IRAN AND THE GULF MILITARY BALANCE

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III. MILITARY COMPETITION

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The most threatening form of US and Iranian competition takes place in the military and security arena. The US and Iran are military competitors in the Gulf, Indian Ocean, and Levant – and in steadily wider areas as Iran expands its ballistic missile capabilities. Military competition occurs in ways where each nation, and its allies, seeks to deny the other side military options, and seeks to establish or reinforce containment, deterrence, and limits on escalation. It is also a competition for military prestige and status, and which seeks to use military forces to influence the behavior of other states.

The Historical Background

The historical background of this military competition tracks closely with the history of the political tensions between the US and Iran. Iran sees competition as driven by US efforts to dominate the Gulf and the region, by a period of US intervention in Iranian internal affairs that began in 1953, by US security assistance to the Pahlavi regime before the Shah's fall, US support of Iraq during the Iran-Iraq War, the "tanker war" from 1987-1988, and US efforts to deny Iran imports of arms and military technology. Iran feels the US seeks to become the dominant power in the region while seeking to contain Iran's power and influence.

The US sees Iran as a state that has been vehemently anti-American since the fall of the Shah and the founding of the Islamic Republic, which held US embassy employees hostage, threatens the region and exports terrorism, has exported aid and arms to insurgents in Iraq and Afghanistan, threatens Israel's existence, is seeking nuclear-armed missiles, and is steadily building up asymmetric forces that threaten the stable flow of Gulf petroleum exports. It feels Iran seeks to become the dominant power in the region while seeking to expel US power and influence.

The end result is a competition that has now gone on for 32 years and which has occasionally led to direct action. Key events include the Iranian hostage crisis (1979-1981), US seizure of Iranian assets, the imposition of sanctions on Iran, and occasional military clashes (1988). The most prominent aspect of US-Iranian rivalry, though, has been the use of proxies.

The US has continued to provide its Gulf allies with advanced military equipment to counter Iran. Saudi Arabia has received billions of dollars of advanced equipment, including AH-64 Apache attack helicopters, M1 Abrams main battle tanks, and F-15S multirole fighters. Such systems are far more advanced than Iranian military technology, and serve to both limit Iran's influence and provide a major deterrent to Iranian forces.

Throughout this period the US and Europe have refused to provide Iran with new arms sales as well as military technology, parts, and updates for the systems they sold during the time of the Shah. They have also put continuing pressure on Russia, China and other arms suppliers to limit the transfer of arms. The US and its allies also favored Iraq during the Iran-Iraq War, and the US provided substantial support to Iraq in the form of arms sales, intelligence, and technological assistance. The combination of such limits on Iran's arms imports and its massive losses during the Iran-Iraq war have severely restricted the quality and modernization of Iran's conventional forces, and forced Iran to both create a domestic arms industry and find alternatives to conventional military power.

The recent history of US and Iranian military competition is shown in **Figure III.1**, and it reflects the fact that Iran has sought to bridge the gap in conventional capability by building a strong capacity asymmetric warfare to defend against attacks and invasion, and the extend its influence throughout the region and pose a threat to tanker and shipping in the Gulf. After it conventional forces suffered tactical defeats at the hands of superior US forces in the Gulf during Operation Praying Mantis (1987-1988), Iran shifted its focus to developing a strong asymmetric capacity that focuses on the use of smart munitions, light attack craft, mines, swarm tactics, and missile barrages to counteract US naval power. While such assets cannot be used to achieve a decisive victory against US and other forces in a direct confrontation in the Gulf, they are difficult to counter and give Iran the ability to strike at larger conventional forces with little, if any warning.

Iran has also created robust nuclear and ballistic missile programs, which have become a focal point of US-Iranian military competition. Iran's missile program dates to the 1980s, and was fully underway during the Iran-Iraq War. While Iran's ballistic missile capabilities were initially limited, the range and sophistication of the country's missiles has increased greatly since its inception in the early days of the Iran-Iraq War. Iran has now created conventionally armed ballistic missile forces that can strike at US allies and US bases in the region with little warning, and could be configured to carry nuclear warheads if Iran can develop them.

Although an Iranian nuclear program has existed in some form since the 1950s, Iran's push to enrich uranium and reach a nuclear breakout capability began in earnest during the Iran-Iraq War, and accelerated in the early 2000s. This program may have paused in 2003, but recent reporting by the International Atomic Energy Agency (IAEA) and other sources makes it clear that Iran has since made further advances in its capability to produce nuclear weapons, now has all of the technology necessary to produce a nuclear device, and is pursuing warhead designs for its missiles that could be used to deliver nuclear weapons, In spite of sabotage, the assassination of some scientists, and international sanctions — Iran's nuclear program continues to progress. Iran still claims that its nuclear program is entirely peaceful, but its lack of cooperation with the IAEA – and the growing range of other indicators that it is developing the capability to produce nuclear weapons – make such claims doubtful. It is possible that Iran may acquire deliverable nuclear weapons at some point in the next five years.

Figure III.1: Summary Chronology of US-Iranian Military Competition: 2000-2011[1,2,3]

2001

March 12 – Russian president Vladimir Putin and Iranian president Mohammed Khatami sign a cooperation and security agreement during a state visit to Moscow, the first since the 1979 Revolution.

April – Iran and Saudi Arabia sign a security agreement with the objective of combatting drug trafficking and terrorism.

June – Five years after a truck bomb destroyed the Khobar Towers in Dhahran, Saudi Arabia, a federal grand jury in the US indicts 13 Saudis and one Lebanese for their role in the attack. The indictment states that all were part of Saudi Hezbollah, an Iranian proxy. The blast killed 19 US servicemen.

October 2 – Six years after it halted arms sales to Iran due to US diplomatic pressure, Russia signs a military agreement with Iran that includes the sale of missiles, fighter aircraft, and other armaments.

October 8 – Supreme Leader Ali Khamenei condemns the US airstrikes in Afghanistan. However, Iran agrees to perform search and rescue missions for US pilots that crash or are shot down over Iranian soil.

September – A CIA report accuses Iran of possessing one of the most active nuclear weapons programs in the world. Moreover, it indicates that Iran is seeking ballistic missile technology from Russia, China, and North Korea.

2002

January – Israeli seize the *Karina A.* They discover that the ship is carrying 50 tons of arms which Israeli officials believe are intended for Palestinian militant organizations.

January 29 – US president George W. Bush refers to Iran, Iraq, and North Korea as an "axis of evil" in his State of the Union address.

September – Iran begins construction of its first nuclear reactor at Bushehr with the assistance of Russian engineers and technicians. The move prompts strong objections from the US.

December – The US accuses Iran of possessing a secret nuclear weapons program centered on two nuclear facilities at Natanz and Arak, both of which are under construction at the time.

2003

March – In the wake of the US-led invasion of Iraq, Iran and Syria expand and intensify their cooperation to ensure that they themselves would not become targets as well. Both countries begin to support insurgent groups in Iraq, and expand bilateral defense cooperation.

May – Shortly after the US invasion of Iraq, a Swiss diplomat relays Iranian conditions for bilateral talks to the US government. The offer, however, is not considered seriously by the Bush administration.

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[1] "Timeline: Iran-US Relations." Al-Jazeera English. June 25, 2009.

[2] "Timeline: US-Iran Ties." BBC. May 10, 2011.

[3] "Timeline of Iran's Foreign Relations." United States Institute of Peace

2004

June 21 – Iran arrests six British sailors for allegedly trespassing into Iran's territorial waters. They are paraded through Tehran and later forced to apologize. All are released three days later after negotiations.

November – Iran agrees to suspend uranium enrichment in exchange for trade concessions from Europe.

2005

August – George W. Bush makes one of many statements to follow about not ruling out the use of force to halt Iran's nuclear program.

June – Former IRGC commander and presidential candidate Mohsen Rezaei states that Iran played a larger role in the overthrow of the Taliban than the US gave it credit for.

June 16 – Iran and Syria sign a military cooperation agreement to defend against what both sides deemed the "common threats" presented by the US and Israel. The defense ministers of both countries stated in a joint press conference that the agreement was aimed at consolidating defense efforts and strengthening mutual support.

June 6 – Iran is given observer status in the Shanghai Cooperation Organization, an intergovernmental mutual security organization that includes Russia, China, Kazakhstan, Kyrgyzstan, Tajikistan, and Uzbekistan. Iran later applies for full membership in March 2008, but its admission is blocked by sanctions imposed on it by the UN.

October 25 – Iran's new president, Mahmoud Ahmadinejad, calls for Israel to "vanish from the pages of time." This statement is widely seen as a threat leveled at Israel.

2006

April – Washington denies a claim reported in *The New York Times* that the US is considering a tactical nuclear strike on Iran's underground nuclear facilities.

Iran lodges a complaint at the UN, and states that it will retaliate against any attack. Iranian president Mahmoud Ahmadinejad reaffirms that Iran's nuclear program is peaceful. Iran later offers to hold direct talks with the US regarding Iraq, but withdraws the offer soon after.

May – Iran threatens withdrawal from the Nuclear Non-Proliferation Treaty if pressure on its nuclear program escalates following a UN Security Council draft resolution.

Later that month, the US offers to join the EU in direct negotiations with Iran if Tehran agrees to suspend uranium enrichment

December – The UN Security Council passes a resolution that imposes sanctions on Iran over its nuclear program.

2007

January – Members of the IRGC are arrested in Iraq by US forces for engaging in sectarian warfare. After lumping Iran together with al-Qaeda in the State of the Union address, US president George W. Bush states that he does not intend to attack Iran.

February – Iran denies accusations that it is promoting violence in Iraq.

February 8 – Iran's Supreme Leader Ali Khamenei states that Iran would retaliate against US interests

around the world if the US were to attack Iran's nuclear program.

March 24 – Iran detains 15 British marines and sailors for allegedly trespassing into Iran's territorial waters. They are released after approximately two weeks.

May 28 – The US and Iran hold the first high level official talks since the 1979 Revolution in Baghdad. The meeting comes after the Iraqi government holds a security conference attended by regional states and permanent members of the UN Security Council. The talks focus on Iraqi security, and are later followed by more talks in July and November. In the course of these meetings, the US urges Iran to stop supporting Shi'ite militias in the country. The talks, however, do not lead to anything meaningful, and cease after three meetings.

August – Iranian officials denounce US plans to designate the IRGC as a terrorist organization as "worthless." Bush warns Iran over its support for Shi'ite militias in Iraq.

September 6 – A large shipment of Iranian arms intended for the Taliban is intercepted by NATO forces in Afghanistan. Among other things, the shipment includes explosively formed penetrators (EFPs). US officials state that the large size of the shipment made is indicative that Iranian officials are at least aware of it. Iran denies the accusations.

October – The commander of US forces in Iraq, General David Petraeus, claims that Iran is promoting violence in Iraq. Petraeus also accuses Iran's ambassador to Iraq, Hassan Kazemi Qomi, of being a member of the Al Qods Force, the special operations wing of the IRGC that is responsible for training and equipping Iran's proxies.

November – Twenty Iranian citizens held by US forces in Iraq are released.

The IAEA releases a report that states that Iran supplied transparent records of its past nuclear activities, but emphasizes that it only has limited knowledge of Iran's then-current nuclear activities.

December – A US intelligence report states that Iran suspended its nuclear weapons program in 2003, but continued to enrich uranium.

Iranian president Mahmoud Ahmadinejad hails the report as an Iranian victory. US president George W. Bush states that Iran risks further isolation if it does not reveal the full extent of its nuclear activities.

US Secretary of Defense Robert Gates states that Iran may have restarted its nuclear weapons program at a conference in Bahrain, despite the US report. Moreover, he states that Iran still poses a serious threat to Middle East security and the US.

Iran protests US espionage against its nuclear activities in a formal letter to the US.

2008

January – Iran's Supreme Leader, Ali Khamenei, states that US-Iranian relations could be restored in the future. The US accuses Iran of harassing US Navy ships in the Strait of Hormuz.

Bush accuses Iran of being the world's leading sponsor of terrorism.

April – The US accuses Iran of continuing to support Afghan insurgents.

July – The IRGC carries out a series of war games and ballistic missile tests during the Great Prophet 3 military exercises. Iran test fired a new version of its Shahab-3 intermediate range ballistic missile, which Iran states are capable of hitting targets in Israel. The tests, however, draw attention over allegedly doctored

photographs, and some experts claim that the missile is the shorter range Shahab-3A or the SCUD C, which would indicate no improvement in Iran's ballistic missile technology or capabilities.

2009

January 29 – A White House spokesman indicates that US president Barack Obama will "preserve all his options," and has not ruled out the use of force to confront Iran's nuclear program.

February 3 – Iranian president Mahmoud Ahmadinejad announces the launch of the Omid ("Hope"), Iran's first indigenously produced satellite. The launch is seen in the West as veiled research into ballistic missile technology.

May 1 – The US Department of State designates Iran as the most active state sponsor of terrorism. Iran responds by stating that the US is in no position to accuse other states of terrorism in light of its actions at the Guantanamo Bay detention camp and the scandal at Iraq's Abu Ghraib prison.

May 20 – Iran successfully tests the Sajjil-2 ballistic missile, which the regime states has a 1,500 mile range (the longest range of any of Iran' missiles). The Obama administration responds by stating that the test was a "significant step" in Iran's ballistic missile program, and indicated that Iran was working on enhancing its missiles' payload capacity.

September – Iran admits to constructing the Fordow uranium enrichment facility near Qom, but states that it is for peaceful purposes.

September 22 – Iran shows its Shahab-3 and Sajjil ballistic missiles in a military parade. Additionally, it shows off its Russian-built Tor M1 air defense system for the first time.

September 27-28 – Iran tests a number of different ballistic missiles during the Great Prophet 4 war games, including the Tondar-69, the Shahab-1, the Shahab-2, and the Fateh-110.

December – General David Petraeus again accuses Iran of supporting Shi'ite militants in Iraq, and providing a "modest level" of support to Afghan insurgents.

2010

January – Masoud Ali Mohammadi, an Iranian physics professor, is killed in a bombing in Tehran. No group claims responsibility, but the Iranian government claims the US and Israel are behind the attack.

March – Iran and Qatar sign a security agreement to combat terrorism and promote security cooperation.

April - The IRGC conducts the Great Prophet 5 exercises in the Gulf and the Strait of Hormuz. The exercises include the conspicuous use of IRGC fast attack craft armed with anti-ship missiles against larger, static targets.

May - Iran holds the Velayat 89 naval war games in the Gulf and the Sea of Oman. Both the IRGC and the regular navy participate. The games include exercises in chemical and biological warfare, large scale offensive naval infantry operations, and the use of small, fast-attack patrol craft.

August – Iran successfully tests a new version of the Fateh-110, a short range ballistic missile with a 155 mile range.

In what Iran describes as a milestone in its quest for nuclear energy, technicians begin loading fuel into the Bushehr nuclear power plant.

September – The Stuxnet computer virus is detected in staff computers at the Bushehr nuclear power plant. The virus is believed to have been created by a nation state.

November - Iran carries out what it terms its "largest ever" air defense drill. The five-day exercise is aimed at defending the country's nuclear sites from airstrikes, and a number of missiles are test fired, including the S-200 system.

2011

January – Iran's nuclear chief, Ali Akbar Salehi, states that Iran now possesses the technology needed to make fuel plates and rods for its nuclear reactors.

February 7 – The commander of the IRGC, Brigadier General Mohammed Ali Jafari, unveils the *Khalij Fars*, a guided anti-ship ballistic missile. General Jafari claims the missile is capable of destroying a US aircraft carrier.

Iran sends two warships through Suez Canal for first time since the Islamic Revolution, in what Israel describes as an act of provocation.

July – The Iranian military holds the "Great Prophet 6" war games, during which Iran test-fires new long-range missile designs and reveals the presence of underground missile silos.

US Secretary of Defense Leon Panetta and Army General Lloyd Austin express concern that Iran is providing Shi'ite militants in Iraq with advanced rockets and other armaments.

September – The commander of Iran's navy, Admiral Habibollah Sayyari, announces Iran's intention to send warships to patrol the Atlantic, stating following: "Like the arrogant powers that are present near our marine borders, we will also have a powerful presence close to the American marine borders."

