. Iran purchased 20 Russian 9K331 Tor-M-1 (SA-15 Gauntlet) self-propelled surface-to-air missiles in December 2005.<sup>233</sup> Global Security indicates that this is a modern short-range missile that has the capability to simultaneously attack two targets using a relatively high powered and jam-resistant radar, and has "electronic beam control and vertically launched missiles. able to maintain high speed and maneuverability inside an entire engagement envelope; the high degree of automation of combat operation provided by the electronic equipment suite." It is said to be capable of detecting targets at a distance of 25 kilometers and attack them at a maximum distance of 12 kilometers. For what it is worth, Russian sources claim that Tor is much more efficient than similar systems like France's Crotale and Britain's Rapier.

The basic combat formation is a firing battery consisting of four TLARs and the Rangir battery command post. The TLAR carries eight ready missiles stored in two containers holding four missiles each. It is claimed to have an effective range of 1,500 to 12,000 meters against targets flying at altitudes between 10 and 6,000 meters. The maximum maneuvering load factor limit on the weapon is said to be 30 "Gs".<sup>234</sup> It should be noted that Russian manufacturer claims are no less exaggerated than those of European and US manufacturers.

Delivery dates ranging from 2006-2009 have been reported, but the Tor is too range limited to have a major impact on US stealth attack capability, although its real-world performance against cruise missiles still has to be determined. It might have more point defense lethality against regular Israeli and US strike fighters like the F-15 and F-16 using precision guided-bombs, but would only be lethal against such aircraft with stand-off air-to-surface missiles if it could be deployed in the flight path in ways that were not detected before the attack profile was determined.

Iran also announced in February 2006 (along with several other weapons and military exercise announcements that seemed timed to try to deter US or Israeli military action) that it was mass producing a new man-portable, low altitude, short-range air defense missile called the Mithaq-2.<sup>235</sup> It was said to be electronic warfare and IR-flare resistant, and seemed to be based on the Chinese QW-1 Vanguard. If it is the QW-1, it is an IR-homing missile introduced in the mid-1990s. It may, however, be a variant of the QW-2 with an improved IR seeker. China claims it has an effective range of 500-5,000 meters at target altitudes of 30-4,000 meters. The maximum maneuvering load factor limit on the weapon is said to be 30 "Gs." In spite of Iranian claims, it does not seem superior to the Russian SA-14s already in Iranian inventory, and is too short-ranged to have more than a minimal deterrent effect.<sup>236</sup>

Some reports indicate that Iran is seeking more modern Soviet SA-300 missiles, and to use Russian systems to modernize its entire air defense system. If Iran could acquire, deploy, and bring such systems to a high degree of readiness, they would substantially improve Iranian capabilities. A report in Jane's claims that Iran is building surface-to-air missile defense zones around its nuclear facilities that will use a single battery of S-300PMU (SA-10) missiles to defend Bushehr reactor and will deploy the S-300V (SA-12b) to provide wide area defense coverage of other targets which it will mix with the TOR-M1 to provide low altitude point defense.

This is a logical Iranian approach to improving its defenses, and Iran has sought to purchase the S-300 in the past. It seems to have advanced electronic warfare capabilities, sensors, computer systems and software. The SA-10 is reported to be able to intercept aircraft at a maximum slant



range of 32,000 to 43,200 meters, and a maximum effective defense perimeter of 150 km (90 miles). The minimum effective interception altitude is claimed to be 10 meters. One variant of the missile is reported to have some BMD capability and be able to engage ballistic missile targets at ranges of up to 40 km (25 miles). Each battery is said to have a load of 32 missile rounds on its launchers, a battery deployment time as low as five minutes, and the ability to fire three missiles per second. A standard battery consists of an 83M6E2 command post (CP), up to six 90Zh6E2 air defense missile complexes, 48N6E2 air defense missiles, and technical support facilities.<sup>237</sup>

If Iran were to get the SV-300 (SA-12a and SA-12b), it would get a system with far more advanced sensors, electronic warfare capabilities, and significant point defense capabilities against ballistic missiles. A Russian S-300V brigade has the following components: 9M82 SA-12b Giant missiles (2 per launcher) and TELAR, 9M83 SA-12a Gladiator missiles (4 per launcher), and TELAR, Giant and Gladiator launcher/loader vehicles, 9S15 Bill Board Surveillance Radar system, 9S19 High Screen Sector Radar system, 9S32 Grill Pan Guidance Radar system, and 9S457 Command Station. The SA-12a is a dual-role anti-missile and anti-aircraft missile with a maximum range between 75 and 90 km. The SA-12b GIANT missile is configured as an ATBM role with a longer maximum range of between 100 and 200 kilometers. Each unit can detect up to 200 targets, track as many as 70 targets and designate 24 of the targets to the brigade's four GRILL PAN radar systems for engagement.<sup>238</sup>

It seems doubtful, however, that Iran has operational S-300PMU systems, has taken delivery on such units, or has even been able to buy them from Russia. It is also unclear that Russia has sold Iran SV-300 systems or plans to. The Russian minister of defense flatly denied any such sales had taken place in February 2006.<sup>239</sup> Even if such systems are delivered, their real-world performance will be uncertain. In the past, Russia has also been careful to control some critical aspects of its weapons exports, and sell degraded export versions.

Iran's air forces are only marginally better able to survive in air-to-air combat than Iraq's were before 2003. Iran's command and control system has serious limitations in terms of secure communications, vulnerability to advanced electronic warfare, netting, and digital data transfer. According to the IISS, Iran does still have 5 operational P-3MP Orion and may have made its captured Iraqi IL-76 Candid AEW aircraft operational. These assets would give it airborne warning and command and control capability, but these are obsolescent to obsolete systems and are likely to be highly vulnerable to electronic warfare and countermeasures, and long-range attack, even with Iranian modifications and updates. There are some reports Iran may be seeking make a version of the Russian AN-140 AEW aircraft but these could not be deployed much before 2015.<sup>240</sup>

Iran's air defense aircraft consist of a maximum operational strength of two squadrons of 25 export versions of the MiG-29A and two squadrons of 25-30 F-14As. The export version of the MiG-29A has significant avionics limitations and vulnerability to countermeasures, and it is not clear Iran has any operation Phoenix air-to-air missiles for its F-14As or has successfully modified its IHawk missiles for air-to-air combat. The AWG-9 radar on the F-14 has significant long distance sensor capability in a permissive environment, but is a US-made system in a nearly 30-year old configuration that is now vulnerable to countermeasures.

Iran might risk using its fighters and AEW aircraft against an Israeli strike. It seems doubtful that Israel could support a long-range attack unit with the air defense and electronic assets necessary to provide anything like the air defense and air defense suppression assets that would support a

US strike. A US strike could almost certainly destroy any Iranian effort to use fighters, however, and destroy enough Iranian surface-to-air missile defenses to create a secure corridor for penetrating into Iran and against key Iranian installations. The US could then maintain such a corridor indefinitely with restrikes.