October – US officials reveal an alleged Iranian plot to assassinate Adel Al-Jubeir, Saudi Arabia's ambassador to the US. Iran denies all involvement.

November – The IAEA releases a report that provides detailed indicators that Iran has weaponized its nuclear program.

Current Patterns in the Structure of US and Iranian Military Competition

The current patterns of US and Iranian military competition have four major aspects:

- *Iran's conventional forces: Iran seeks to improve its conventional forces in ways intended to expand its influence, limit US military options, provide the ability to intimidate its neighbors, and increase its power projection capabilities. The US seeks to counter Iran by denying it modern conventional arms, improving its own forces and power projection capabilities, and by building up those of friendly Arab Gulf states, particularly those of Saudi Arabia and the UAE. Both Iran and the US compete for influence over Iraq's future military development.*

  The US has had considerable success in persuading other states not to sell Iran modern major weapons system, and Iran has been forced to try to produce many of its own systems with only limited success. Iran is still heavily dependent on systems that date back to the time of the Shah and which were worn by the stress of the Iran-Iraq War. It has had some successes in modernization, but it has not been able to acquire large numbers of modern armor, combat aircraft, longer-range surface-to-air missiles, or major combat ships. Partly because of US efforts, much of its conventional military force is obsolescent or is equipped with less capable types of weapons.

  Much of the outcome of this aspect of US and Iranian military competition depends on how other nations treat arms sales to Iran. Iran has negotiated with Russia over sales of advanced types of modern combat aircraft, surface-to-air missiles, and ballistic missile defenses. It also actively seeks advanced systems from other countries.

  Moreover, Iran successfully imported Russian and North Korean submarines and a variety of Chinese anti-ship missiles. It also has acquired modern Russian and Chinese air-to-air, air-to-ground, SHORAD, and anti-armor missiles. It has modern Russian homing torpedoes and may possess advanced types of Russian and Chinese mines.

  Iran does have large conventional forces with significant capabilities to threaten and influence its neighbors. It is improving its ability to deter US naval and air operations—as well as potential operations by Israel and other states—and it has significant military options it might use against Iraq, targets in the Gulf, Gulf of Oman, and the GCC states. As the Israeli-Hezbollah War and use of shaped-charge IEDs in Iraq have shown, Iran has also strengthened its proxies in other areas.

  The end result is a constant and growing challenge to the US in the Gulf region, particularly in terms of air, missile, and naval warfare, as well as a challenge to the US in providing military support and transfer to the GCC states, Israel, and Iraq.

- *Asymmetric and irregular warfare*: *Iran has made major efforts to improve its capability for asymmetric warfare, and to use those forces to pressure, threaten, or attack other powers in ways which the US finds difficult to counter.*

  These Iranian efforts have generally focused on improving the capabilities of Iran's Islamic Revolutionary Guards Corps (IRGC), but they affect every aspect of Iran's

military and security efforts. Any weapon and any type of force can be used in asymmetric, irregular, or hybrid ways—from a terrorist proxy to a nuclear weapon.

Iran has already demonstrated its ability to use its forces in asymmetric and irregular warfare in a number of ways:

- Iranian tanker war with Iraq
- Oil spills and floating mines in the Gulf
- Use of Al Qods Force in Iraq
- Series of IRGC and naval/air exercises in Gulf and Gulf of Oman
- Iranian use of UAVs over Iraq
- Funding and training of Hezbollah; Provision of UAVs, long-range rockets, Kornet ATGMs to Hezbollah
- Incidents and demonstrations during pilgrimage in Makkah
- Transferring shaped charges and other advanced IEDs to Mahdi Army and others in Iraq; training of Iraqi insurgents
- Arms flows into western Afghanistan
- Shipments of arms to Hamas and Palestinians
- Support of Shi'ite groups in Bahrain
- Long-range ballistic missile and space tests; expanding range of missile programs. Iranian public description of possible missile attacks on Israel that indirectly demonstrating Iran's capability to attack its neighbors
- Naval guards seizure of British boats, confrontation with US Navy
- Long series of IRGC and Iranian military exercises in Gulf demonstrating ability to attack coastal targets, shipping, and offshore facilities

Iran's military efforts to compete with the US and its Gulf neighbors by developing capabilities for asymmetric warfare cannot be separated from Iran's emphasis on missiles and weapons of mass destruction (WMD). Both compensate for the limits of its conventional forces and act as a substitute. Moreover, if Iran does acquire – or is perceived to acquire – nuclear weapons, this will have at least some impact on deterring any response to Iran's use of asymmetric warfare. Iran's neighbors, as well as the US, Britain, France, and Israel must then at least consider the risk that Iran will escalate.

Iran has also gone to considerable lengths to use proxies to undermine the US presence and influence in regional countries. Examples include Iranian support for Shi'ite militant groups in Lebanon such as Hezbollah and Islamic Jihad, which led to the 1983 bombing of the US Marine barracks in Beirut, an event that pushed the US military presence out of the country. More recently, Iran has provided extensive material support and training to Shi'ite militias in post-2003 Iraq, which have constituted a thorn in the side of Coalition forces as well as a major obstacle to the establishment of a stable Iraqi state.

- *Expanded areas of operation and influence.* ***Figure III.2*** *shows that US-Iranian military competition now extends throughout much of the Middle East and North Africa, into Central and South Asia, and beyond; its strategic focus is centered on Iranian efforts to build up Iran's military capabilities in the Gulf, Straits of Hormuz, and Gulf of Oman.*

Iran is seeking the capability to challenge the US and other Gulf states with a mix of capabilities ranging from free-floating mines and small craft with anti-ship missiles, to the ability to conduct air attacks on key targets like desalination plants, as well as missile attacks on military bases and cities.

Many experts believe Iran already has a limited capability to halt most commercial shipping through the Gulf for a short period. Few doubt that Iran now has a mix of forces that can carry out low-level attacks and harassment over extended periods of time in ways that would make it difficult for the US and its allies to respond by escalating in a manner that would seem justified.

The US does, however, retain the advantage in scenarios that involve an Iranian attempt to "close the Gulf." Despite Iran's steadily advancing capabilities in asymmetric and proxy warfare, they are still vulnerable to US conventional forces and devastating precision attacks on its military and economic assets. Acquiring weapons of mass destruction, though, would serve as a potential deterrent to US conventional attacks on Iran.

- *Missiles and weapons of mass destruction: Iran is a declared chemical weapons power, has long-range missiles, may be developing biological weapons, and is seems to be seeking nuclear weapons to counter US capability to threaten and deter Iran, as well as to win influence over its neighbors. The US is seeking to prevent Iran from acquiring nuclear weapons and long-range missiles while simultaneously developing options to deter and defend against Iran if they should succeed.*

  A November 2011 report by the IAEA lists strong indicators that Iran has been moving towards a nuclear weapons capability since the mid-1980s. This seems to be a process that has been going on since the Iran-Iraq War, and that grew out of Khomeini's decision to resume nuclear research once Iran came under chemical weapons attack from Iraq.

  IAEA and other reports show that Iran developed underground nuclear facilities that it initially attempted to keep covert, and expressed an active interest in nuclear warheads for its missiles. Reports also show that Iran is making advances in its centrifuge designs that can greatly increase their capacity as well as making it far easier for them to create small, dispersed sites that will be far harder to detect. Even if Iran agrees to IAEA inspections and is vulnerable to some form of preventive attack, its growing technology base will continue to create new options for concealing a nuclear weapons program and/or developing a break out capability.

  The resulting competition between Iran's efforts to acquire nuclear capabilities, and efforts by the US and others to prevent such an occurrence, is only the most visible aspect of US-Iranian competition involving WMD. Iran is a declared chemical weapons power, although it has never complied with the Chemical Weapons Convention (CWC), nor stated its holdings. It probably has the capability to manufacture persistent nerve gas. It could certainly put such gas in a unitary warhead and probably has some cluster weapon capability.

  Iran is a signatory to the Biological Weapons Convention (BWC), but there are no firm data to indicate whether it does or does not have an ongoing biological weapons program. It is clear, however, that Iran does have the capability to develop and produce advanced

biological weapons – and could do so as either a supplement or substitute for nuclear weapons. Iran could acquire the ability to develop even more advanced genetically engineered biological weapons in within the next five years, roughly the same timeframe required to deploy a nuclear force.

There is no inspection regime for the BWC, and US studies raise serious questions as to whether such a regime is even possible. Accordingly, even if Iran did fully comply with all IAEA requirements, it could still develop and produce weapons of mass destruction. Similarly, there is no enforceable way that a true WMD free zone can be established and enforced in the Middle East – or any other area with advanced biotechnology.

Iran's missile programs represent another critical part of its military efforts and expenditures. Iran is making major advances in its long-range missiles, including the development of solid fuel systems. Its longer-range missiles have not, however, been tested in ways that demonstrate the reliability and accuracy required to be effective against anything other than area targets, unless they are armed with a nuclear warhead. A chemical missile warhead would have such limited lethality that it would be more a weapon of terror rather than a true weapon of mass destruction.

So far, the US has responded with efforts to prevent Iran from building and deploying nuclear weapons, by seeking to develop US and regional capabilities like missile defense, and by offering its allies "extended regional deterrence." There is little evidence, however, that the US has yet been able to halt Iran's nuclear program.

The ways in which the Gulf states will respond to Iran's efforts remain uncertain, but this is an area of US and Iranian competition where neither the US or Iran can ignore either the possibility that a state like Saudi Arabia will seek its own nuclear weapons or that Israel is not already involved in a nuclear and missile arms race with Iran.

Like the US, Israel has examined military options for strikes on Iran that could delay or prevent it from acquiring nuclear weapons. Israel is also making major improvements to its missile defense programs. As is discussed later in this study, Israel currently has the capability to target Iran with nuclear-armed missiles, and is reported to be developing nuclear-armed cruise missiles for its Dolphin submarines.

Israel has had French fission and fusion design and test data on nuclear weapons for decades. While Iran is still developing fission designs, Israel is probably targeting Iran with boosted and thermonuclear weapons. As a result, there is already an existential nuclear arms race in the region, although at present it is Iran and not Israel that is the target.

Differing National Perspectives

As is the case with every other aspect of US and Iranian competition, military competition is shaped by differing US, Iranian, and third country perceptions and politics.

US Perceptions

American policymakers and planners are forced to deal with Iran's military capabilities as they affect the entire region. They must focus on the full range of Iran's military actions and capabilities, and on the fact Iran plays a growing role outside the Gulf and Levant that the US

and many of its other allies perceive as an additional threat. American planners focus on the fact that Iran has begun to compete with the US on a global basis. Iran's actions range from interfering in the internal affairs of Morocco, to an anti-American political and propaganda alliance with the Chavez regime in Venezuela.

At the same time, American policymakers and planners have repeatedly made it clear that Iran poses an asymmetric threat in the Gulf and to all of its neighbors, and that Iran poses a threat that could lead to a major crisis in Gulf petroleum exports and world oil markets. The US is now deeply involved in a de facto alliance with the Southern Gulf states to deal with these threats, as well as with Jordan and Egypt in finding ways to contain Iran and limit its ability to pose a security threat to Iraq.

American policymakers and planners also feel that Iran's missile and potential nuclear weapons capabilities threaten the entire Gulf, many other MENA states, and Turkey. American policymakers see Iran's missiles as a potential threat to Europe in any confrontation where it seeks to deter US military action. They have also made it clear that they feel Iran not only threatens Israel, but the Arab-Israeli peace process as well. The US must deal with the fact that Iran opposes the current Arab-Israeli peace negotiations and is probably unwilling to accept any broad Arab-Israeli peace settlement in the near future.

Most American leaders do not, however, view this military competition as inevitably leading to some form of warfighting, nor do they see military options as desirable. American policymakers – and most Europeans as well – currently act on the perception that the Iranian threat can best be dealt with using options like sanctions and negotiations, and by focusing more on diplomatic options, although American leaders make it clear that military options remain on the table. Key US military leaders like Admiral Mullen, General Petraeus, and General Dempsey have made it clear that they oppose any near-term Israeli strike on Iran, and see such actions as deeply destabilizing at a time when the US is still engaged in Iraq and Afghanistan, and is dealing with a broader struggle against violent Islamic extremists.

Iranian Perceptions

Iran's policymakers and planners see the US as the major threat to Iran and claim to see it as the most significant threat – followed by Israel – to the entire region. While their private views may be different and more nuanced, and Iran uses the "threat" posed by the US and Israel to justify a military build up that is also directed at increasing its influence over its Arab neighbors and Turkey, key Iranian officers and leaders have described their military competition with the US as follows:

- *"Iran's military strategy is defensive in nature, while our tactics are offensive."* – Brigadier General Hossein Salami, Lieutenant Commander of the IRGC, June 28, 2011.
- *"The hegemonic system and its regional supporters should know that as they could not isolate or weaken the Iranian nation and could not trample upon the Iranian nation's rights through their supports for (former Iraqi dictator) Saddam Hussein and the Baath party, they will not succeed in ignoring the inalienable rights of the Iranians through continuing their threat, sanctions and Iranophobia strategy and through their resort to lies and deceitful measures, use of an arrogant language, hegemony and bullying behavior."* – Major General Gholam Ali Rashid, Deputy Head of the General Staff of Iran's Armed Forces
- **"***When we study history we reach the absolute conclusion that the only nation that is fit for passing through the last curve leading to the promised point is the pious and revolutionary, dear Iranian nation; a nation*

that with its Islamic Revolution started this great historic mission." – Iranian President Mahmoud Ahmadinejad, May 5, 2011.

- *"The new and young generation of the IRGC should be growingly higher and stronger (than the older generation) in knowledge, informedness, insight, dedication, correct and prompt accomplishment of tasks and duties, because although there is no military war happening today, a more delicate and of course more dangerous war is underway."* – Iranian Supreme Leader Khamenei, July 4, 2011.
- *"It is the warmongering and interventionist American leaders who try to harm good relations between the countries of the region by designing false matters and creating divisions."* – Ahmad Vahidi, Iranian Minister of Defense, December 13, 2010.
- *"The US' Iran 'scenario' is intended to create an excuse for its illegitimate presence and the sale of weapons in the region."* – Ahmad Vahidi, Iranian Minister of Defense, December 13, 2010.
- *"With the arrival of the British and later the Americans in the region, plots were hatched to try and change the name with fake identities... to distort the history and identity of the Persian Gulf."* – Major General Hassan Firouzabadi, Chief of Staff of Iran's armed forces, April 30, 2011.
- *"Whenever there is a problem, they [US] take out their guns."* – Iranian President Mahmoud Ahmadinejad, April 11, 2010.
- *"As the Commander-in-Chief (Ayatollah Seyed Ali Khamenei) has emphasized, our fingers should be kept on the trigger for deterrence."* – Lieutenant Commander of the IRGC Ground Forces, General Abolqassem Foroutan, July 13, 2011.
- *"We must exploit the chaotic situation and accelerate the arming of the resistance groups in Palestine.*

  Groups like HAMAS and Islamic Jihad should be armed with high-quality, modern weapons from Iranian production.

  In order to purposefully exert influence on the next Egyptian Government, we must support Shiite forces in the region and establish an anti-American axis." – A report provided to Supreme Leader Khamenei by the Iranian National Council, April 20, 2011.
- *"The [P]GCC should not put the blame for the ongoing developments in Bahrain on Iran. The Islamic Republic seeks peace in the region.*

  Iran's policy on Arab countries in the Persian Gulf has not changed and we still believe in good relations with these states.

  The Islamic Republic of Iran is the most influential country in the region which tightens regional security and has played a valuable role in defusing crisis and establishing security." – Alaeddin Boroujerdi, head of the National Security and Foreign Policy Commission of the Iranian Parliament, April 17, 2011.
- *"The Persian Gulf has always, is and shall always belong to Iran."* – Major General Hassan Firouzabadi, Chief of Staff of Iran's armed forces, April 30, 2011.
- *"Iranian forces are in complete control of the Strait of Hormoz and the Sea of Oman."* – Rear Admiral Ali Fadavi, commander of the IRGC navy, December 10, 2010.[4]

These statements, and others like them, do much to reveal the perceptions of Iranian leaders and military officers. They reflect Iran's perception of itself as a Gulf power and a natural regional leader, and as a state with a special mission and justification for its actions. Moreover, they show that Iran sees the US and the US' regional allies as the principal threat to what these leaders and officers perceive is Iran's right to emerge as the Gulf's dominant state.

[4] Quotes taken from a number of Iranian news sources such as Fars News, PressTV, the Tehran Times, and others. Also included are quotes from Western news outlets such as CNN, the New York Times, and the Washington Post.

These statements also track with Iranian military developments that reflect the country's perception that the US' military presence in the Gulf is hostile and unacceptable. Iran's focus on asymmetric doctrine in its military strategy illuminates what the country perceives as the primary threat to its regional influence and national security: the US 5th fleet and US military bases in the Gulf. Iran's response to the overwhelming American hard power in the region has been to develop a range of asymmetric assets that focus on confronting superior US forces while avoiding frontal combat, and establishing the ability to close the Gulf in ways that would disrupt international petroleum shipments.

Iran's ballistic missile arsenal is another reflection of its threat perceptions, as it constitutes another dimension of Iran's asymmetric response to the US' presence in the region. Iranian military officials often boast openly of the country's ability to strike at Israel and US bases in the Gulf with a range of missiles.

Fore example, the IRGC announced in February 2011 that it had developed an anti-ship ballistic missile, the *Khalij Fars* ("Persian Gulf"), which it claimed was capable of destroying US warships and commercial vessels.[5] This weapons system, and others like it, reflect Iran's threat perceptions and strategic priorities. Iran's focus on systems designed to counter superior US conventional forces is indicative that it perceives American – and other – foreign military power in the Gulf as an unacceptable threat to its national security and regional ambitions. As Iran has shaped its asymmetric assets, ballistic missile arsenal, and nuclear program as a deterrent to the US conventional advantage in the Gulf, it is clear that the American presence in the region is Iran's principle concern.

While Iran's perception of the US is negative and confrontational, Iran's security approach to its Gulf neighbors has been more nuanced, although its stance has steadily hardened in recent years and Iran was found to be carrying out an assassination ploit against the Saudi ambassador to the US in October 2011., Despite friendly rhetoric that invokes notions of Islamic brotherhood and regional solidarity, it is clear that Iran perceives its neighbors as competitors, not partners. In a speech in April of 2011, Iran's "National Day of the Persian Gulf," the Chief of Staff of Iran's armed forces – Major General Hassan Firouzabadi – articulated this perception clearly when referencing the GCC's intervention in Bahrain's 2011 unrest:

> "The Arab dictatorial regimes in the Persian Gulf are unable to contain the popular uprisings. Instead of trying and failing to open an unworkable front against Iran, these dictators should relinquish power, end their savage crimes and let the people determine their own future."[6]

Iran's perception of its Gulf neighbors as military competitors is reinforced by the fact that Iran is a revolutionary Shi'ite state, while most of its neighbors are Sunni-dominated monarchies that have close ties to the US. Even when Iranian officials do make conciliatory statements regarding their Gulf neighbors, they normally do not refer to them as equals. In September of 2010, the Iranian Defense Minister was quoted as stating that:

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[5] "Iran mass producing smart ballistic missiles: IRGC chief." Tehran Times, February 8, 2011.

[6] "Gulf 'Belongs to Iran': Top Military Officer." Associated Free Press. 30 April '11

> "There is no reason for regional countries to fear our weapons and military equipment… We have announced that whatever we have belongs to all regional nations, and we are even ready to supply… [Iranian-made weapons] to these countries."[7]

While such statements are not threatening, they are revealing in terms of Iran's regional aspirations and perceptions of its Gulf neighbors. Such offers to share arms and military technology with neighboring countries can be seen as political gestures, Iranian attempts to play a leadership role in the region, and as Iranian attempts to provide a counterweight or regional alternative to US patronage.

Arab Perceptions

As **Figure III.2** shows, every aspect of this US and Iranian military competition involves a wide range of other players. In general, this competition favors Washington. Iran has, however, created an informal military alliance with Syria and the Hezbollah in Lebanon, and is now actively competing for military influence in Iraq. The southern Gulf states, most of the rest of the Arab world, Israel, and a number of other regional powers, however, perceive Iran as a current or potential threat.

National perceptions do differ, though, in terms of risk, priority, and probability, evolving with changes in Iran's behavior, military forces, and nuclear capabilities. There are also differences between the perceptions of leaders and national security elites and the perceptions of the public and media.

Many Arab countries and Turkey have their own versions of hawks and doves in the way they view Iran as a potential threat. Such internal debates do, however, have to be kept in perspective. While the current political upheavals in the Arab world may change past alignments, it is the perceptions of national intelligence services, military planners, and top-level decision makers that usually shape national policy. These constituencies generally see Iran as a threat and the US as an ally.

In the past, Arab leaders have been less willing to publically refer to Iran as a threat, even though they would acknowledge it in private. Many Gulf leaders, military officials, and intelligence experts – as WikiLeaks' release of various diplomatic cables make clear – view Iran as a steadily growing threat. Gulf leaders not only view Iran's nuclear and missile capabilities as a threat, but they are also much more sensitive to the asymmetric threats that Iran poses to their territory and petroleum exports than most US policymakers and national security analysts.

US and Gulf leaders, military officials, and intelligence experts share a common concern over Iran's growing ability to use specialized asymmetric forces like the Al Qods Force as well as key elements of the IRGC. This focus has been strongly reinforced in recent months by events in Bahrain, and many in the Gulf feel that Iran has also supported the Houthi rebels in Yemen and is seeking dominant influence in Iraq. The US revelation of a plot to assassinate the Saudi ambassador to the US that is linked to Iran's Al Qods Force in October of 2011 has made such concerns even more serious. This raises problems for every Arab Gulf state with a Shi'ite

[7] Defense Minister Says US Arms Sales to Regional States a Plot Aimed at Iran." Islamic Republic News Agency. 22 Sept. '10

majority, as well as increases the risk of broader tension and clashes between Shi'ites and Sunnis throughout the Muslim world.

Turkey, which plays a critical role in dealing with Iran, Syria, and Iraq has been careful to avoid direct confrontation with Iran. It does, however, have major military forces in the east, plays a growing role in seeking to stabilize Iraq, and is considering missile defenses. It also is playing a growing role in seeking political reform and change in Syria – actions which would limit Iran's military links to Syria and Lebanon and possibly affect Iranian influence in Iraq.

Israeli perceptions

As later chapters discuss, Israel sees its military competition with Iran from a somewhat different perspective. Many Israelis see Iran as an emerging "existential" threat because of Iran's long-range missiles and nuclear program. They have a more narrow view of Iran as an asymmetric threat, and focus on Iranian actions like supporting Hezbollah in Lebanon and arming Hamas in Gaza. While Israel does have its own version of hawks and doves, nearly all Israelis broadly feel that Iran should be prevented from acquiring nuclear weapons, even if this means Israeli or US military strikes on Iran. While they are less focused on such issues, they also see missile defense as a key option and there is almost no public opposition (or discussion of any kind) of the role that Israel's undeclared nuclear forces play in deterring or potentially striking Iran.

At the same time, US, European, Gulf, Turkish, and Israeli threat perceptions all focus to some extent on the broader range of Iranian threats outlined in **Figure III.2**. These include the threats posed by Iran's ties to Syria, closer relations with Turkey, its role in Afghanistan, and its broader role in Central Asia. Arab states like Egypt and Jordan have expressed their concern over the potential threat posed by Iran's relations with Syria and the creation of a "Shi'ite crescent" that includes Lebanon and could come to include Iraq.

Finally, American, European, Gulf, Turkish, Israeli, Russian, Chinese, and other national threat perceptions cannot be decoupled from the "war of sanctions" between Iran and the US and Iran's diplomatic offensive in the UN – throughout the world – to block sanctions and win acceptance for its declared nuclear programs. This struggle includes Iran's efforts to use energy and other investment opportunities to win influence over China and Russia, as well as obtain imports of advanced arms from both countries. While Israel, the US, and the Gulf may perceive destabilizing arms sales and technology transfers to Iran in somewhat different ways, they all perceive such sales and transfers as a threat.

Figure III.2: Assessing the Full Range of Iranian Competition and Threats

Non-Military Competition

- *Ideology, religion, and political systems*
- *"Terrorism" and violent extremism vs. "counterterrorism"*
- *Energy, sanctions, and global economic impacts*
- *Arms control, arms exports, and arms imports*
- *International diplomac* y

Military Com petition

- *Weapons of mass destruction*
- *Conventional forces*
- *Asymmetric and irregular warfare*
- *Proxy use of state and non - state actors*
- *Threat and intimidation*

Nations and Sub -Regions of Competition

- *Gulf Cooperation Council countries*
- *Yemen*
- *Iraq*
- *Jordan*
- *Syria*
- *Lebanon*
- *Israel*
- *Gaza and West Bank*
- *Morocco*
- *Pakistan*
- *Turkey*
- *Afghanistan*
- *Central Asia*
- *Europe*
- *Russia*
- *China*
- *Japan and Asia*
- *Venezuela, Cuba, Brazil, Argentina*

Key Uncertainties in Assessing the Details of US and Iranian Military Competition

There are a wide range of useful data that provide insights into the details of US and Iranian military competition, and the role of Arab states and Israel, but it is important to keep unclassified sources in perspective. Estimates and perceptions of the data on Iran's conventional forces and asymmetric warfare capabilities are less divided, but this level of confidence only affects estimates of force size and key manpower and equipment numbers. Iran's intentions in building up such forces are far from clear, as are its intentions on using them. Iran often uses hardline rhetoric in threatening the use of such forces or describing their exercises, but this may be little more than a deterrent or threatening propaganda.

Other Iranian activity, like the use of its Al Qods Force, Revolutionary Guards, and intelligence branches in aiding non-state actors or conducting operations in countries like Iraq is far more covert and harder to assess. The US and Saudi Arabia, for example did not agree on the level of Iranian support of the Houthi rebels. There are disagreements on the level of Iranian covert activity in supporting dissidents in Bahrain, and experts disagree on some of the details of the role of the Al Qods Force, Sevak, and other elements of Iranian action in supporting Sadrist militias and hardline Shi'ite splinter groups, as well as covert support of AQIM for spoiler purposes. Gulf and Israel policymakers are also somewhat more concerned of the risk of a "Shi'ite crescent" including Iran, Iraq, Syria, and Lebanon that their US and European counterparts.

These differences between experts and by country are particularly important in the case of perceptions of Iran's nuclear weapons program. In spite of reporting like the IAEA report issued in November 2011, hard data are lacking on many aspects of Iran's current efforts, and experts are forced to speculate. There are still experts who question whether Iran is seeking nuclear weapons, and there is no consensus over how soon it will be able to get the weapons-grade fissile material it needs and be able deploy nuclear bombs and missile warheads – although the November 2011 IAEA report indicates that Iran has made much more progress in assembling the technology necessary to design a fission warhead small enough to mount on a missile and test it through simulated explosive testing than has previously been reported .

This issue is further complicated by major uncertainties over how many nuclear facilities Iran really has and how far it has gotten in producing more advanced centrifuges like the IR-2 and IR-4. Some experts estimate that even the IR-2 could be far more reliable and have some six times the output of the IR-1, making it far easier to disperse and conceal. The IR-4 would presumably be even more efficient, allowing Iran to conceal enrichment activity in smaller spaces and disperse such activity at much lower cost. Other uncertainties exist over its reactor project in Arak and whether it will seek more power reactors in ways that might affect its future weapons production capabilities. "Guesstimates" are notoriously unreliable – particularly in their worst-case form.

As yet, there are only very limited unclassified data on the size and nature of Iran's plans to deploy a nuclear-armed force; what role aircraft and various types of missile will play; how such a force will be based; and what kinds of command, control, computer, communications, and intelligence (C4I) systems Iran intends to deploy. It is clear that Iran has modified the warhead of its Shahab 3 in ways that would make it easier to mount a nuclear weapon, and that Iran is

constantly testing variants of its existing missiles and claiming it is producing new types, as well as using alleged satellite launches as a vehicle for research and development into ballistic missile technology. It may be shifting from liquid-fueled missiles to solid-fuel types, and it keeps changing warhead configurations.

There is no consensus among US, European, Gulf, or Israeli experts as to the level of political instability in Iran, how close it might be to some form of regime change, and how this affects the Iranian threat. There are advocates of the position that Iran faces massive popular discontent and advocates that the regime has reestablished secure control.

Officials and intelligence experts in the US, Europe, Gulf states, and Israel rarely seem to adopt either extreme, and differ sharply on how vulnerable Iran is to outside efforts at regime change. Few, however, seem to believe any major regime change is now likely or that sanctions are now likely to create public pressures that will halt Iran's nuclear efforts or fundamentally alter its relations with Israel, the US, or its neighbors.

There does seems to be some degree of expert consensus in both countries that there are disagreements among Iran's leaders that affect the threat it poses, and some of these differences have become public in debates over how to confront Israel and the US, the past details on Iran's negotiating positions, and how Iran should deal with internal and external threats. There also seems to be an expert consensus in Israel and the US that rivalries between Iran's leaders, its Revolutionary Guards and other Iranian political forces, and between the various elements of its military and security forces involve different perceptions of how Iran should shape almost every aspect of its military development and use of force.

At the same time, there is an equal level of consensus that talking about Iran as if it had one unified and detailed set Iranian policies, goals, and plans is misleading. There also seems to be some degree of agreement that Iran's constant denials that it is seeking nuclear or other weapons of mass destruction and refusals to cooperate with the UN and the International Atomic Energy Agency (IAEA) are efforts to disguise Iran's nuclear programs.

This consensus only extends to very broad trends, however, and it is scarcely surprising that experts and decision makers in the US and Israel – as well as each of the Gulf states, and key actors like Britain, France, Germany, China, and Russia – all have experts that perceive the threat from Iran in very different ways. No one can attend a range of international conferences on Iran without discovering that every country has officials, officers, and intelligence officers that take contrasting pessimistic and optimistic views of Iran. All have experts that disagree in detail over Iran's current threat and the threats that might emerge in the future.

There also is little point in trying to catalog just how different the views of US, European, Gulf, and Israeli intelligence experts really are because so many of the details are sensitive and classified, but it is clear that there is no one US or Israeli view of the threat. Moreover, sources like WikiLeaks show that few Gulf and Arab governments are as transparent in discussing national security issues as Western states, and – as WikiLeaks has made all too clear – Arab leaders often talk as if Iran were a friend in public while describing it as a threat in private.

Moreover, questions do arise over the unity of Iran's leaders and the relative role of key figures like its President and Supreme leader in shaping its military policies and force development. While the statements of its senior military officers in both its regular forces and the IRGC are relatively consistent, they are focused largely on external audiences and its not clear whether

they agree on any overall strategy, plans for force development, or operational plans. Iranian exercises do seem to have a significant degree of operational consistency, but they are anything but transparent. While it is possible to speculate about such power relationships and differences, too few data exist to really make meaningful judgments.

In short, any discussion of relative perceptions of any aspect of the Iranian threat has to be kept in careful perspective. Key data are lacking, uncertain, or disputed. Talking about the nominal threat perceptions of given countries has to focus on broad trends and what key officials, officers, and experts perceive – not the full range of different national views. Moreover, perceptions of future trends in Iran's actions range from potential worst cases to diplomatic success and claims that Iran either is not pursuing a given threatening trend or will reverse its course.

Competition in Conventional Military Forces

The competition in conventional forces largely favors the US and its regional friends and allies, although – as is discussed in a later chapter – Iraq is now a notable exception. The US and southern Gulf states not only have larger and far more modern conventional forces, but there is little prospect that Iran can begin to catch up in the near and mid-term. It should be noted, however, that it is far harder for the US to exploit this advantage if Iran can present the threat of nuclear escalation or a nuclear crisis, or if Iran's total mix of conventional and asymmetric forces are taken into consideration.

The Trends in the Conventional Balance

Figure III.3 shows that Iran has been unable to either compete in total military spending or import advanced modern arms on the scale required to shift the balance. In spite of constant propaganda claims to the contrary, Iran has as yet been unable to create national defense industries that can produce the range of systems required.