### ***Iranian Retaliation Against US Strikes***

This does not mean it would be easy or desirable for the US to exercise its military options. US forces are preoccupied in Iraq, and the lack of security in Iraq makes a full military attack against Iran all too unlikely. US military options are not risk-free, and the consequences of US strikes are enormous. Tehran has several retaliatory options:

- Retaliate against US forces in Iraq and Afghanistan overtly using Shahab-3 missiles armed with CBR warheads
- Use proxy groups including al-Zarqawi and Sadr in Iraq to intensify the insurgency and escalate the attacks against US forces and Iraqi Security Forces
- Turn the Shi'ite majority in Iraq against the US presence and demand US forces to leave
- Attack the US homeland with suicide bombs by proxy groups or deliver CBR weapons to al-Qa'ida to use against the US
- Use its asymmetric capabilities to attacks US interests in the region including soft targets: e.g. embassies, commercial centers, and American citizens
- Attack US naval forces stationed in the Gulf with anti-ship missiles, asymmetric warfare, and mines
- Attack Israel with missile attacks possibly with CBR warheads
- Retaliate against energy targets in the Gulf and temporarily shut off the flow of oil from the Strait of Hormuz
- Stop all of its oil and gas shipments to increase the price of oil, inflict damage on the global and US economies

Many observers argue that a military strike against Iran can add to the chaos in Iraq and may further complicate the US position in Iraq. While the consequences of US military attacks against Iran remain unclear; the Shi'ite majority in Iraq can: 1) as the US to leave Iraq, 2) Shi'ite militia groups directly attack US forces, and/or 3) turn the new Iraqi security and military forces against US forces in Iraq.<sup>241</sup>

As has been discussed earlier, Iran has extensive forces suited to asymmetric warfare. These not only include the Revolutionary Guards and elements of the al-Quds force under the Directorate of the Islamic Revolutionary Guards Corps, but elements of the foreign intelligence directorate in the Ministry of Intelligence and Security (Vezerat-e-Ettela'at va Amniat-e Keshvar or VEVAK).<sup>242</sup>

The Iranian surface navy is highly vulnerable, but Iran could position land-based anti-ship missile where it could strike at tanker traffic, and mobile firing elements using systems like the HY-2/C-201 Silkworm or Seerseeker (Raad) have ranges of 90 to 100-kilometers and have proved difficult to detect and kill in the past.<sup>243</sup> Iran is reported to have the capability to make or assemble such missiles, modify and upgrade them, have roughly 100 systems in stock, and have 8-10 mobile missile launchers. These are reported to be deployed near the Strait of Hormuz, but may actually be in a number of different locations.<sup>244</sup>

Iran also has three relatively effective Kilo-class submarines, which can use long-range wire guided torpedoes or release mines. (Reports Iran has advanced “bottom” mines with sensors that release and activate them as they sense ships passing overhead are uncertain.)

The naval branch of the IRGC is reported to have up to 20,000 men. They operate 10 Hudong missile patrol boats with C-801K (42-120 kilometers) and C-802 (42-120 kilometers) sea-skimming anti-ship missiles.<sup>245</sup> The Iranian air force has airborne variants of these systems.

They have additional C-14 high speed catamarans which each have C-701 anti-ship missiles, and additional North Korean missile boats. They operate some 50 additional patrol boats, including 40 Boghammar Marine boats. Many are so small they are difficult to detect with ship-borne radars. These can be armed with recoilless rifles, RPGs and small arms to attack or harass ships in are near the Gulf and raid or attack offshore facilities. They can conduct suicide attacks, or release floating mines covertly in shipping lanes or near key facilities. Iran can use any commercial ship to release free-floating mines for the same purpose.<sup>246</sup>

Iran made claims in the spring of 2006 that it was testing more advanced weapons for such forces. These included a sonar-evading underwater missile (torpedo?) that IRGC Rear Admiral Ali Fadavi claimed no enemy warship could detect, and “no warship could escape because of its high velocity.” Iran also claimed to be testing a new missile called the Kowsar with a very large warhead and extremely high speed to attack “big ships and submarines” that it claimed could evade radar and anti-missile missiles. While such tests may have been real, Iran has made so many grossly exaggerated claims about its weapons developments in the past, that it seems they were designed more to try to deter US military action and/or reassure the Iranian public than serious real-world capabilities.<sup>247</sup>

In any case, Iran could not close the Strait of Hormuz, or halt tanker traffic, and its submarines and much of its IRGC forces would probably be destroyed in a matter of days if they become operational. It could, however, conduct a series of raids to threaten and disrupt Gulf traffic, and/or strike at offshore and shore facilities in the Southern Gulf, or at Iraqi oil facilities in the Gulf. Even sporadic random strikes would create a high risk premium and potential panic in oil markets. Iran could potentially destabilize part of Afghanistan, and use Hezbollah and Syria to threaten Israel.

Iran can also use its IRGC asymmetric warfare assets to attack US interests in the region. Iranian officials do not hide the fact that they would use asymmetric attacks against US interests. For example, a Brigadier General in the IRGC and the commander of the “Lovers of Martyrdom Garrison,” Mohammad-Reza Jaafari, threatened US interest with suicide operations if the US were to attack Iran:<sup>248</sup>

Now that America is after gaining allies against the righteous Islamic Republic and wants to attack our sanctities, members of the martyrdom-seeking garrisons across the world have been put on alert so that if the Islamic Republic of Iran receives the smallest threat, the American and Israeli strategic interests will be burnt down everywhere.

The only tool against the enemy that we have with which we can become victorious are martyrdom-seeking operations and, God willing, our possession of faithful, brave, trained and zealous persons will give us the upper hand in the battlefield...

Upon receiving their orders, our martyrdom-seeking forces will be uncontrollable and a guerrilla war may go on in various places for years to come...

America and any other power cannot win in the unbalanced war against us.

Iran could seek to create an alliance with extremist movements like al-Qa'ida in spite of their hostility to Shi'ites. It can seek to exploit Arab and Muslim anger against US ties to Israel and the invasion of Iraq on a global level, and European and other concerns that the US might be repeating its miscalculation of the threat posed by Iraq and striking without adequate cause. Unless Iran is far more egregious in its non-compliance, or the US can find a definitive smoking gun to prove Iran is proliferating, Iran would be certain to have some success in such efforts.

Iran's energy resources are another potential weapon. Shutting off exports would deeply hurt Iran but would have an impact on global markets. As Iraq found, energy deals can also sharply weaken support for even diplomatic options, and Russia and China might well oppose any kind of US military strike, regardless of the level of justification the US could advance at the time.

### ***The Strategic Implications of a Military Strike Against Iran***

It may be years, or as much as a decade, before all of the implications surrounding Iran's possible efforts to acquire nuclear weapons become clear. As the previous chapters have shown, the strategic implications of whether Iran has any nuclear device are only part of the story. There are many different ways in which Iran can proliferate, deploy nuclear-armed or other CBRN weapons, and use them to deter, intimidate, and strike against other nations. All have only one thing in common: *they are all provocative and dangerous to both any nation Iran may chose to try to influence and target, and to Iran.*

Iran's options for warfighting, and the possible response, have already been described in detail. One final point does, however, need to be raised. Even Iranian ambiguity will probably lead Israel and the US -- and possibly India, Pakistan, and Russia -- to develop nuclear options to deter or retaliate against Iran. Restraint does not have to stop at the first convincing Iranian threat to use nuclear or highly lethal biological weapons, but it could do so. Any actual Iranian use of such weapons is likely to provoke a nuclear response and may well provoke one targeted on Iranian cities and its population. Iran's effort to limit or control the game will probably end at the first ground zero.