This is clearly reflected in the trends in Iranian and other Gulf conventional military forces shown in **Figure III.3 to Figure III.13** These figures show that Iran's conventional capabilities are limited relative to those of the southern Gulf states, and would be even more limited if it was possible to quantify the level of forces the US would deploy in a given contingency, but they can hardly be ignored.

The Limits to Iran's Air Power

Figures III.4 and **III.5** show that Iran lags badly behind the Gulf states in modernizing its air forces. Iran's most advanced fighters consist of a small number of export versions of the Su-24 and MiG-29, whose avionics lag far behind their Russian counterparts. These limits to Iran's air force are particularly important as Iran has air bases that are only a few minutes flight time from critical targets in the Gulf and in the coastal areas of the southern Gulf states.

Iran has sought more modern fighters from Russia, but past reports of sales have never materialized. As a result, Iran has sought to develop its own fighters, the most notable of which are the Saeqeh ("Thunderbolt") and the Azarakhsh ("Lightning"), both of which are based on the Northrop F-5. It also has made many claims to have modernized its fighters and their systems and munitions, although most such claims seem exaggerated:

- "*Sukhoi fighter jet has been optimized by the Army Air Force experts and now has the capability to hit and destroy targets with high precision in absolute darkness."* – General Seyed Mohammed Alavi, Lieutenant Commander of the Iranian Air Force for Operations, April 25, 2011.
- *"The production of hi-tech and advanced military tools, weapons and equipments [sic] displays Iran's might and power and proves that sanctions against the country have been futile.*

  Iran has recently made good progress in the air industry and has succeeded in gaining the technical know-how for producing stealth aircraft and drones." – Brigadier General Ahmad Vahidi, Iranian Minister of Defense, October 7, 2011.
- *"Now the Islamic Republic of Iran is not only independent in the area of defense industries production, but also exports strategic defensive items."* – General Mostafa Mohammad Najjar, Iranian Defense Minister Brigadier, February 6, 2006.
- *"One of the most important actions taken in these drills was increasing the range of the anti-radar missiles mounted on Sukhoi-24 fighters… they hit the specified targets successfully.*

  The missiles enjoy a 100-percent precision capability, meaning that they can hit any target with a zero margin of error." – Brigadier General Hossein Chitforoush, Iranian Air Force Lieutenant Commander, September 15, 2011
- *"The squadron is the first fighter squadron equipped with fighters [Saeqeh] and equipments made inside the country.*

  The squadron is capable of detecting and confronting aggressive aircraft and enemy fighters." – General Seyed Mohammad Allavi, Lieutenant Commander of Army's Air Force for Operations, February 25, 2011.
- *"By mass-production of home-made Saeqeh fighters, we move past all the gorges of designing and building of this fighter and we will strive to use more high-tech and updated models in our fleet in the future."* – Brigadier General Hassan Shahsafi, Iranian Air Force Commander, September 9, 2009. [8]

Although Iran's air assets have aged considerably in comparison with those of its Gulf neighbors, the southern Gulf states have special vulnerabilities. They are dependent on critical infrastructure such as desalination facilities. As they are comparatively small countries and lack the same strategic depth that Iran possesses, they are vulnerable to Iran's large force holdings and selective attacks that aim to cripple their critical infrastructure and coastal facilities.

Furthermore, while the air forces of the member states of the Gulf Cooperation Council (GCC) are more advanced than Iran's, they are not necessarily a decisive factor in a conflict with Iran: the forces of the Gulf states need improved interoperability, specialization, and orientation around key missions. Additionally, while the GCC could to serve as a unified military presence in the region, it now lacks effective unity of effort in war fighting, deterrence, and development terms.

Ground-Based Air Defenses

Figure III.7 shows that Iran has extensive surface-to-air missile assets, but most are obsolete or obsolescent. All of these systems are poorly netted, have significant gaps and problems in their radars and sensors, and are vulnerable to electronic warfare. Once again, Russia is Iran's only current potential source of the modern weapons Iran needs, and it would take major deliveries of

[8] Quotes taken from a number of Iranian news sources such as Fars News, PressTV, the Tehran Times, and others. Also included are quotes from Western news outlets such as CNN, the New York Times, and the Washington Post.

a new integrated air defense system based around the S-300 or S-400 surface-to-air missile to change this situation.

Iran has augmented its holdings of modern short range air defense (SHORAD) systems with the acquisition of some Tor-M1 (SA-15 Gauntlet) and Pantsyr S-1E (SA-22 Greyhound). Russia rejected the idea of deliveries of modern S-300PMU1 (SA-20 Gargoyle) long range SAMs in 2010, although a shift in Russian policy represents a potential risk. Iran has also claimed it is building its own S-300 equivalents, but such claims again seem to be exaggerated:[9]

- *"Manufacturing Bavar (Belief) 373 Missile System is in progress and all production needs have been supplied domestically.*

  This project will soon enter its final stage (of production) and it will be much more advanced than the S-300 missile system.

  The flaws and defects of the (Russian) S-300 system have been removed in the indigenous version of the system and its conceptual designing has finished." – Brigadier General Farzad Esmayeeli, Commander of Khatam ol-Anbia Air Defense Base, September 22, 2011.

- *"It is now several years that our defense industries researchers and experts have been designing a system whose capabilities are way beyond the S-300 missile system.*

  The system has been designed based on our own operational needs." – Colonel Mohammad Hossein Shamkhali, Deputy Commander of Khatam ol-Anbia Air Defense Base for Research and Self-Sufficiency Jihad, September 22, 2011.

- *"If they do not deliver S-300 defensive system to us, we have replacements and we can supply our operational requirements through innovative techniques and different designs."* – General Hassan Mansourian, Deputy Commander of Khatam ol-Anbia Air Defense Base for Coordination, July 6, 2010.[10]

Saudi Arabia and the smaller southern Gulf states have a wide mix of surface-to-air missile assets, but these were purchase with purchased with limited attention to interoperability with other Gulf states, and there effectiveness is limited in some cases by a lack of effective long-range sensors, battle management systems training and readiness, and strategic depth.

It should be stressed, however, that such comparisons do not include the massive air, surface-to-air missile, and ballistic missile defense forces the US could deploy. They also do not take account of the US ability to provide the GCC states and Iraq with IS&R, maritime surveillance, air control and warning, and missile defense data and command and control capabilities. In practice, a combination of Gulf and US forces would have a decisive advantage.

Land and Naval Forces

Figures III.8 and III.9 show that Iran's land and naval forces are large enough to present a serious threat, but that the vast majority are aging, of low to moderate capability, and lack modernization. At the same time, these same figures show that Iran does have large elements of its conventional forces that it can use to supplement the forces it is developing for asymmetric

[9] "Kremlin Bans Sale of S-300 Missiles to Iran." BBC. September 22, 2010. http://www.bbc.co.uk/news/world-europe-11388680

[10] Quotes taken from a number of Iranian news sources such as Fars News, PressTV, the Tehran Times, and others. Also included are quotes from Western news outlets such as CNN, the New York Times, and the Washington Post.

warfare. Moreover, they show that Iran has large enough ground forces to make any US invasion of Iran problematic at best.

Iran's conventional naval forces are large enough to present a challenge during the initial phases of any major clash, and they include submarines and minelayers, as well as advanced mines that can be delivered by any surface vessel. Moreover, as **Figure III.11** shows, Iran possesses a navy with large holdings of ship-to-ship missile (SSM)-equipped patrol craft. These assets, in combination with Iran's large fleet of submarines and minelayers, are formidable, even in the face of the more advanced weaponry of its neighbors.

Iranian officials and senior officers have made many claims that this gives Iran major capabilities for naval warfare and that Iran is buying new systems that are altering the naval balance in the Gulf:

- *"The new equipment (submarines) are smaller and faster under water and operate similar to our small speedboats, which terrify our enemies on the surface.*

  We are trying to increase our operational range and reach enemy vessels there [in the Indian Ocean]." – Major General Mohammed Ali Jafari, Commander of the IRGC, April 11, 2011.

- *"Underwater is a good area (of activity) that is used by our forces but in an asymmetric and small-scale form, meaning that we are not seeking to build large and giant submarines since they are vulnerable.*

  These new high-speed small-sized equipments [sic] (vessels) will have an underwater function similar to the performance of small speedboats in seas, an ability that has worried the enemy.

  Accordingly, we must use the same asymmetric approaches in building tools and equipments and even in defining our tactics.

  In addition to rapid transfer of forces and detection of the enemy's surface and subsurface vessels, these submarines can identify military targets and carry special forces, while they also enjoy rapid swamp power and have radar (sonar) evading capability.

  The system enjoys high-precision in targeting." – Major General Mohammed Ali Jafari, Commander of the IRGC, April 24, 2011.

- *"And now the Navy plans to widen its presence in the high seas in a bid to protect the country's interests and provide security for the country's shipping lines.*

  In case of a final approval, the Army's naval fleet will be dispatched to the Atlantic Ocean." – Rear Admiral Habibollah Sayyari, Commander of Iran's Navy, September 21, 2011.

- *"Missile frigates and destroyers have been equipped with these missiles since long time ago and the surface-to-surface missiles of the logistic vessels were successfully tested and assessed during the recent naval war games, dubbed as Joushan.*

  Right now we are mounting air-defense missile systems onto a number of surface vessels. Other units will also be equipped with these systems after final tests." – Rear Admiral Seyed Mahmoud Mousavi, Deputy Commander for Operations of Iran's Navy, July 20, 2011.

- *"The Navy is in a good status in terms of training and equipments [sic], and the Navy is equipped with new weapons and systems every year.*

  The range of the Navy's missiles and its coastal defense power are increasing on a daily basis." Rear Admiral Habibollah Sayyari, Commander of Iran's Navy, April 26, 2011.

- *"By dispatching the Iranian navy ships to the Mediterranean Sea and through the Suez Canal, the Iranian Navy has increased the radius of its operations to 7,000 kilometers."* – Commander Fariborz Ghaderpanah, Commander of Iran's First Naval Zone, March 23, 2011.

- *"The Islamic Republic of Iran's Jammaran destroyer, Sina missile frigate and different submarines are examples of the products that have already been manufactured (domestically) shown powerful in accomplishing missions in the sea."* – Rear Admiral Habibollah Sayyari, Commander of Iran's Navy, December 7, 2010.[11]

The Arab Gulf states do have countervailing weaknesses, and Iran's air and naval forces can still be used to selectively raid and attack targets in the Gulf region. They lack effective standardization and interoperability, but once again, they cooperate closely with the US. Without US support, the Arab states are potentially vulnerable to Iranian conventional naval attacks despite their military resources given their lack of strategic depth, training, and real-world war fighting experience. With US support, Iran's weaknesses would be decisive in anything other than a carefully managed asymmetric struggle.

The Problem of Iraq

The balance of Gulf forces could, however, become steadily more problematic if Iraq does not develop an effective Strategic Framework Agreement with the US. **Figure III.13** shows that the US invasion of Iraq stripped away Iraq's capability to deter and defend against Iran, and act as a regional counterbalance. Even if the US can develop an effective strategic partnership with Iraq, this situation is unlikely to change beforce 2020, if then. Iraq now lacks any coherent plan for force modernization, and its plans for limited imports of M-1 tanks and F-16 aircraft are only the first step in rebuilding effective national defense capabilities.

Measuring the Balance of US and Iranian Military Competition

These details help put some of the more exaggerated claims from Iranian officials and officers in perspective. Their statements about the role US military forces play in the Gulf, and the role and capabilities of Iran's conventional forces consistently downplay US capabilities and exaggerate Iranian capabilities:

- *"Iran is always one of the most powerful countries all throughout the world and enjoys the capability to confront any kind of threats by the enemies."* – General Kioumars Heidari, Lieutenant Commander of the Iranian Army's Ground Force, September 22, 2010.

- *"With our present technology, we can produce radars for different ranges and we can definitely detect enemies' stealth warplanes."* – General Hassan Mansourian, Deputy Commander of Khatam ol-Anbia Air Defense Base, September 19, 2010.

- *"The strong presence of the Islamic Republic of Iran's Navy in the high seas is promising and inspiring for nations.*

  The Islamic Republic of Iran doesn't favor aggression, but it favors presence in the high seas because these seas belong to all and are a ground for transfer of culture.

  A naval force with such strategic features will play a decisive role in the country's politics, national dignity and honor, and independence." – Supreme Leader Khamenei, July 24, 2011.

- *"Iran is self-sufficient in making and mass-producing artillery, tanks, helicopters and warships.*

[11] Quotes taken from a number of Iranian news sources such as Fars News, PressTV, the Tehran Times, and others. Also included are quotes from Western news outlets such as CNN, the New York Times, and the Washington Post.

In the recent resolution, arrogant powers banned weapons sales to Iran, but we do not need their weapons and we can even export such weapons." – Iranian Defense Minister Ahmad Vahidi, April 16, 2011.

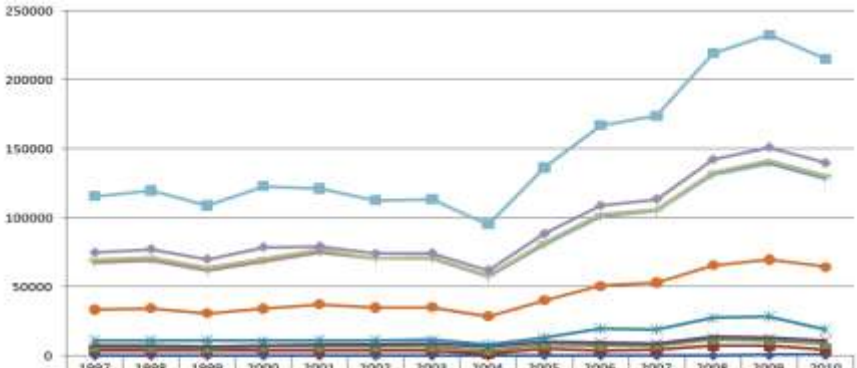
- "*Sukhoi fighter jet has been optimized by the Army Air Force experts and now has the capability to hit and destroy targets with high precision in absolute darkness."* – General Seyed Mohammed Alavi, Lieutenant Commander of the Iranian Air Force for Operations, April 25, 2011.[12]

In practice, the mix of US and Arab Gulf forces, bases, and resources would give the US and Arab Gulf states a decisive advantage in every aspect of conventional military competition. However, this mix of Iranian and Arab Gulf strengths and weakness confronts the US with at least a decade in which it must compete with Iran by maintaining enough conventional forces in the Gulf, and credible surge capabilities, to deter and defend against the full spectrum of the Iranian threats to the Gulf region, including missiles, weapons of mass destruction, asymmetric forces, and conventional forces. The US must focus on building up southern Gulf forces that can deal with the same spectrum of threats, and compete with Iran for influence in Iraq and to create Iraqi security forces that can both provide internal security and deter and defend against Iran.

[12] Quotes taken from a number of Iranian news sources such as Fars News, PressTV, the Tehran Times, and others. Also included are quotes from Western news outlets such as CNN, the New York Times, and the Washington Post.

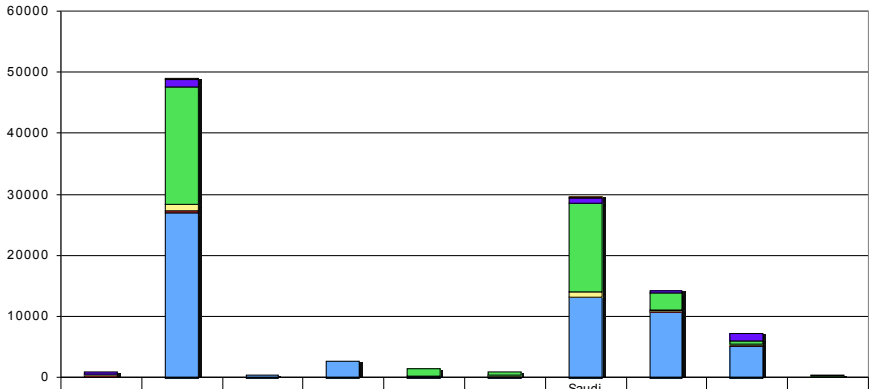
Figure III.3: Comparative Spending on Military Forces and Arms Sales

Military Spending *



	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Gulf Total	41074	42623	38983	44346	41849	38848	39107	33338	48043	58290	60379	76779	81377	75452
Iran	4996	6165	6060	7972	2232	3189	3189	3720	6590	6759	7310	9590	10000	9020
Iraq	1982	1382	1488	1488	1488	0	0	0	0	0	0	0	0	0
Yemen	437	421	456	529	570	547	596	940	1001	858	927	1490	1550	2020
GCC Total	33659	34655	30979	34557	37559	35112	35322	28678	40452	50676	52142	65699	69827	64412
Saudi Arabia	22323	23386	19878	23386	26256	23599	23599	20515	27000	30810	34020	38200	41200	45240
UAE	3614	3933	4039	3189	2976	2976	2976	1701	2817	9888	10292	13730	15470	7960
Qatar	1382	1382	1488	1275	1807	2020	2020	2232	2327	2430	1090	1750	1750	2500
Oman	2126	1913	1701	2232	2551	2445	2657	2764	3210	3410	3298	4657	4060	4060
Kuwait	3827	3614	3401	3933	3614	3720	3720	1275	4559	3640	4002	6810	6650	3910
Bahrain	387	427	472	542	555	552	550	191	559	498	550	552	697	742

Arms Sales **



	Iran	GCC	Bahrain	Kuwait	Oman	Qatar	Saudi Arabia	UAE	Iraq	Yemen
Total	*900	*49,000	*400	*2,600	*1,400	*900	*29,500	*14,200	*7,200	*400
All Others	100	200	0	0	0	100	100	0	100	0
All Other European	300	1,200	0	0	0	0	800	400	1,100	100
Major West European	0	19,200	0	0	1,300	500	14,600	2,800	600	100
China	100	1,100	0	0	0	100	900	100	100	0
Russia	400	300	0	0	0	0	0	300	200	200
US	0	27,000	400	2,600	100	200	13,100	10,600	5,100	0

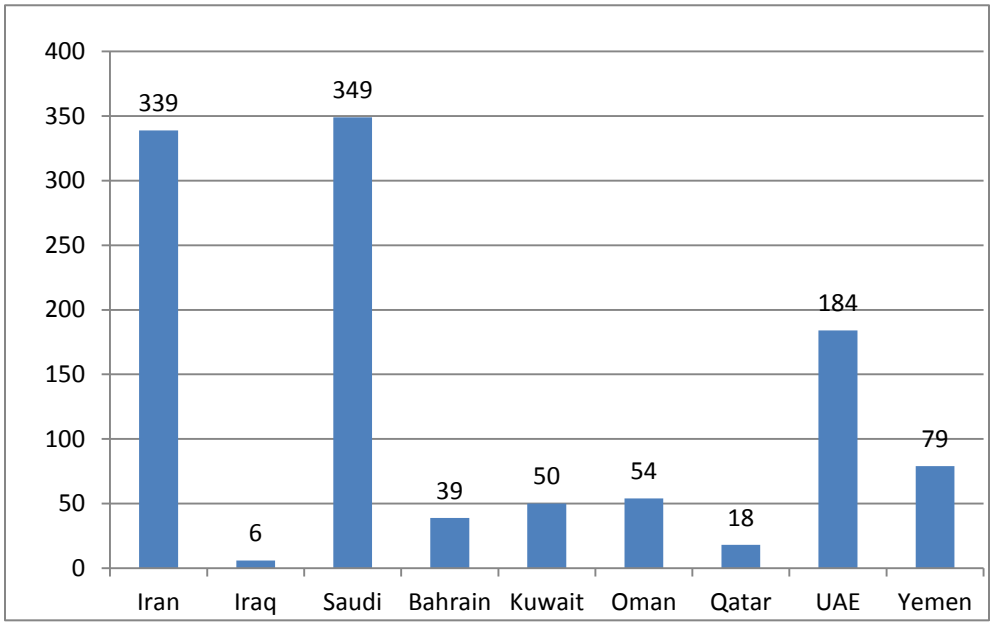
* Source: Adapted from the IISS, **Military Balance, 2011**; and the Jane's Sentinel series.

** 0 = Data less than $50 million or nil. All data rounded to the nearest $100 million.

Source: Adapted from Richard F. Grimmett, Conventional Arms Transfers to the Developing Nations, Congressional Research Service, 2000 edition, pp. 53-44, and 57-58.

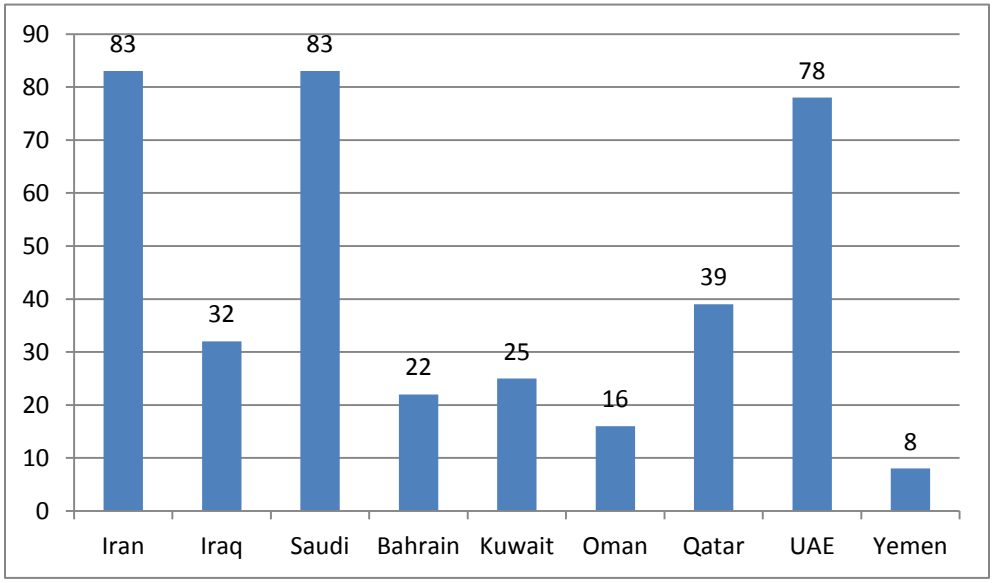
Figure III.4: Total Gulf Holdings of Combat Aircraft in 2011

Fixed Wing Combat Aircraft



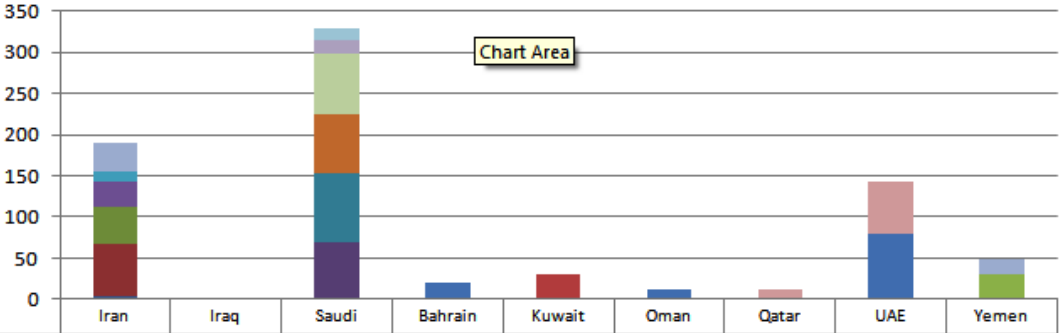
Note: Only armed or combat-capable aircraft are counted, not trainers, recce or other aircraft. Iraq has 6 Cessna AC-208Bs fulfilling dual recce and attack roles.

Armed and Attack Helicopters



Source: Adapted from IISS, The Military Balance, Periscope, JCSS, Middle East Military Balance, Jane's Sentinel and Jane's Defense Weekly. Some data adjusted or estimated by the author

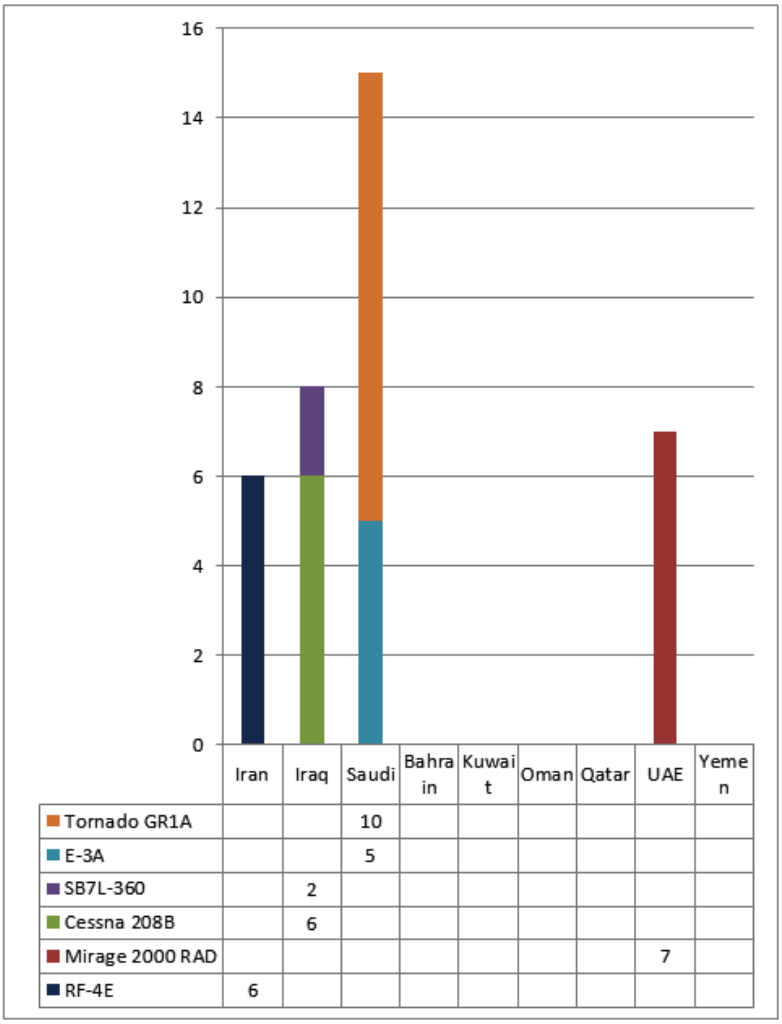
Figure III.5: Comparative Modern Iranian and Gulf Air Forces



	Iran	Iraq	Saudi	Bahrain	Kuwait	Oman	Qatar	UAE	Yemen
Typhoon-2			16						
Tornado ADV			15						
Tornado IDS			75						
Mirage 2000							12	62	
MiG-29	35								18
MiG-25									
Su-25	13								
Su-24	30								
Su-20/22									30
F-18					31				
F-16				21		12		80	
F-15S			70						
F-15C/D			84						
F-15S			70						
F-14	44								
F-4D/E	65								
Saegheh	3								

Source: Adapted from the IISS, **Military Balance, 2011**; and the Jane's Sentinel series.

Figure III.6: Gulf Reconnaissance and AWACS Aircraft in 2011



	Iran	Iraq	Saudi	Bahrain	Kuwait	Oman	Qatar	UAE	Yemen
Tornado GR1A			10						
E-3A			5						
SB7L-360		2							
Cessna 208B		6							
Mirage 2000 RAD								7	
RF-4E	6								

* These figures show that that Saudi Arabia has a monopoly of airborne warning and control systems, and that its AWACS aircraft give it a major advantage in battle management, some forms of intelligence collection and air force maritime patrol capability. They also reflect the limited emphasis on reconnaissance aircraft capability in the Gulf region, and the limitations to situation awareness and targeting. While Iraq has growing holdings, their impact and mission integration are more geared towards internal security and support for COIN operations. The problems for the southern Gulf States will, however, be of limited importance if they operate in a coalition with the US.

Source: Adapted from IISS, The Military Balance, Periscope, JCSS, Middle East Military Balance, Jane's Sentinel and Jane's Defense Weekly. Some data adjusted or estimated by the author.

Figure III.7: Comparative Land Based Air and Missile Defense Forces

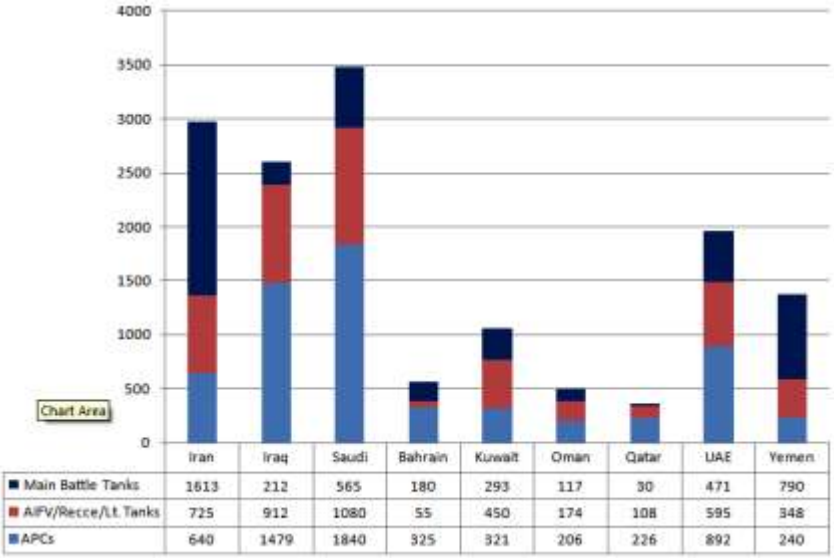
Country	Major SAM	Light SAM	AA Guns
Bahrain	8 I Hawk MIM-23B 60	R BS-70 18 FIM-92A Stinger 15 7 Crotale	27 guns Oerlikon 35 mm 12 L/70 40 mm
Iran	16/150 I Hawk 3/10 SA-5 45 SA-2 Guideline	SA-7/14/16, HQ-7 29 SA-15 S o me QW-1 Misaq 29 TOR-M1 Some HN-5 5/30 Rapier 10 Pantsyr (SA-22) Some FM-80 (Ch Crotale) 15 Tigercat Some FIM-92A Stinge r	1,700 Guns ZSU-23-4 23mm ZPU-2/4 23mm ZU-23 23mm M-1939 37mm S-60 57mm ZSU-57-2
Iraq			
Kuwait	5 / 24 I Hawk Phase III 12 5/40 Patriot PAC-2 12	Aspide S t a rburst Aspide Stinger	12 Oerlikon 35mm
Oman	None	Blowpipe 8 Mistral 2 SP 12 Panstsyr S1E 34 SA-7 6 Blindfire S713 Martello 20 Javelin 40 Rapier	26 guns 4 ZU-23-2 23 mm 10 GDF-005 Skyguard 35 mm 12 L-60 40 mm
Qatar	None	10 Blowpipe 12 FIM-92A Stinger 9 Roland II 24 Mistral 20 SA-7	?
Saudi Arabia (NG)	16/128 I Hawk 4-6/16-24 Patriot 2 17/73 Shahine Mobile 16/96 PAC-2 launchers 17 ANA/FPS-117 radar 73/68 Crotale/Shahine	40 Crotale 500 Stinger (ARMY) 92 500 Mistral (ADF) 500 FIM-43 Redeye 500 Redeye (ADF) 128 73-141 Shahine static	1,220 guns M-163 Vulcan 20 mm 30 M-167 Vulcan 20 mm 850 AMX-30SA 30 mm GDF Oerlikon 35mm 150 L-70 40 mm (in store) 130 M-2 90 mm (NG)
UAE	2/6/36 I Hawk	20+ Blowpipe 20 Mistral Some Rapier Some Crotale Some RB-70 Some Javelin Some SA-18	62 guns 42 M-3VDA 20 mm SP 20 GCF-BM2 30 mm
Yemen	S o me SA-2, 3 Some SA-6 SP	Some 800 SA-7 Some SA-9 SP Some SA-13 SP Some SA-14	530 guns 20 M-163 Vulcan SP 20mm 50 ZSU-23-4 SP 23 mm 100 ZSU-23-2 23 mm 150 M-1939 37 mm 50 M-167 20mm 120 S-60 57 mm 40 M-1939 KS-12 85 mm

Source: Adapted by Anthony H. Cordesman from IISS, The Military Balance, Periscope, JCSS, Middle East Military Balance, Jane's Sentinel and Jane's Defense Weekly. Some data adjusted or estimated by the author.