Iranian ambiguity also may trigger Saudi and Egyptian efforts to become nuclear powers. They might show restraint if the US could provide convincing ballistic and cruise missile defenses, and the same form of extended deterrence it once provided to Germany during the Cold War. But, these options are speculative and do not yet exist. Saudi Arabia has already said that it has examined nuclear options and rejected them, but this is no certainty and inevitably depends on Iranian action.

The end result is the prospect of a far more threatening mix of CBRN capabilities in the Gulf region, and the areas that most models project as the main source of continued world oil and gas exports beyond 2015. It is also the threat of more polarization between Sunni and Shi'ite, and broader regional tensions and actions that spillover out of the confrontation over Iran's nuclear activities. None of these prospects are pleasant.

### ***The Future of Iraq***

Iran already plays a major role in the political stability (or instability) of Iraq, and may take a more aggressive role in trying to shape Iraq's political future and security position in the Gulf. Some believe that the Iranians have abandoned their efforts to export their "Shi'ite revolution" to the Gulf. This view has changed since the invasion of Iraq. Officials across the Arab world, especially in Saudi Arabia and Jordan, have expressed reservation over the right of Iraqi Sunnis,

Kurdish and Shi'ite dominance over the Iraqi government, and a new "strategic" Shi'ite alliance between Iran and Iraq.

Jordan's King Abdullah has claimed that that more than 1 million Iranians have moved into Iraq to influence the Iraqi election. The Iranians, King Abdullah argued, have been trying to build pro-Iranian attitudes in Iraq by providing salaries to the unemployed. The King has also said that Iran's Revolutionary Guards are helping the militant groups fighting the US in Iraq, and warned in an interview with the *Washington Post* of a "Shi'ite Crescent" forming between Iran, Iraq, Syria, and Lebanon. He was quoted as saying:<sup>249</sup>

It is in Iran's vested interest to have an Islamic republic of Iraq.

If Iraq goes Islamic republic, then, yes, we've opened ourselves to a whole set of new problems that will not be limited to the borders of Iraq. I'm looking at the glass half-full, and let's hope that's not the case. But strategic planners around the world have got to be aware that is a possibility.

Even Saudi Arabia is not immune from this. It would be a major problem. And then that would propel the possibility of a Shi'ite-Sunni conflict even more, as you're taking it out of the borders of Iraq.

The same sentiment has been echoed by the former interim Iraqi President, Ghazi Al-Yawar, a Sunni. "Unfortunately, time is proving, and the situation is proving, beyond any doubt that Iran has very obvious interference in our business -- a lot of money, a lot of intelligence activities and almost interfering daily in business and many [provincial] governates, especially in the southeast side of Iraq." Mr. Al-Yawar, however, asserted that Iraq should not go in the direction of Iran in creating a religious oriented government. He was quoted in a *Washington Post* interview as saying "We cannot have a sectarian or religious government... We really will not accept a religious state in Iraq. We haven't seen a model that succeeded."<sup>250</sup>

These comments were rejected by both Iran and Iraqi Shi'ites. Iran called King Abdullah's comment "an insult" to Iraq. Iranian Foreign Ministry Spokesman, Hamid Reza Asefi, also called on Ghazi Al-Yawar to retract his statement and accusing King Abdullah II and Al-Yawar of wanting to influence the election against Iraqi Shi'ites. Asefi said "Unfortunately, some political currents in Iraq seek to tarnish the trend of election there and cause concern in the public opinion... We expect that Mr. al-Yawar takes the existing sensitive situation into consideration and avoids repeating such comments."<sup>251</sup>

What is clear is that Iran has close relations with many Iraqi Shi'ites, particularly Shi'ite political parties and militias. Some Iraqi groups have warned against US military strikes against their neighbors. For example, Moqtada Sadr pledged that he would come to the aid of Iran in the case of a military strike by the US against Tehran. Sadr pledged that his militia, the Mahdi army, would come to the aid of Iran. According to Sadr, Iran asked him about what his position would be if Iraq was attacked by the US and he pledged that the Mahdi army would help any Arab or neighboring country if it was attacked.<sup>252</sup>

*The London Times* in September 2005 identified at least a dozen active Islamic groups with ties to Tehran. Eight were singled out as having considerable cross-border influence.<sup>253</sup>

- **Badr Brigades:** A Shi'ite militia force of 12,000 trained by Iran's Revolutionary Guards and blamed for a number of killings of Sunni Muslims. They are thought to control several cities in southern Iraq.
- **Islamic Dawaa Party:** A Shi'ite party that has strong links to Iran. Its leader, Ibrahim al-Jaafari, the present Prime Minister, has vowed to improve ties between the two neighbors.

- **Mahdi Army:** Received arms and volunteers from Iran during its battle against US and British troops last year. The group's commander in Basra, Ahmed al-Fartusi, was arrested by British forces in mid-September 2005.
- **Mujahideen for Islamic Revolution in Iraq:** A Tehran-backed militia blamed for the murder of six British Royal Military Police soldiers in Majar el-Kabir in 2003.
- **Thar Allah (Vengeance of God):** An Iranian-backed terror group blamed for killing former members of the ruling Ba'ath party and enforcing strict Islamic law.
- **Jamaat al-Fudalah (Group of the Virtuous):** A Paramilitary group that imposes Islamic rules on Shi areas and has attacked shops selling alcohol and music.
- **Al-Fadilah (Morality):** A Secret political movement financed by Iran. It is thought to have many members among provincial officials.
- **Al-Quawaid al-Islamiya (Islamic Bases):** An Iranian-backed Islamic movement that uses force to impose Islamic law.

A number of experts believe that Tehran-backed militias have infiltrated Iraqi security forces. In September 2005, Iraq's National Security Adviser, Mouwafak al-Rubaie, admitted that insurgents had penetrated Iraqi police forces in many parts of the country, but refused to speculate about the extent of the infiltration.<sup>254</sup>

In addition, both the US and British ministers of defense have complained that Iran is actively supporting various militias in Iraq, has supplied advanced triggering and motion detector systems for IEDS, and is using elements of the al-Quds force to train death squads and militias.<sup>255</sup> Work by Nawaf Obaid and the Saudi National Security Assessment Project (SNSAP), indicates that:<sup>256</sup>

Iran is insinuating itself into Iraq. The first is through the activities of the al-Quds Forces, the special command division of the Iranian Revolutionary Guard (IRGC). The second approach is by funding and arming Shi'ite militias, the most prominent of which is the SCIRI's 25,000-strong armed wing, the Badr Organization of Reconstruction and Development. Senior members of the Badr Organization and the al-Quds Forces have a closely coordinated relationship. Intelligence reports have indicated that Iranian officers are directing operations under cover in units of the Badr Organization. The Mahdi Army also receives important Iranian assistance, but on a much smaller scale.

The IRGC Commander is General Yahya Rahim-Safavi and the Deputy Commander is General Mohammad Bager Zulgadr. The al-Quds Forces Commander is General Qassem Soleimani. Generals Zulgadr and Soleimani are two most senior officers responsible for Iran's large covert program in Iraq and have a direct link to the Office of the Leader. Additionally, intelligence estimates have identified four other IRGC generals and nine IRGC colonels that are directly responsible for covert operations in Iraq.

The al-Quds Forces mainly functions as a large intelligence operation skilled in the art of unconventional warfare. Current intelligence estimates puts the strength of the force at 5,000. Most of these are highly trained officers. Within the al-Quds Forces, there is a small unit usually referred to as the "Special Quds Force" which consists of the finest case officers and operatives.

The senior officers attached to this unit conduct foreign covert unconventional operations using various foreign national movements as proxies. The forces operate mainly outside Iranian territory, but maintain numerous training bases inside Iran as well. Al-Quds international operations are divided into geographic areas of influence and various corps. The most important and largest cover Iraq, Saudi Arabia (and the Arabian Peninsula), and Syria / Lebanon. The smaller corps cover Afghanistan, Pakistan/India, Turkey, the Muslim Republics of the former Soviet Union, Europe / North America, and North Africa (Egypt, Tunisia, Algeria, Sudan, and Morocco).

The goal of Iran is to infiltrate all Iraq-based militias by providing training and support to their members. For example, al-Sadr's estimated 10,000-strong Mahdi Army, which gets logistical and financial support from al-Quds, also receives training in IRGC camps in Iran. Moreover, nearly all of the troops in the Badr

Organization were trained in these camps as well. In addition, most senior officers acquired their skills in specialized camps under the control of the al-Quds Forces. Intelligence estimates that al-Quds currently operates six major training facilities in Iran, with the main facility located adjacent to Imam Ali University in Northern Tehran. The other most important training camps are located in the Qom, Tabriz, and Mashhad governorates. There are also two similar facilities operating on the Syrian-Lebanese border.

According to a senior general in the Iraqi Defense Ministry and a critic of Iran, the Iranians have set up the most sophisticated intelligence-gathering network in the country, to the extent that they have infiltrated "every major Iraqi ministry and security service." There is also an intelligence directorate that has been set up within the Revolutionary Guard that is under the command of the al-Quds Forces devoted exclusively to monitoring the movements of US and Allied forces in Iraq.

Many members of the newly created police and Iraqi forces are controlled by Shi'ite officers who, in some form or another, previously belonged to SCIRI or other groups affiliated with Iran. Recent intelligence indicates that IRGC officers are currently operating in Iraq in certain Shi'ite militias and actual army and police units. The degree of penetration of these organizations is difficult to assess, and it is virtually impossible to distinguish between Iraqi Shi'ite militias and police units, both of which are profoundly influenced by Iran, and in some cases are under Iranian control.

Iranian manipulation has filtered down to street level as well. Ordinary police and military officers now have a stronger allegiance to the Badr Organization or the Mahdi Army than to their own units. And of course, these organizations are deeply connected to Iran. According to the head of intelligence of an allied country that borders Iraq, "the Iranians have not just pulled off an infiltration, in certain regions in Baghdad and Basra, it's been a complete takeover."

Iran stands accused of using its security and intelligence forces to destabilize the political situation in Iraq. Iran's political objectives in Iraq remain obscure and partly contradictory. Tehran has stated repeatedly that it supports stability in Iraq. At the same time, several organizations with ties to the Iranian security apparatus are suspected of actively driving a wedge between rivaling factions in Iraq. The IRGC and its affiliates, out of any Iranian government organization, appear to be most strongly involved in assisting terrorist groups in neighboring Iraq.

In December of 2004, a group named the Committee for the Commemoration of Martyrs of the Global Islamic Campaign, had assembled more than 25,000 "martyrdom-seeking volunteers" to fuel the insurgency of Iraqi groups against American forces. The committee maintains close ties to the IRGC from which it probably receives considerable material support. According to Iranian dissident groups, the IRGC is also directly involved in instigating the Iraqi insurgency through its Qods commandos, particularly in southern Iraq. Their number and extent of involvement with Iraqi factions remains unclear, however. Since the beginning of the American military campaign in Iraq, more than 2,000 people - believed to be sponsored directly by Iran - have entered the country to promote militant Islam.<sup>257</sup>

Reports suggest that Iranian sources have tried to establish contact with Moqtada Al-Sadr's organization in Iraq. Al-Sadr in the past spoke out against Iranian influence in Iraq. A relatively close connection between his organization and the Committee for the Commemoration of Martyrs of the Global Islamic Campaign with Iran suggests that destabilizing the political situation in Iraq is an important objective for the Iranian leadership. Apparently, Iranian forces try to gain leverage even over hostile forces in order to further Iraqi factionist politics.

Iran has a strategic interest in a stable Iraqi government. However, at this time, it appears as if Tehran is mobilizing great resources to tilt the political climate in its favor, accepting a certain degree of political instability.

## ***Other Challenges***

This focus on Iran's nuclear programs and relations with Iraq does not mean that its hostility to Israel, Sunni versus Shi'ite religious tensions, or its other challenges could not suddenly become the most important issues Iran faces -- or simultaneously complicate its other challenges. Iran is also becoming progressively more dependent on high oil prices and exports revenues as years go by with governments that all have at least one thing in common -- some of the worse economic policies and management in the world compounded to serious social and cultural repression.

It is important to note, however, that many of Iran's strategic challenges owe far more to history, ideology, and political extremism than grand strategic necessity. Iran has every reason to seek better relations with its neighbors and the US, to reach out to the moderate Gulf and other Islamic regimes that are the natural enemies of Neo-Salafi Sunni extremism, and to confine its opposition to Israel to the political support of the Palestinians. Iran has far more to gain from focusing on internal development and regional cooperation than from political or military adventures and would greatly reduce its strategic risks.



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<sup>1</sup> CIA, The World Factbook, 2006, "Iran," <http://www.odci.gov/cia/publications/factbook/geos/ir.html>.

<sup>2</sup> BP, *Statistical Review of World Energy*, June 2005.

<sup>3</sup> Energy Information Agency (EIA), "OPEC Revenues Fact Sheet," Department of Energy, Washington, January 2006, [http://www.eia.doe.gov/emeu/cabs/OPEC\\_Revenues/OPEC.html](http://www.eia.doe.gov/emeu/cabs/OPEC_Revenues/OPEC.html).

<sup>4</sup> CIA, The World Factbook, 2006, "Iran," <http://www.odci.gov/cia/publications/factbook/geos/ir.html>.

<sup>5</sup> IISS, Military Balance, 2005-2006, 2006, CIA, The World Factbook, 2006, "Iran," <http://www.odci.gov/cia/publications/factbook/geos/ir.html>.

<sup>6</sup> IISS, The Military Balance, various editions; Jane's Sentinel: The Gulf States, "Iran", various editions, p. 24.

<sup>7</sup> There are reports that the lighter and smaller formations in the regular army include an Airmobile Forces group created since the Iran-Iraq War, and which includes the 29th Special Forces Division, which was formed in 1993-1994, and the 55th paratroop division. There are also reports that the regular army and IRGC commando forces are loosely integrated into a corps of up to 30,000 men with integrated helicopter lift and air assault capabilities. The airborne and special forces are trained at a facility in Shiraz. These reports are not correct. Note that detailed unit identifications for Iranian forces differ sharply from source to source. It is unclear that such identifications are accurate, and now dated wartime titles and numbers are often published, sometimes confusing brigade numbers with division numbers.