Source: Adapted from the IISS, **Military Balance, 2011**; and the Jane's Sentinel series.

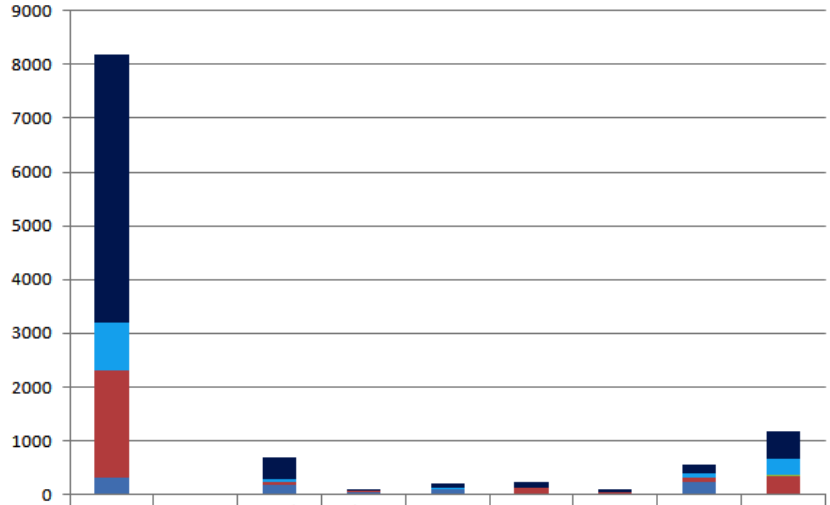
Figure III.8: Comparative Iranian and Gulf Land Forces

Comparative Armor



	Iran	Iraq	Saudi	Bahrain	Kuwait	Oman	Qatar	UAE	Yemen
Main Battle Tanks	1613	212	565	180	293	117	30	471	790
AIFV/Recce/Lt. Tanks	725	912	1080	55	450	174	108	595	348
APCs	640	1479	1840	325	321	206	226	892	240

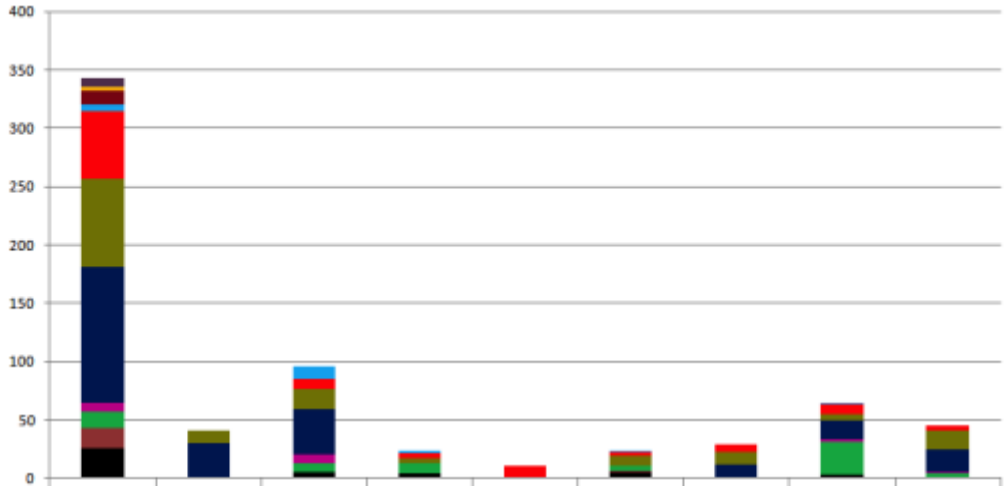
Comparative Artillery



	Iran	Iraq	Saudi	Bahrain	Kuwait	Oman	Qatar	UAE	Yemen
Mortar	5000		400	24	78	101	45	155	502
Multiple Rocket Launcher	876		60	0	27	0	4	92	294
Assault and Coastal	0		0	0	0	0	0	0	36
Towed Tube	2010		58	26	0	108	12	93	310
Self-Propelled Tube	310		170	33	95	24	28	221	25

Source: Adapted from the IISS, **Military Balance, 2011**; and the Jane's Sentinel series.

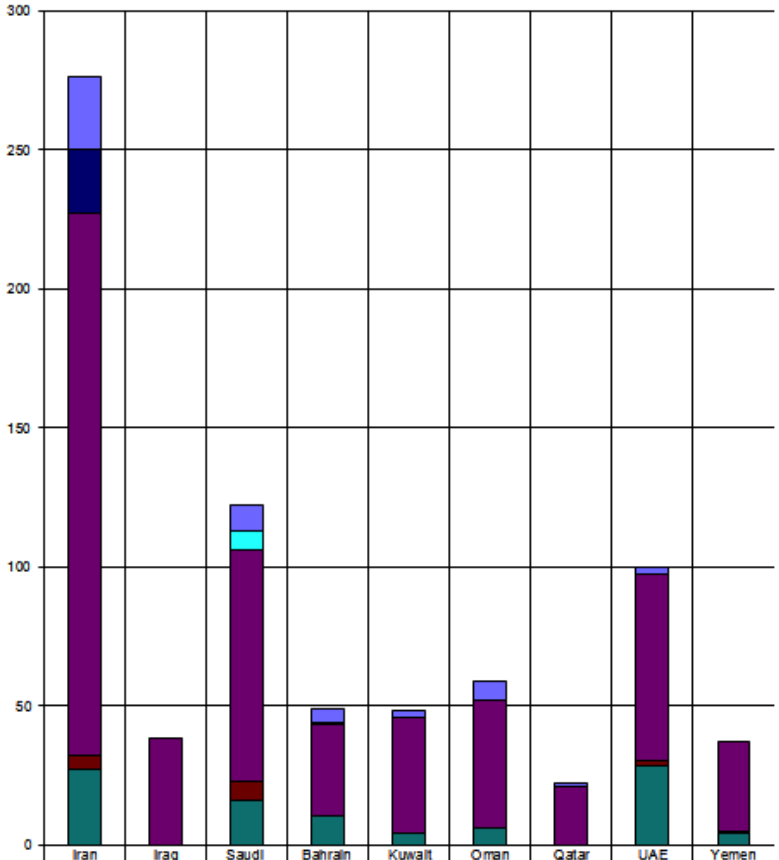
Figure III.9: Comparative Iranian and Gulf Major Naval Forces



	Iran	Iraq	Saudi	Bahrain	Kuwait	Oman	Qatar	UAE	Yemen
SDVs	8								
Submarines	3								
Midget Submarines	12								
Major Missile Combat	5		11	3		2		2	
Major Other Combat	1								
Missile Patrol	57		9	4	10	3	7	8	4
Other Patrol	76	11	17	4		8	10	6	16
Armed Boats	117	30	39				11	16	20
Mine	7		7					2	1
Landing Craft	14		8	9		5		28	3
Amphibious Ships	17					1	1		1
Support	26		5	4	1	5		3	

Source: Adapted from the IISS, **Military Balance, 2011**; and the Jane's Sentinel series.

Figure III.10: Iranian and Gulf Smaller Naval Ships by Category in 2011

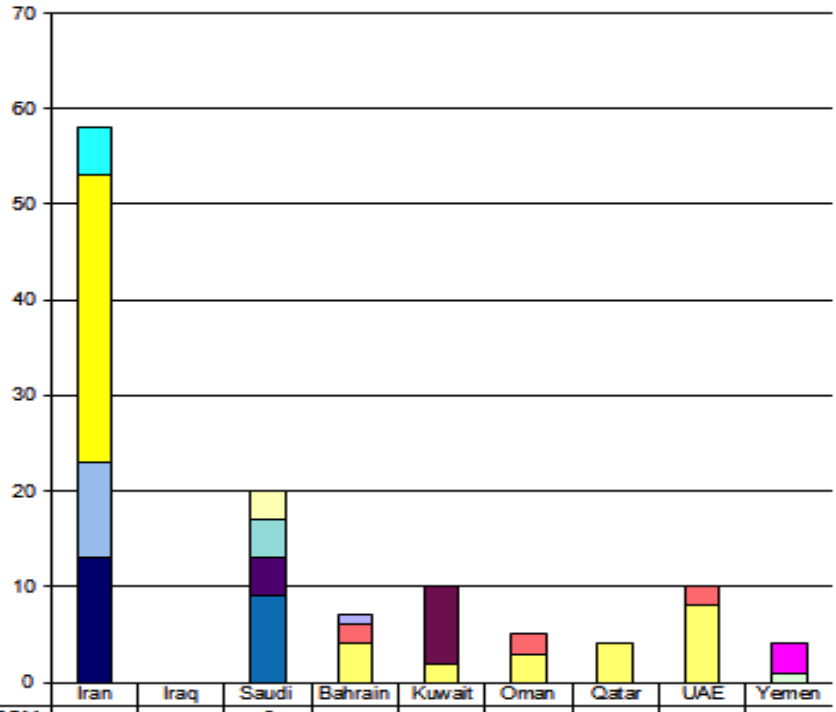


	Iran	Iraq	Saudi	Bahrain	Kuwait	Oman	Qatar	UAE	Yemen
Support	26		9	5	2	7	1	3	
Submarines	23								
Principle Surface Combatants			7	1					
Patrol and Coastal Combatants	195	38	83	33	42	46	21	67	32
Mine	5		7					2	1
Amphibious	27		16	10	4	6		28	4

Note: Iranian totals include active forces in the Revolutionary Guards. Totals include coast guard-operated patrol and costal combatants where applicable.

Source: Adapted from IISS, The Military Balance, Periscope, JCSS, Middle East Military Balance, Jane's Sentinel and Jane's Defense Weekly. Some data adjusted or estimated by the author.

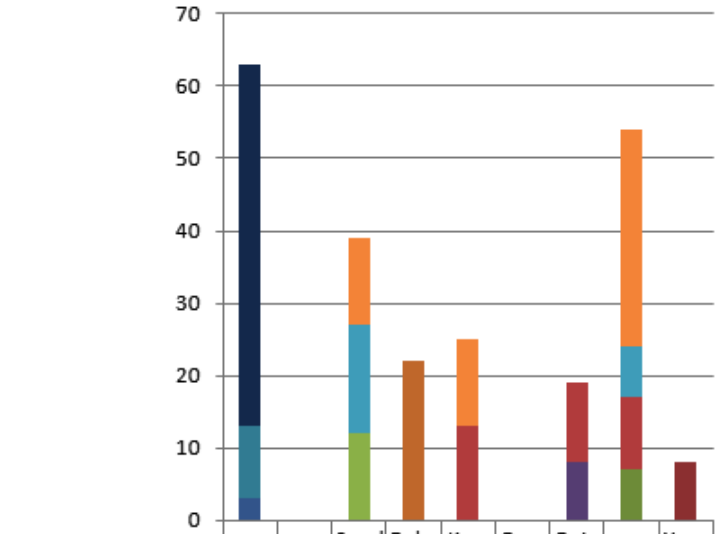
Figure III.11: Gulf Warships with Anti-Ship Missiles in 2011



	Iran	Iraq	Saudi	Bahrain	Kuwait	Oman	Qatar	UAE	Yemen
Destroyers with MM-40 Exocet SSM			3						
Frigates with MM-40 Exocet SSM									
Frigates with Harpoon SSM				1					
Frigates with Otomat SSM			4						
Corvettes with CCS-N-4 SSM	5								
Corvettes with Harpoon SSM			4						
Corvettes with MM-40 Exocet SSM				2		2		2	
Patrol Craft with Harpoon SSM			9						
Patrol Craft with C-701 SSM	30								
Patrol Craft with C-802 SSM	10								
Patrol Craft with CSS-N-4 SSM	13								
Patrol Craft with Sea Skua SSM					8				
Patrol Craft with MM-40 Exocet SSM				4	2	3	4	8	0
Patrol Craft with SS-N-4 SSM									3
Patrol Craft with SS-N-2 SSM									1

Source: Adapted from IISS, The Military Balance, Periscope, JCSS, Middle East Military Balance, Jane's Sentinel and Jane's Defense Weekly. Some data adjusted or estimated by the author.

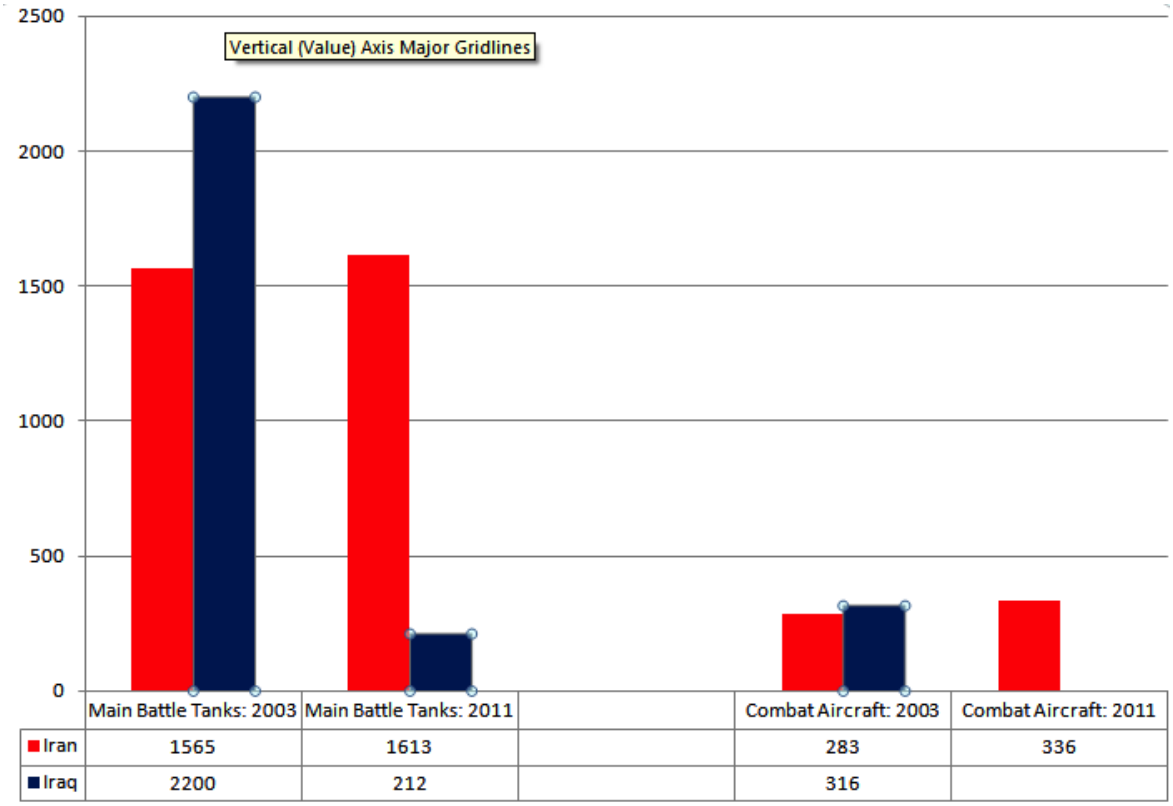
Figure III.12: Gulf Attack, Anti-Ship and ASW Helicopters in 2011



	Iran	Iraq	Saudi	Bahrain	Kuwait	Oman	Qatar	UAE	Yemen
AH-64			12		12			30	
AS-565			15					7	
AS-550C3									
AS-532 Exocet			12						
SA-342 HOT					13		11	10	
AH-1J	50								
AH-1E				22					
SH-3D	10								
Commando Exocet							8		
AS-332 Exocet								7	
Mi-35									8
RH-53D	3								

Source: Adapted from IISS, The Military Balance, Periscope, JCSS, Middle East Military Balance, Jane's Sentinel and Jane's Defense Weekly. Some data adjusted or estimated by the author.