<sup>8</sup> No reliable data exist on the size and number of Iran's smaller independent formations.

<sup>9</sup> The estimates of Iran's AFV and APC strength are based on interviews with Israeli, British and US civilian experts, and the IISS, Military Balance, "Iran"; Jane's Sentinel: The Gulf States, "Iran."

<sup>10</sup> Foss, Christopher, "Iran Reveals Up-Armored Boraq Carrier," Jane's Defence Weekly, April 9, 2003, <http://jdw.janes.com>, Accessed January 8, 2004. Labeled 42.

<sup>11</sup> Pronina, Lyubov, "U.S. Sanctions Russian Firm for Alleged Iran Sales," Defense News, September 22, 2003, p. 12. Labeled 43.

<sup>12</sup> Jane's Missiles and Rockets, "Iran's Raad Cruise Missile Enters Production", by Dough Richardson.

<sup>13</sup> Jane's Defence Weekly, January 15, 2003, <http://jdw.janes.com>, Accessed January 8, 2004. Labeled 45.

<sup>14</sup> International Defense Review, 7/1996, pp. 23-26; Anthony H. Cordesman, Iran's Weapons of Mass Destruction, CSIS, April, 1997.

<sup>15</sup> Amir Taheir, "The Mullah's Playground," Wall Street Journal, December 7, 2004, p. A10.

<sup>16</sup> "Iran Enhances Existing Weaponry by Optimizing Shahab-3 Ballistic Missile," Jane's Missiles and Rockets, January 20, 2004.

<sup>17</sup> Reports that the IRGC is operating F-7 fighters do not seem to be correct.

<sup>18</sup> Reuters, June 12, 1996, 17:33.

<sup>19</sup> See Time, March 21, 1994, pp. 50-54, November 11, 1996, pp. 78-82. Also see The Washington Post, November 21, 1993, p. A-1, August 22, 1994, p. A-17; October 28, 1994, p. A-17, November 27, 1994, p. A-30, April 11, 1997, p. A-1, April 14, 1997, p. A-1; The Los Angeles Times, November 3, 1994, pp. A-1, A-12; Deutsche Presse-Agentur, April 17, 1997, 11:02; Reuters, April 16, 1997, BC cycle, April 17, 1997, BC cycle; The European, April 17, 1997, p. 13; The Guardian, October 30, 1993, p. 13, August 24, 1996, p. 16 April 16, 1997, p. 10; The New York Times, April 11, 1997, p. A1; Associated Press, April 14, 1997, 18:37.

Jane's Defense Weekly, June 5, 1996, p. 15; Agence France Press, April 15, 1997, 15:13; BBC, April 14, 1997, ME/D2892/MED; Deustcher Depeschen via ADN, April 12, 1997, 0743; The Washington Times, April 11, 1997, p. A22.

<sup>20</sup> Riad Kahwaji and Barbara Opall-Rome, "Hizbollah: Iran's Battle Lab," Defense News, December 13, 2004, pp. 1 & 6.

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<sup>21</sup> Amir Taheir, "The Mullah's Playground," The Wall Street Journal, December 7, 2004, p. A10.

<sup>22</sup> The estimates of such holdings of rockets are now in the thousands, but the numbers are very uncertain. Dollar estimates of what are significant arms shipments are little more than analytic rubbish, based on cost methods that border on the absurd, but significant shipments are known to have taken place.

<sup>23</sup> The reader should be aware that much of the information relating to the Quds is highly uncertain. Also, however, see the article from the Jordanian publication Al-Hadath in FBIS-NES-96-108, May 27, 1996, p. 9, and in Al-Sharq Al-Awsat, FBIS-NES-96-110, June 5, 1996, pp. 1,4; A J Venter, "Iran Still Exporting Terrorism," Jane's Intelligence Review, November, 1997, pp. 511-516.

<sup>24</sup> The New York Times, May 17, 1998, p. A-15; The Washington Times, May 17, 1998, p. A-13; The Washington Post, May 21, 1998, p. A-29.

<sup>25</sup> A J Venter, "Iran Still Exporting Terrorism," Jane's Intelligence Review, November, 1997, pp. 511-516.

<sup>26</sup> For typical reporting by officers of the IRGC on this issue, see the comments of its acting commander in chief, Brigadier General Seyyed Rahim Safavi, speaking to reporters during IRGC week (December 20-26, 1995). FBIS-NES-95-250, December 25, 1995, IRNA 1406 GMT.

<sup>27</sup> Jane's Sentinel Security Assessment-The Gulf States, Armed Forces, Iran, October 7, 2004.

<sup>28</sup> The range of aircraft numbers shown reflects the broad uncertainties affecting the number of Iran's aircraft which are operational in any realistic sense. Many aircraft counted, however, cannot engage in sustained combat sorties in an extended air campaign. The numbers are drawn largely from interviews; Jane's Intelligence Review, Special Report No. 6, May, 1995; Jane's Sentinel - The Gulf Staffs, "Iran," various editions; the IISS, Military Balance, various editions, "Iran;" Andrew Rathmell, The Changing Balance in the Gulf, London, Royal United Services Institute, Whitehall Papers 38, 1996; Dr. Andrew Rathmell, "Iran's Rearmament: How Great a Threat?," Jane's Intelligence Review, July, 1994, pp. 317-322; Jane's World Air Forces (CD-ROM).

<sup>29</sup> Wall Street Journal, February 10, 1995, p. 19; Washington Times, February 10, 1995, p. A-19.

<sup>30</sup> Periscope, Nations/Alliances/Geographic Regions/Middle East/North Africa, Plans and Programs. Labeled 69.

<sup>31</sup> Reports that the IRGC is operating F-7 fighters do not seem to be correct.

<sup>32</sup> Reuters, June 12, 1996, 17:33.

<sup>33</sup> Jane's All the World's Aircraft, 2002-2003, London, Jane's Information Group, pp 259-263

<sup>34</sup> Hewson, Robert, "Iran's New Combat Aircraft Waits in the Wings," Jane's Defence Weekly, November 20, 2002, p. 15. Labeled 43; Jane's All the World's Aircraft, 2002-2003, London, Jane's Information Group, pp 259-263.

<sup>35</sup> Jane's All the World's Aircraft, 2002-2003, London, Jane's Information Group, pp 259-263.

<sup>36</sup> Jane's All the World's Aircraft, 2002-2003, London, Jane's Information Group, pp 259-263

<sup>37</sup> Hewson, Robert, "Iran's New Combat Aircraft Waits in the Wings," Jane's Defence Weekly, November 20, 2002, p. 15; Jane's All the World's Aircraft, 2002-2003, London, Jane's Information Group, pp 259-263.

<sup>38</sup> Jane's Defence Weekly, "Iran Reveals Shahab Thaqeb SAM Details," September 4, 2002, <http://jdw.janes.com>, Accessed January 9, 2004. Labeled 44.

<sup>39</sup> Based on interviews with British, Israeli, and US experts, and Anthony H. Cordesman, Iran and Iraq: The Threat from the Northern Gulf, Boulder, Westview, 1994; Anthony H. Cordesman and Ahmed S. Hashim, Iran: the Dilemmas of Dual Containment, Boulder, Westview, 1997; IISS, Military Balance, various editions, "Iran;" Jane's Sentinel: The Gulf States, various editions, "Iran;" USNI Data Base; Anoushiravan Ehteshami, "Iran's National Strategy," International Defense Review, 4/1994, pp. 29-37; Military Technology, World Defense Almanac: The Balance of Military Power, Vol. XVII, Issue 1-1993, ISSN 0722-3226, pp. 139-142; and working data from the Jaffee Center for Strategic Studies; Dr. Andrew Rathmell, "Iran's Rearmament: How Great a Threat?," Jane's Intelligence Review, July, 1994, pp. 317-322; Ahmed Hashim, "The Crisis of the Iranian State," Adelphi Paper 296, London, IISS, Oxford, July 1995, pp. 7-30 and 50-70; Andrew Rathmell, The Changing Military Balance in the Gulf, London, RUSI, Whitehall Series, 1996, pp. 9-23; Michael Eisenstadt, Iranian Military Power, Capabilities and

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Intentions, Washington, Washington Institute, 1996, pp. 9-65; and Anoushiravan Enreshami, "Iran Strives to Regain Military Might," International Defense Review, 7/1996, pp. 22-26.

<sup>40</sup> Jane's Defense Weekly, September 4, 1996, p. 4.

<sup>41</sup> Jane's, "Iran", 29 October 2001.

<sup>42</sup> World Missiles Briefing, Teal Group Corporation.

<sup>43</sup> Jane's Defense Weekly, June 25, 1997, p. 3; Associated Press, June 17, 1997, 1751; United Press, June 17, 1997, 0428; International Defense Review, 6/1996, p. 17.

<sup>44</sup> Jane's Fighting Ships, 2002-2003, London, Jane's Information Group, pp 336-343.

<sup>45</sup> Jane's Fighting Ships, 2002-2003, London, Jane's Information Group, pp 336-343.

<sup>46</sup> Washington Times, March 27, 1996, p. A-1.

<sup>47</sup> Defense News, January 17, 1994, pp. 1, 29.

<sup>48</sup> Jane's Fighting Ships, 2002-2003, London, Jane's Information Group, pp 336-343

<sup>49</sup> Only two torpedo tubes can fire wire guided torpedoes. Defense News, January 17, 1994, pp. 1, 29.

<sup>50</sup> Jane's Fighting Ships, 2002-2003, London, Jane's Information Group, pp 336-343,

<sup>51</sup> See David Miller, "Submarines in the Gulf," Military Technology, 6/93, pp. 42-45 David Markov, "More Details Surface of Rubin's 'Kilo' Plans," Jane's Intelligence Review, May 1997, pp. 209-215.

<sup>52</sup> In addition to the sources listed at the start of this section, these assessments are based on various interviews, various editions of the IISS Military Balance; the Jaffee Center Middle East Military Balance, Jane's Sentinel: The Gulf States, "Iran;" and Jane's Defense Weekly, July 11, 1987, p. 15.

<sup>53</sup> Central Asia's Affairs, No: 3, "The Military Political Situation in the Caspian Region", by A. Kozhikhov, D. Kaliyeva

<sup>54</sup> *ibid*

<sup>55</sup> Proliferation: Threat and Response, US Department of Defense, The Office of Secretary of Defense, 2001, p.36. available at: <http://www.defenselink.mil/pubs/ptr20010110.pdf>

<sup>56</sup> CIA, Unclassified Report: to Congress on the Acquisition of Technology Relating to Weapons of Mass Destruction and Advanced Conventional Munitions, November 2003, available at: [http://www.cia.gov/cia/reports/721\\_reports/pdfs/721report\\_july\\_dec2003.pdf](http://www.cia.gov/cia/reports/721_reports/pdfs/721report_july_dec2003.pdf)

<sup>57</sup> John R. Bolton, "Iran's Continuing Pursuit of Weapons of Mass Destruction," Testimony Before the House International Relations Committee Subcommittee on the Middle East and Central Asia, June 24, 2004, available at: <http://www.state.gov/t/us/rm/33909.htm>

<sup>58</sup> Quoted in the IISS, Iran's Strategic Weapons Programs: A Net Assessment, IISS Strategic Dossier, 2005, p. 67.

<sup>59</sup> Merav Zafary, "Iranian Biological and Chemical Weapons Profile Study," Center for Nonproliferation Studies, Monterey Institute of International Studies, February 2001.

<sup>60</sup> "Iran: Chemical Overview," Nuclear Threat Initiative, Revised in January 2006, available at: [http://www.nti.org/e\\_research/profiles/Iran/Chemical/#fnB15](http://www.nti.org/e_research/profiles/Iran/Chemical/#fnB15)

<sup>61</sup> Proliferation: Threat and Response, US Department of Defense, The Office of Secretary of Defense, 1997, available at: <http://www.defenselink.mil/pubs/prolif97/>

<sup>62</sup> Proliferation: Threat and Response, US Department of Defense, The Office of Secretary of Defense, 2001, p. 36, available at: <http://www.defenselink.mil/pubs/ptr20010110.pdf>

<sup>63</sup> "Iran," Jane's Sentinel Security Assessment: the Gulf States' Armed Forces, October 7, 2004.

<sup>64</sup> Statement by John A. Lauder, to the Senate Committee on Foreign Relations on Russian Proliferation to Iran's Weapons of Mass Destruction and Missile Programs, October 5, 2000, available at: [http://www.cia.gov/cia/public\\_affairs/speeches/2000/lauder\\_WMD\\_100500.html](http://www.cia.gov/cia/public_affairs/speeches/2000/lauder_WMD_100500.html)

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<sup>65</sup> CIA, Unclassified Report: to Congress on the Acquisition of Technology Relating to Weapons of Mass Destruction and Advanced Conventional Munitions, July-December 2003, available at: [http://www.cia.gov/cia/reports/721\\_reports/pdfs/721report\\_july\\_dec2003.pdf](http://www.cia.gov/cia/reports/721_reports/pdfs/721report_july_dec2003.pdf)

<sup>66</sup> John R. Bolton, "Iran's Continuing Pursuit of Weapons of Mass Destruction," Testimony Before the House International Relations Committee Subcommittee on the Middle East and Central Asia, June 24, 2004, available at: <http://www.state.gov/t/us/rm/33909.htm>

<sup>67</sup> IISS, Iran's Strategic Weapons Programs: A Net Assessment, IISS Strategic Dossier, 2005, pp. 82-83.

<sup>68</sup> Earlier unclassified CIA reports on problems like the ballistic missile threat often projected alternative levels of current and future capability. The qualifications and possible futures are far less well defined in more recent reports. For example, see CIA, Unclassified Summary of a National Intelligence Estimate, Foreign Missile Developments and the Ballistic Missile Threat Through 2015, National Intelligence Council, December 2001, [http://www.cia.gov/nic/pubs/other\\_products/Unclassifiedballisticmissilefinal.htm](http://www.cia.gov/nic/pubs/other_products/Unclassifiedballisticmissilefinal.htm).