Figure III.13: Shifting the Balance: Iran vs. Iraq in 2003 and 2011



Category	2003 Iraq	2003 Iran	2003 Force Ratio	2011 Iraq	2011 Iran	2011 Force Ratio
Active Manpower	424,000	513,000	8:10	245,782	523,000	2:5
Reserve Manpower	650,000	350,000	19:10	0	350,000	NA
Main Battle Tanks	2,200	1,565	7:5	212	1,613	1:8
OAFVs	1,300	815	8:5	434	725	1:1.7
Reconnaissance				478	35	
APCs	2,400	590	4:1	1,479	640	23:10
Towed Artillery	1,900	2,085	9:10	0	2,010	NA
SP Artillery	150	310	1:2	0	310	NA
MRLs	200	889	1:5	0	876	NA
Combat Aircraft	316	283	11:10	0	336	NA
Attack Helicopters	100	85	6:5	0	50	NA
Major SAM Launchers	225	205	11:10	0	289	NA

Source: Adapted from IISS, The Military Balance 2011, various editions and Jane's Sentinel series.

Competition in Asymmetric Forces

Iran provides a wide range of description of its programs (and claims of progress) in building up its asymmetric forces and the role they might place in US and Iranian military competition. It should be noted that while such competition would have far less serious effects than any use of nuclear weapons, it is still a critical aspect of US and Iranian competition, and Iran's actual use of such forces would be much less provocative and is much more probable. This makes this area of military competition critical to both the Arab Gulf states, the secure flow of world energy exports, and the stability of the global economy.

Iran's Growing Asymmetric Forces

Mohammad Ali Jafari, the commander in chief of the IRGC has made numerous statements regarding Iran's growing emphasis on asymmetric or irregular warfare, and the role it plays in US and Iranian military competition. One such statement notes that,,

> "Asymmetrical warfare... is [our] strategy for dealing with the considerable capabilities of the enemy. A prominent example of this kind of warfare was [the tactics employed by Hezbollah during] the Lebanon war in 2006... Since the enemy has considerable technological abilities, and since we are still at a disadvantage in comparison, despite the progress we have made in the area of equipment, [our only] way to confront [the enemy] successfully is to adopt the strategy [of asymmetric warfare] and to employ various methods of this kind."

Other Iranian leaders and officials have echoed these themes and provided more detail:

- *"Our method (of choice in any possible war) is asymmetric warfare since enemy's systems and military doctrine have been designed based on the classical methods of battling."* – Brigadier General Farzad Esmayeeli, Commander of Khatam ol-Anbia Air Defense Base, August 28, 2011.
- *"Underwater is a good area (of activity) that is used by our forces but in an asymmetric and small-scale form, meaning that we are not seeking to build large and giant submarines since they are vulnerable.*

  These new high-speed small-sized equipments [sic] (vessels) will have an underwater function similar to the performance of small speedboats in seas, an ability that has worried the enemy.

  Accordingly, we must use the same asymmetric approaches in building tools and equipments and even in defining our tactics.

  In addition to rapid transfer of forces and detection of the enemy's surface and subsurface vessels, these submarines can identify military targets and carry special forces, while they also enjoy rapid swamp power and have radar (sonar) evading capability.

  The system enjoys high-precision in targeting." – Major General Mohammed Ali Jafari, April 24, 2011.
- *"We should sketch out plans in a bid to resolve problems, and our goal should be winning the upper hand in the balance of powers in asymmetric wars."* – Brigadier General Ahmad Miqani, Commander of Khatam ol-Anbia Air Defense Base, July 6, 2009.
- *"What makes up for asymmetries in wars against those countries which enjoy technological superiority and hi-tech military tools and equipment is faithful and highly motivated troops."*

  "This faith and motivation can resist against the enemies' superior equipment and make up for a given country's technological lacks and inferiorities. Therefore, Baseej, as a faithful and motivated force, plays a decisive, fundamental and pivotal role in asymmetric battles." – Major General Mohammed Ali Jafari, Commander of the IRGC, December 10, 2007.
- "*We can use all the available military equipment and tools in any (possible) asymmetric war through creativity, initiative and employing new methods.*

We should redefine methods for utilizing weapons in accordance with the type of the combat." – Brigadier General Mohammad Pakpour, Commander of the IRGC Ground Force, July 16, 2009.

- *"The new equipment (submarines) are smaller and faster under water and operate similar to our small speedboats, which terrify our enemies on the surface.*

  "We are trying to increase our operational range and reach enemy vessels there [in the Indian Ocean]." – Major General Mohammed Ali Jafari, Commander of the IRGC, April 25, 2011.

- *"All divisions of the Islamic Republic's military pay close attention to events in neighboring states and incorporate these into their asymmetric warfare training. For example, if we train pilots in aerial combat, we actively link those lessons with asymmetric warfare."* – Brigadier General Ataollah Salehi, commander-in-chief of the Iranian army, January 12, 2011.

- *"The Kaviran meets our needs in asymmetric warfare. Its high rate of fire could enhance our ability to confront helicopters and low-level planes."* – General Ahmad-Reza Purdastan, commander of the Islamic Republic of Iran Army Ground Force regarding the development of the new Kaviran all-terrain vehicle and its 7.62 mm Gatling gun, September 23, 2010.

- *"The Revolutionary Guards [Corps] will invest efforts in strengthening its asymmetrical warfare capabilities, with the aim of successfully confronting the enemies."* – Major General Mohammed Ali Jafari, Commander of the IRGC.

- *"After September 11, [2001], all [IRGC] forces changed their [mode of] operation, placing emphasis on attaining combat readiness. The first step [towards achieving] this goal was to develop [a strategy] of asymmetrical warfare and to hold maneuvers [in order to practice it]."* – Major General Mohammed Ali Jafari, Commander of the IRGC. [13]

These statements, and others like them, show the trends in Iran's perceptions, actions, and force development, and highlight key exercises and developments in military technology. Other open source evidence also shows that Iran is building an increasingly capable asymmetric capability that relies on light fast-attack watercraft, midget submarines, anti-ship missiles, smart mines, light guided weapons, and UCAVs, all effective asymmetric tools to counter the superior conventional forces of its neighbors.

These assets include small, mobile, hard-to-detect platforms such as the Qadr-SS-3 midget submarine, high-speed combat boats such as the Seraj-1 and Zolfaqar, the Bavar-2 flying boat, the Kaviran all-terrain vehicle, and the ATV-500 *Jaguar*, among others, all of which fit into the IRGC's asymmetric doctrine.[14][15][16]

These systems, while low-tech and lightly-armed, are not capital-intensive and are intended to offset superior military technology through sheer numbers and high mobility. As Iran understands that the country cannot reasonably fight the US in a frontal confrontation, these assets are designed to strike at vulnerable targets and critical infrastructure, such as Gulf shipping, oil tankers, oil platforms, and coastal desalination facilities.

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[13] Quotes taken from a number of Iranian news sources such as Fars News, PressTV, the Tehran Times, and others. Also included are quotes from Western news outlets such as CNN, the New York Times, and the Washington Post.

[14] PressTV, August 10, 2010

[15] Tehran Iranian Student News Agency (ISNA), September 23, 2010.

[16] Internet Mashregh News, December 31, 2010.

They also give Iran greater capability for asymmetric (or irregular) warfare than conventional warfare. Iran has developed a wide mix of land, air, and naval capabilities that can threaten its neighbors, challenge the US, and affect other parts of the Middle East and Asia. These capabilities include Iran's ability to threaten and intimate its Gulf neighbors, and threaten Gulf exports.

Iran may also be able to use state and non-state actors as proxies to threaten and manipulate a range of neighboring states, including Afghanistan, Iraq, and Israel. These forces are the key military elements of Iranian strategic competition and are steadily increasing in size and capability.

Conventional Weakness vs. Asymmetric Capability

Iran's conventional weakness does need to be kept in careful perspective. It has spent nearly two decades building up capabilities for asymmetric and revolutionary warfare. These are largely capabilities the US can counter relatively quickly in any outright conflict, but which give Iran a powerful capability to intimidate its neighbors, and which would be far harder for the US to defeat in a limited war of attrition where the US might not be able to act decisively in striking Iranian forces and targets.

These are difficult capabilities to summarize, but many trends are clear. Iran's military doctrine places heavy emphasis on asymmetric warfare:

- Iran sends signals about its use of asymmetric warfare through its military parades and exercises.
- 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 often a fraction of IRGC claims.
- By displaying both its real and virtual military (e.g. naval) fighting capabilities through electronic, printed and network media, and through official statements, Iran seeks to achieve the following politico-diplomatic and propaganda ends (4Ds):
    1. Defiance (to maintain a course of resistance, targeting primarily the Western political will and system).
    2. Deception (on the real state of Iranian warfighting capabilities, targeting the Western military establishments).
    3. Deterrence (with the IRI military "might", targeting Western public opinion, delivered through the media).
    4. Demonstration (of the outreach of its own power, targeting the Iranian people and the Moslem world).

Iran's asymmetric capabilities interact with its nuclear weapons development efforts to compensate for the limitations to its conventional forces. "Going nuclear" provides a level of intimidation that Iran can use as both a form of terrorism and to deter conventional responses to its use of asymmetric warfare:

- Even the search for nuclear power is enough to have a major effect on competition and perceptions.
- Development of long range missiles adds to Iran's credibility and pressure on Iran's competitors.
- Crossing the nuclear threshold in terms of acquiring a "bomb in the basement" option.

- Threats to Israel legitimize the capability to tacitly threaten Arab states. Support of Hamas and Hezbollah increase legitimacy in Arab eyes – at least Arab publics.
- Many future options: stockpile low enriched material and disperse centrifuges, plutonium reactors, underground tests, actual production, arm missiles, breakout arming of missiles.
- Declared forces, undeclared forces, leverage Israeli/US/Arab fears.

At the same time, "going Asymmetric" allows Iran to substitute asymmetric forces for weak conventional forces:

- Combined nuclear and asymmetric efforts sharply reduce the need for modern conventional forces – which have less practical value.
- Linkages to Syria, Lebanon, other states, and non-state actors like Hamas and Hezbollah add to Iran's ability to deter and intimidate/leverage.
- Iran can exploit fragility in the Gulf, world dependence on oil exports, and GCC dependence on income and imports.
- Threats to Israel again legitimize the capability to tacitly threaten Arab states.

Unlike Iran's nuclear and missile programs, Iran has also proven its capability to use such forces effectively. Iran's past actions have shown this threat is all too real:

- Iranian tanker war with Iraq.
- Oil spills and floating mines in the Gulf.
- Use of Al Qods Force in Iraq.
- Iranian use of UAVs.
- Border and coastal "incidents."
- Arms transfers, in cooperation with Syria, to Hezbollah.
- Pilgrimage "incidents" in Makkah.
- Support of Shi'ite groups in Bahrain.
- Missile and space tests; expanding range of missile programs (future nuclear test?).
- Naval guards' seizure of British boat, confrontation with US Navy, exercises in Gulf.
- Development of limited "close the Gulf" capability.
- Hamas/PIJ arms transfer and their rocket attacks on Eilat, Aqaba in August 2010.
- Iran regularly practices "swarming" targets in the Gulf with large numbers of small craft, shore-based anti-ship missiles, missile-armed aircraft, and increasing support from UAVs/UCAVs.
- Increasingly arming and supporting insurgents in Afghanistan.

Iran's Growing Mix of Asymmetric Warfare Forces

Iran has steadily improved the capabilities and training of its conventional forces for asymmetric warfare, but it has also built up specialized elements within its force structure.

As of 2011, some of the key recent developments in Iran's growing asymmetric capabilities included:

- The development of the *Karrar* and *R'ad* UCAVs in early 2010, both of which have a range in excess of 1000 km and can destroy targets with guided munitions.[17]
- The installation of a "Coastal Defense Missile" system along the country's 1,500 mile coastline, a move deemed the "appropriate strategy" to protect the country from attack.[18]
- The development of the *Khalij Fars* ("Persian Gulf") anti-ship ballistic missile.[19]
- The introduction of new high-speed combat boats armed with guided missiles and torpedoes such as the Seraj-1 and the Zalfaqar.[20]
- The introduction of the Bavar-2 flying boat, which is equipped with night vision and armed with machine guns and rockets.[21]
- The introduction of high mobility all-terrain vehicles such as the ATV-500 Jaguar and the Kaviran.[22][23]
- Increasing use of SDVs ("Swimmer Delivery Vehicle"), which can be used for inserting special forces elements or laying mines covertly.

The core aspects of Iran's growing capabilities for asymmetrtic warfare are shown in **Figure III.14,** but this is only part of the story:

- **Figure III.15** shows the expanding capabilities of the IRGC, and the pivotal role it is coming to play in shaping Iran's overall military capabilities. The IRGC is not only playing a growing role in Iran's overall force mix, but in its top leadership and economy.
- **Figure III.16** describes the evolving military capabilities of the IRGC. They are tailored to both offensive and defensive irregular and asymmetric warfare.
- **Figure III.17** describes the special role of the naval branch of the IRGC and the critical role it can play in asymmetric warfare in the Gulf.
- **Figure III.18** shows Iran's strength in naval asymmetric warfare capabilities relative to that of other Gulf navies. It should be noted, however, that few Iranian Navy ships have had modern refits, and efforts to upgrade them have had mixed success – particularly in creating integrated command centers and sensor suites.
- **Figure III.19** shows Iran's strength in mine warfare capabilities relative to that of other Gulf navies. These totals disguise the fact that almost any ship can lay or drop mines, but mine hunting and sweeping is far more difficult than in the past, and other Gulf navies have very little mine sweeping capability.
- **Figure III.20** shows Iran's robust amphibious warfare capabilities relative to other Gulf navies.
- **Figure III.21** describes the roles and capabilities of the IRGC's elite Al Qods Force.
- **Figure III.22** shows how the full range of Iranian security efforts work with other states and non-state actors and the expanding presence of Iranian cadres and intelligence elements.

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[17] "Hizballah Possesses Advanced Iranian-Controlled Air Drone System." Al-Siyasah Online, November 6, 2010.

[18] Mashregh News Agency, January 3, 2011.

[19] "Iran mass producing smart ballistic missiles: IRGC chief." Tehran Times, February 8, 2011.

[20] PressTV, August 10, 2010.

[21] Ministry of Defense of the Islamic Republic of Iran, September 28, 2010.

[22] Tehran Iranian Student News Agency (ISNA), September 23, 2010.

[23] Internet Mashregh News, December 31, 2010.

- **Figure III.23** summarizes Iran's ties to Hezbollah and its role in Lebanon in cooperation with Syria. Hezbollah is now considerably better armed than in 2006, and has far better defense in depth.
- **Figure III.24** summarizes Iran's role in Gaza. Iran is not a key player, but even limited arms shipments allow it to play a spoiler role.

The Islamic Revolutionary Guards Corps (IRGC)

The Islamic Revolutionary Guards Corps (IRGC, or "Sepah-e Pasdaran") is a key element in this aspect of US and Iranian military competition. The IRGC grew out of the Iranian Revolution of 1979. Ayatollah Ruhollah Khomeini established the force both to protect the Islamic order of the new Iranian government, and to act as a counter to the regular armed forces – which were perceived as still loyal to the Shah or as having uncertain loyalty to the new regime. The IRGC became the backbone of Iran's military forces during the Iran-Iraq War, as well as a key tool in dealing with internal opposition and providing support to other state and non-state actors outside Iran.

The IRGC has now evolved to be a major political, military, and economic force in Iran. It reports directly to the Supreme Leader, and is believed to be loyal to Ayatollah Khamenei, but has its own factions – some of which have loyalties to President Mahmoud Ahmadinejad, who is a veteran of the IRGC. It is more political and ideological than the regular armed forces. A number of senior officers in the IRGC have relatives or close ties to Iran's leading clerics.

While unbclassfied sources are of uncertain reliability, the IRGC is generally reported to have approximately 125,000 men. It has significant conventional forces, and operates Iran's longer-range surface-to-surface missiles. It is believed to play a major role in Iran's effort to create nuclear weapons, and most or all other chemical, biological, radiological, and nuclear (CBRN) programs, and to be the force that would operate Iran's nuclear-armed forces if they are deployed.

The IRGC has substantial capabilities for asymmetric warfare and covert operations. It was members of the Naval Branch of the IRGC that seized 15 British sailors and Marines, who seem to have been in Iraqi waters, in March 2007.[24] The IRGC also includes the Al Qods Force and other elements that operate covertly or openly overseas – working with Hezbollah of Lebanon, Shi'ite militias in Iraq, and Shi'ites in Afghanistan.