<sup>69</sup> There is no way to determine just how much the Special Plans Office team set up within the office of the Secretary of Defense to analyze the threat in Iraq was designed to produce a given conclusion or politicized intelligence. The Department has denied this, and stated that the team created within its policy office was not working Iraqi per se, but on global terrorist interconnections. It also stated that the Special Plans Office was never tied to the Intelligence Collection Program—a program to debrief Iraqi defectors—and relied on CIA inputs for its analysis. It states that simply conducted a review, presented its findings in August 2002, and its members returned to other duties. See Jim Garamone, "Policy Chief Seeks to Clear Intelligence Record," American Forces Information Service, June 3, 2003; and Briefing on policy and intelligence matters, Douglas J. Feith, under secretary of defense for policy, and William J. Luti, deputy under secretary of defense for special plans and Near East and South Asian affairs, June 4, 2003, <http://www.defenselink.mil/transcripts/2003/tr20030604-0248.html>.

Some intelligence experts dispute this view, however, and claim the team's effort was used to put pressure on the intelligence community. Such "B-teams" also have a mixed history. They did help identify an intelligence community tendency to underestimate Soviet strategic nuclear efforts during the Cold War. The threat analysis of missile threats posed to the United States by the "Rumsfeld Commission," however, was a heavily one-sided assessment designed to justify national missile defense. Also see Greg Miller, "Pentagon Defends Role of Intelligence Unit on Iraq," The Los Angeles Times, June 5, 2003; and David S. Cloud, "The Case for War Relied on Selective Intelligence," The Wall Street Journal, June 5, 2003.

<sup>70</sup> Some press sources cite what they claim is a deliberate effort to ignore a September 2002 DIA report on Iraqi chemical weapons capabilities called "Iraq-Key WMD Facilities-An Operational Support Study." See James Risen, "Word that US Doubted Iraq Would Use Gas," The New York Times, June 18, 2003 and Tony Capaccio, "Pentagon 2002 Study Reported No Reliable Data on Iraq Weapons," USA Today, June 6, 2003.

In fact, the unclassified excerpts from the DIA report, show that DIA was not stating that Iraqi did not have chemical weapons, but rather that it had, No reliable information on whether Iraq is producing and stockpiling chemical weapons, or where Iraq has—or will—establish its chemical weapons facilities." The report went on to say that, "although we lack any direct information, Iraq probably possess CW agent in chemical munitions, possibly include artillery rockets, artillery shells, aerial bombs, and ballistic missile warheads. Baghdad also probably possess bulk chemical stockpiles, primarily containing precursors, but that also could consist of some mustard agent of stabilized VX."

If anything, the report is a classic example of what happens when intelligence reports do state uncertainty and of how the user misreads or misuses the result.

<sup>71</sup> Alireza Jafarzadeh, "Iranian Regime's Plan and Attempts to Start Uranium Enrichment at Natanz Site," Statement at the National Press Club, Washington DC, January 10, 2006.

<sup>72</sup> "Iran Says it Will Resume Uranium Conversion Today," Global Security Newswire, August 11, 2005, available at: [http://www.nti.org/d\\_newswire/issues/2005/8/1/6860ebe5-d0a1-428e-829d-6005c7b26698.html](http://www.nti.org/d_newswire/issues/2005/8/1/6860ebe5-d0a1-428e-829d-6005c7b26698.html)

<sup>73</sup> Dafna Linzer, "Powell Says Iran Is Pursuing Bomb," The Washington Post, November 18, 2004, p. A01.

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<sup>74</sup> “UN Atomic Agency Seeks To Visit Key Iranian Defense Site: Diplomats,” Agence France Presse, September 10, 2004.

<sup>75</sup> Dafna Linzer, “Nuclear Disclosure on Iran Unverified,” The Washington Post, November 19, 2004, p. A01.

<sup>76</sup> Dafna Linzer, “Powell Says Iran Is Pursuing Bomb,” The Washington Post, November 18, 2004, p. A01.

<sup>77</sup> Dafna Linzer, “Nuclear Disclosure on Iran Unverified,” The Washington Post, November 19, 2004, p. A01.

<sup>78</sup> Sonni Efron, Tyler Marshall, and Bob Drogin, “Powell’s Talk of Arms Has Fallout,” The Los Angeles Times, November 19, 2004.

<sup>79</sup> Carla Anne Robbins, “As Evidence Grows Of Iran’s Program, US Hits Quandary,” The Wall Street Journal, March 18, 2005, p. 1.

<sup>80</sup> IAEA, Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran: Report by the Director General, November 15, 2004, p. 18, available at: [http://www.iaea.org/Publications/Documents/Board/2004/gov2004-83\\_derestrict.pdf](http://www.iaea.org/Publications/Documents/Board/2004/gov2004-83_derestrict.pdf)

<sup>81</sup> John R. Bolton, “Preventing Iran from Acquiring Nuclear Weapons,” Remarks to the Hudson Institute, Washington DC, August 17, 2004.

<sup>82</sup> Dafna Linzer, “Strong Leads And Dead Ends In Nuclear Case Against Iran,” The Washington Post, February 8, 2006, p. A01.

<sup>83</sup> John R. Bolton, “Preventing Iran from Acquiring Nuclear Weapons,” Remarks to the Hudson Institute, Washington DC, August 17, 2004.

<sup>84</sup> John R. Bolton, “Preventing Iran from Acquiring Nuclear Weapons,” Remarks to the Hudson Institute, Washington DC, August 17, 2004.

<sup>85</sup> IAEA, Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran: Report by the Director General, September 2, 2005, Annex 1, p. 14, available at: <http://www.iaea.org/Publications/Documents/Board/2005/gov2005-67.pdf>

<sup>86</sup> IAEA, Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran: Report by the Director General, September 2, 2005, p. 7, available at: <http://www.iaea.org/Publications/Documents/Board/2005/gov2005-67.pdf>

<sup>87</sup> “Iran Far From Nuclear Bomb-Making Capacity: Ex-UN Weapons Chief Blix,” Agence France Presse, June 23, 2005.

<sup>88</sup> Ali Akbar, “Iran Hits Milestone in Nuclear Technology,” Associated Press, April 11, 2006.

<sup>89</sup> Ali Akbar Dareini, “Iran To Move to Large Scale Enrichment,” Associated Press, April 12, 2006.

<sup>90</sup> Nazila Fathi and Christine Hauser, “Iran Marks Step in Nuclear Development,” New York Times, April 11, 2006.

<sup>91</sup> IAEA, Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran: Report by the Director General, November 15, 2004, available at: [http://www.iaea.org/Publications/Documents/Board/2004/gov2004-83\\_derestrict.pdf](http://www.iaea.org/Publications/Documents/Board/2004/gov2004-83_derestrict.pdf)

<sup>92</sup> John R. Bolton, “Preventing Iran from Acquiring Nuclear Weapons,” Remarks to the Hudson Institute, Washington DC, August 17, 2004.

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<sup>94</sup> IAEA, Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran: Report by the Director General, September 2, 2005, available at: <http://www.iaea.org/Publications/Documents/Board/2005/gov2005-67.pdf>

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<sup>95</sup> IAEA, Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran: Report by the Director General, September 2, 2005, available at: <http://www.iaea.org/Publications/Documents/Board/2005/gov2005-67.pdf>

<sup>96</sup> David Albright and Corey Hinderstein, "Iran's Next Steps: Final Tests and the Construction of a Uranium Enrichment Plant," Institute for Science and International Security, Issue Brief, January 12, 2006, available at: <http://www.isis-online.org/publications/iran/irancascade.pdf>

<sup>97</sup> Dr. Frank Barnaby, "Iran's Nuclear Activities," Oxford Research Group, February, 2006.

<sup>98</sup> IAEA, Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran: Report by the Director General, September 1, 2004, Annex, p. 7, <http://www.iaea.org/Publications/Documents/Board/2004/gov2004-60.pdf>

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F-117s dropped two weapons during the Gulf War. The bomb was modified after the conflict, and F-15s used the weapon in Kosovo. It is not clear that the B-2 or US aircraft would now use this weapon. The Hard and Deeply Buried Target Defeat System (HDBTDS) program has made major progress in recent years.

The fuzing of the weapon is believed to have been improved and possibly some aspects of its penetration capability. It has been tested against rock as well as soil. Global Security indicates that Guided Bomb Unit-28C/B, also known as BLU-122 or Enhanced Paveway III, provides with an improved aerial delivery capability for the BLU-113 P3I warhead, and possesses a Global Positioning System aided laser guidance capability with improved lethality, survivability, and penetration over the 28B/B weapons system, and is compatible with F-15E and B-2A aircraft platforms. <http://www.globalsecurity.org/military/systems/munitions/gbu-28.htm>. The B-2 Spirit bomber has also tested simulated nuclear earth penetrator modifications of the B61-11. [http://www.globalsecurity.org/wmd/library/news/usa/1998/n19980326\\_980417.html](http://www.globalsecurity.org/wmd/library/news/usa/1998/n19980326_980417.html).

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<sup>234</sup> <http://www.globalsecurity.org/military/world/russia/sa-15.htm>; "Russia may deliver Iranian Tor-M1s earlier than expected," *Jane's Missiles and Rockets*, February 1, 2006.

<sup>235</sup> Lyubov Provina, "Russian Arms Sale to Iran Draws US Scrutiny," *Defense News.com*, December 12, 2005; Alon Ben David, "Iran Launches New Surface to Air Missile Production," *Jane's Defense Weekly*, February 15, 2006.

<sup>236</sup> For full details, see <http://www.globalsecurity.org/military/world/china/qw-1.htm>.

<sup>237</sup> Reuters, January 5, 1997, 7:00:32 PST; <http://www.globalsecurity.org/military/world/russia/s-300pmu2.htm>; <http://www.globalsecurity.org/military/world/russia/s-300pmu.htm>.

<sup>238</sup> <http://www.globalsecurity.org/military/world/russia/s-300v.htm>.

<sup>239</sup> "No S-300 deal with Iran, says Russian defense minister," *Jane's Missiles and Rockets*, March 1, 2006.

<sup>240</sup> Michael Knights, "Iran's Conventional Forces Remain Key to Deterring Potential Threats," *Jane's Intelligence Review*, February 1, 2006.

<sup>241</sup> Ellen Knickmeyer and Omar Fekeiki, "Iraqi Shi'ite Cleric Pledges to Defend Iran," *The Washington Post*, January 24, 2006, p. A13.

<sup>242</sup> Michael Knights, "Deterrence by Punishment Could Offer Last Resort Option for Iran," *Jane's Intelligence Review*, April 1, 2006.

<sup>243</sup> This would require remote targeting. Surface-radar coverage of a large ship from a ground-mounted radar is about 26-32 nautical miles.

<sup>244</sup> It is unclear what version of the missile Iran has and what modifications it may have made. China made a wide range of variants of the system. Global Security describes them as follows(<http://www.globalsecurity.org/military/world/china/c-201.htm>):

HY-2A terminal guidance radar of the prototype missile was modified into a passive infrared target seeker which effectively raised the concealment and anti-jamming capabilities of the missile. The interception performance of this missile within guidance range can realize omnidirectional attacks on ship targets at sea.

HY-2B the conical scanning terminal guidance radar of the prototype missile was modified to an advanced monopulse system radar that improved its resistance sea waves interference and various forms of electronic jamming.

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HY-2C terminal guidance radar of the prototype missile was modified into a television-equipped target seeker which was able to effectively raise the concealment and anti-jamming capabilities of the missile as well as increase its hit probability.

HY-2G uses a high precision radio altimeter so that the level flight altitude of the missile can be lowered to 30-50 meters, raising penetration capabilities. The basic HY-2 uses active radar homing, while HY-2G adds a radio altimeter to permit a lower penetration altitude.

<sup>245</sup> <http://www.globalsecurity.org/military/world/china/c-802.htm>.

<sup>246</sup> IISS, Military Balance, 2005-2006; Michael Knights, "Deterrence by Punishment Could Offer Last Resort Option for Iran," Jane's Intelligence Review, April 1, 2006.

<sup>247</sup> Al Akbar Dareini, "Iran Rolls Out Yet Another Missile," Chicago Tribune, April 4, 2006; "Iran says has tested 2<sup>nd</sup> missile," CNN.com, April 4, 2006; Ali Ronaghi, "Iran says fires sonar-evading, underwater missile," Washingtonpost.com, April 2, 2006, 1:03 PM.

<sup>248</sup> "Iran Suicide Bombers to "Burn Down" US Interest," Iran Focus, February 13, 2006, available at: <http://www.iranfocus.com/modules/news/article.php?storyid=5753>

<sup>249</sup> Robin Wright, Peter Baker, "Iraq, Jordan See Threat To Election From Iran," The Washington Post, December 8, 2004, available at: <http://www.washingtonpost.com/wp-dyn/articles/A43980-2004Dec7.html>

<sup>250</sup> Robin Wright, Peter Baker, "Iraq, Jordan See Threat To Election From Iran," The Washington Post, December 8, 2004, available at: <http://www.washingtonpost.com/wp-dyn/articles/A43980-2004Dec7.html>

<sup>251</sup> MEHR News, "Remarks of Jordanian King an Insult on Iraqi Nation: Iran," December 11, 2004, available at: <http://www.mehrnews.ir/en/NewsDetail.aspx?NewsID=137699>

<sup>252</sup> Ellen Knickmeyer and Omar Fekeiki, "Iraqi Shi'ite Cleric Pledges to Defend Iran," The Washington Post, January 24, 2006, p. A13.

<sup>253</sup> Richard Beeston, "Two Years On, Iran Is The Only Clear Winner Of War On Saddam," The London Times, September 23, 2005.

<sup>254</sup> ABCTV News Baghdad Email, September 20, 2005.

<sup>255</sup> Robin Hughes, "Rumsfeld alleges IRGC Al Qods Infiltrating Iraq," Jane's Defense Weekly, March 15, 2006.

<sup>256</sup> Nawaf Obaid, "Meeting the Challenge of a Fragmented Iraq: A Saudi Perspective," CSIS, April 6, 2006, available at [http://www.csis.org/media/csis/pubs/060406\\_iraqsaudi.pdf](http://www.csis.org/media/csis/pubs/060406_iraqsaudi.pdf)

<sup>257</sup> Matthew Levitt, *Statement before the U.S. House of Representatives, Committee on International Relations, Joint Hearing before the subcommittee on the Middle East and Central Asia and the subcommittee on International Terrorism and Nonproliferation of the committee on International Relations House of Representatives 109<sup>th</sup> Congress, 1<sup>st</sup> Session, February 16, 2005*, available at [www.house.gov/international\\_relations/109/98810.PDF](http://www.house.gov/international_relations/109/98810.PDF), 15.