IRGC Land Forces

The IRGC has small elements equipped with armor and has the equivalent of conventional army units, and some units are 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 as are all unclassified estimates of the strength, organization, equipment, and industrial base of the IRGC. This manpower pool includes conscripts recruited from the same pool as regular army conscripts, and training and retention levels are low. The IRGC land forces also seem to control

[24] Slackman, Michael. "Seizure of Britons Underlines Iran's Political Split." *New York Times*. April 4, 2007, p, 5; Lyall, Sarah. "Iran Sets Free 15 Britons Seized at Sear in March." *New York Times*. April 5, 2007.

the Basij (Mobilization of the Oppressed) and other paramilitary forces in most internal security operations and if they are mobilized for war.

Some sources, like the International Institute for Strategic Studies (IISS), report a force structure with 20 "divisions," but most IRGC units seem to be large battalion-sized elements. According to a *Jane's* report, estimates of the IRGC's organization differ sharply. Some sources claim that there are two armored, five mechanized, 18 infantry, and one Special Forces division, and about 15-20 independent brigades. The report concludes that many alleged divisions are equivalent to large brigades and the personnel numbers of the IRGC could support only three to five divisions.[25] The total manpower pool of the IRGC could support only about five to six light infantry divisions. There is supposedly also one airborne brigade.

The IRGC often claims to conduct large exercises, sometimes with 100,000 men or more. The exact size of such exercises is unclear, but they are often a small fraction of what the IRGC claims. With the exception of a limited number of more elite elements, training is 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 and using asymmetric warfare tactics like hit-and-run operations or swarming elements of forces when an invader appears vulnerable.

The IRGC is the center of much of Iran's effort to develop asymmetric warfare tactics to counter a US invasion. Work by Michael Connell of the Center for Naval Analysis notes that the IRGC has been systematically equipping, organizing, and retraining its forces to fight decentralized partisan and guerrilla warfare. It has strengthened the anti-tank and anti-helicopter weaponry of the IRGC battalions, and stressed independent battalion-sized operations that can fight with considerable independence even if Iran loses much of the coherence in its command, control, communications, and intelligence capabilities.[26] Its exercises have included simulated attacks on US AH-64 attack helicopters with Iran's more modern man-portable surface-to-air missiles (MANPADs), and used mines and improvised explosive device (IED)-like systems to attack advancing armored forces.

The IRGC, like the army and the Basij, have attempted to develop and practice deception, concealment, and camouflage methods to reduce the effectiveness of US and other modern imagery coverage, including dispersing into small teams and avoiding the use of uniformed personnel and military vehicles. While the credibility and effectiveness of such tactics are uncertain, the IRGC claims to be adopting tactics to avoid enemy radars and satellites. Both the IRGC and the army have also attempted to deal with US signals and communications intelligence collection capabilities by making extensive use of buried fiber optics and secure communications, while developing more secure ways to use the internet and commercial

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[25] "Iran." *Jane's World Armies*. October 3, 2011

[26] Connell, Michael. "The Influence of the Iraq Crisis on Iranian Warfighting Doctrine and Strategy." CNA Corporation, Alexandria, April 2007; Vision of the Islamic Republic of Iran Network, Network 1. 18:34 GMT, March 9, 2005.

landlines. Iran claims to be creating relatively advanced secure communications systems, but its success is uncertain.[27]

Connell notes that the IRGC is developing such tactics in ways that could form a layered or "mosaic" defense with the army and air forces, where the IRGC could keep up constant pressure on any advancing US forces. He indicates that the IRGC has developed special stay-behind units or "cells" that would include some 1,900 to 3,000 teams of three to four soldiers whose main mission would be to attack US lines of supply and communication, strike at elements in rear areas, and conduct ambushes of combat troops. This could include sending units forward into countries like Iraq and Afghanistan to attack US forces there, or encourage local forces to do so, and sending teams to raid or infiltrate southern Gulf states friendly to the US.[28]

At the same time, Connell notes that if the Iranian Army were defeated and an attacker like the US moved into Iran's territory, the IRGC, the Iranian Army, and the Basij are now organized and trained to fight a much more dispersed war of attrition in which force elements would disperse and scatter, carrying out a constant series of attacks on US forces wherever they deployed as well as against US lines of communication and supply.

If the government allowed them to act as their current doctrine calls for, such elements would have great independence of action, rather than relying on centralized command. The IRGC and the Iranian Army have clearly paid close attention to both the limited successes that Saddam's Fedayeen had against the US advance on Baghdad, and the far more successful efforts of Iraqi insurgents and militias in attacking US and other coalition forces following the fall of Baghdad.

One technique such forces attempt to organize and practice is using cities and built-up areas as defensive areas that provide concealment and opportunities for ambushes, and for the use of swarming tactics, which forces an attacker to disperse large numbers of forces to try to clear and secure given neighborhoods. Connell indicates that some 2,500 Basij members staged such an exercise in the Western suburbs of Tehran in February 2007. Once again, Iran drew on the lessons of Iraq; however, Iran also employed such tactics with great success against Iraqi forces during the Iran-Iraq War, and it has closely studied the lessons of urban and built-up area fighting in Somalia and Lebanon.

Other reports indicate that the IRGC remains the center of Iran's hard-line security forces, but has become steadily more political and bureaucratic, and most of its forces now have no combat experience – it has been more than twenty years since the end of the Iran-Iraq War in 1988. Corruption and careerism are growing problems, and the IRGC's role in the defense industry has led to financial abuses. As such, it is the elite elements of the IRGC that give it real meaning beyond serving the regime's need to control its population.

There are different opinions over the relative conventional role of the IRGC relative to other Iranian forces. One source identifies a trend that will eventually render the regular army more

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[27] Iran has said that experts at its Hossein and Sharif Universities are working on an "impenetrable intranet communications network." Connell indicates that Iran claims such a system was fielded during the Eqtedar ("Power") exercises in February 2007. *Baztab*, Web edition, February 20, 2007.

[28] Connell, "The Influence of the Iraq Crisis on Iranian Warfighting Doctrine and Strategy." *Keyhan*, February 20, 2007, p. 14.

technologically advanced and more modern in general. Accord to this report, the IRGC, by contrast, is to focus on "less traditional defense duties," such as enforcing border security, commanding the country's ballistic missile and potential weapons of mass destruction forces, and preparing for a closing of the Strait of Hormuz militarily.[29]

The IRGC Air Force

The air force of the IRGC is believed to operate Iran's three Shahab-3 intermediate-range ballistic missile units, and may have had custody of its chemical weapons and any biological weapons.

It is not clear what combat formations exist within the IRGC, but the IRGC may operate Iran's ten EMB-312 Tucanos. It also seems to operate many of Iran's 45 PC-7 training aircraft, as well as some Pakistani-made trainers at a training school near Mushak, 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 at least carry a small number of weapons.[30]

The IRGC Naval Forces

The IRGC's naval branch is reported to have some 20,000 men, including marine units of some 5,000 men. This force seems to undergo extensive exercises and could deliver conventional weapons, bombs, mines, and CBRN weapons into ports and oil and desalination facilities. It is operational in the Gulf and the Gulf of Oman, and could operate elsewhere if given suitable sealift or facilities. As of 2011, Iran's navy has sent warships into the Mediterranean and claimed intentions of sending ships into the Atlantic, but such a capability is doubtful.[31][32]

The IRGC's 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, Bandar-e Abbas, Khorramshahr, and Larak. It also controls Iran's coastal defense forces, including naval guns and an HY-2 Seersucker land-based anti-ship missile unit deployed in five to seven 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 the 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.

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[29] "Iran." *Jane's World Armies*

[30] Reuters. June 12, 1996, 17:33.

[31] Londono, Ernesto and Erdbring, Thomas. "Iran Hails Warships' Mission in Mediterranean." *Washington Post*. February 22, 2011.

[32] "Defense Minister Confirms Iran Plans to Deploy Vessels in Atlantic Ocean." *Tehran Times*. October 17, 2011.

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

The Al Qods Force

Iran has built up a specialized force to work with outside state and non-state actors called the Al Qods Force. The size and strength of this force is shown in **Figure III.21**.

The Al Qods Force is a branch of the IRGC that is assigned to special operations and unconventional warfare, and has had priority in terms of funding, training, and equipment. It plays a major role in giving Iran the ability to conduct unconventional warfare overseas using various foreign movements as proxies, and is thought to be composed of 5-15,000 men.

In January 2007, Iran's Supreme National Security Council (SNSC) decided to place all Iranian operations in Iraq under the command of the Al Qods Force. At the same time, the SNSC decided to increase the personnel strength of the Al Qods to 15,000.[33] Exact force strength data for the Al Qods Force, however, are not available.

The Al Qods Force is under the command of Brigadier General Qassem Soleimani and has supported non-state actors in many foreign countries. These include Hezbollah in Lebanon, Hamas and the Palestinian Islamic Jihad in the Gaza Strip and the West Bank, Shi'ite militias in Iraq, and Shi'ites in Afghanistan. Links to Sunni extremist groups like Al Qaeda have been reported, but never convincingly confirmed.

On January 11, 2007, the director of the Defense Intelligence Agency stated in a testimony before the US Senate Select Committee on Intelligence that Iran's Islamic Revolutionary Guards Corps-Qods Force had the lead for its transnational terrorist activities, in conjunction with Lebanese Hezbollah and Iran's MOIS.[34] Other sources believe that the primary mission of the Al Qods Force has been to support Shi'ite movements and militias, and such aid and weapons transfers seem to have increased significantly in the spring of 2007.

The Al Qods Force has provided significant transfers of weapons to Shi'ite (and perhaps some Sunni) elements in Iraq. These include the shaped charge components used in some IEDs and the more advanced components used in explosively formed projectiles, including the weapon assembly, copper slugs, radio links used to activate such devices, and the infrared triggering mechanisms. These devices are very similar to those used in Lebanon, and some seem to operate on the same radio frequencies. Shaped charge weapons first began to appear in Iraq in August 2003, but became a serious threat in 2005.[35]

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[33] IntelligenceOnline.com, Tehran Targets Mediterranean, March 10, 2006.

[34] Maples, Michael D. "Threat Assessment." Statement of Michael D. Maples Director, Defense Intelligence Agency U.S. Army before the Committee on Senate Select Intelligence, January 11, 2007.

[35] Gordon, Michael and Shane, Scott. "Iran Supplied Weapons in Iraq." *New York Times*. March 26, 2007

On January 11, 2007, the US military in Iraq detained five men accused of providing funds and equipment to Iraqi insurgents. According to US military sources, these men had connections to the Al Qods Force.[36] On January 20, 2007, gunmen dressed as US soldiers entered the Provincial Joint Coordination Center in Karbala and killed and wounded several US servicemen. According to some sources, including US military intelligence, the gunmen were members of the Al Qods Force. The sophisticated planning and execution of this attack made it unlikely that any Iraqi group was involved in it.[37]

General David H. Petraeus, the commander of US forces in Iraq at the time, stressed the growing role of the Al Qods Force and the IRGC in testimony to Congress in April 2007. He noted that the US had found Al Qods operatives in Iraq and seized computers with hard drives that included a 22-page document that had details on the planning, approval process, and conduct of an attack that killed five US soldiers in Karbala. Petraeus noted,

> "They were provided substantial funding, training on Iranian soil, advanced explosive munitions and technologies as well as run-of-the-mill arms and ammunition… in some cases advice and in some cases even a degree of direction… Our sense is that these records were kept so that they could be handed in to whoever it was that is financing them… And again, there's no question… that Iranian financing is taking place through the Al-Qods force of the Iranian Republican Guards Corps."[38]

The Al Qods Force is also believed to play a continuing role in training, arming, and funding Hezbollah in Lebanon and to have begun to support Shi'ite militia and Taliban activities in Afghanistan. Experts disagree on the scale of such activity, how much support it has provided to Sunni Islamist extremist groups rather than Shi'ite groups, and over the level of cooperation in rebuilding Hezbollah forces in Lebanon since the cease-fire in the Israel-Hezbollah War of 2006. The debates focus on the scale of such activity and the extent to which it has been formally controlled and authorized by the Supreme Leader and the President, however, and not over whether some level of activity has been authorized.

The exact relationship between the Al Qods Force, Hamas, and the Palestinian Jihad is speculative. Some Iranian arms shipments have clearly been directed at aiding anti-peace and anti-Israeli elements in the Gaza Strip. There is some evidence of aid in training, weapons, and funding to hostile Palestinian elements in both the Gaza Strip and the West Bank. Open sources do not, however, provide a clear picture of the scale of such activity.

Some reports indicate that the budget for the Al Qods Force is classified, directly controlled by the office of Supreme Leader Khamenei, and is not reflected in Iran's general budget. The active elements of the Al Qods Force operate outside Iran's borders, although it has bases both inside and outside of Iran. The Al Qods Force's 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 and the Arabian Peninsula; Asian countries

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[36] Defense Department Documents and Publications, Coalition Targets Iranian Influence in Northern Iraq, January 14, 2007.

[37] Kaufman, Stephen. "Bush Says Iranian Group Certainly Providing Weapons in Iraq." February 14, 2007. http://usinfo.state.gov/xarchives/display.html?p=washfile-english&y=2007&m=February&x=20070214171942esnamfuak0.7028467

[38] Gertz, Bill. "US General Calls Al Qaeda 'Public Enemy No. 1' in Iraq." *Washington Times*, April, 27, 2007, p. 4.

of the former Soviet Union; Western nations (Europe and North America); and North Africa (Egypt, Tunisia, Algeria, Sudan, and Morocco).

The Al Qods Force 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 if the ambassador in each embassy has control of, or detailed knowledge of, operations by the Al Qods staff. However, there are indications that most operations are coordinated between the IRGC and offices within the Iranian Foreign Ministry and MOIS. There are separate operational organizations in Lebanon, Turkey, Pakistan, and several North African countries. There are also indications that such elements may have participated in the bombing of the Israeli Embassy in Argentina in 1992 and the Jewish Community Center in Buenos Aires in 1994 – although Iran has strongly denied any involvement in either.[39]

The Al Qods Force seems to control many of Iran's training camps for extremists, terrorists, and unconventional warfare in Iran and countries like the Sudan and Lebanon. In Sudan, the Al Qods Force is believed to run a training camp of unspecified nature. It has at least four major training facilities in Iran. The Al Qods Force has 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 not indoctrinated in ideology.

There are other training camps in the Qom, Tabriz, and Mashhad governorates 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 Al Qods Force seems to help operate the Manzariyah training center near Qom, which recruits 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-e Abbas.[40]

Israeli defense experts state they believe the IRGC and the Al Qods Force not only played a major role in training and equipping Hezbollah, but may have assisted it in the Israeli-Hezbollah War in 2006. Israeli intelligence officers claim to have found command and control centers, and a missile and rocket fire-control center in Lebanon that was of Iranian design. They feel the Al Qods Force played a major role in the Hezbollah anti-ship missile attack on and Israeli Navy Sa'ar-class missile patrol boat and that Iran and Syria supported Hezbollah with intelligence from facilities in Syria during the fighting.

The Al Qods Force still seems to play a role in dealing with the Sadrists and other hardline Shi'ite forces in Iraq. It also may have helped some elements of the Syrian security forces during the unrest in Syria in 2011. It is often difficult, however, to confirm reports about Al Qods activity, or to separate out its role from other elements of the IRGC and branches of Iranian intelligence, like the Vevak. Some reports of its role seem dubious and others seem to credit the Al Qods Force without clear evidence that it actually has the lead.

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[39] *New York Times*, May 17, 1998, p. A-15; *Washington Times*, May 17, 1998, p. A-13; *Washington Post*, May 21, 1998, p. A-29.

[40] Venter, "Iran Still Exporting Terrorism," *Jane's Intelligence Review*, pp. 511-516

On October 11, 2011, the Al Qods Force gained attention as a result of its role in planning Iran's alleged assassination plot against the Saudi ambassador to the US, Adel Al-Jubeir.[41] Several members of the Force have been sanctioned by the US for their role in this attempt, and it may reflect a new willingness of Iran to take risks in confronting the US and Arab states.

Other Asymmetric Forces

The IRGC and Al Qods Force, however, are only part of this steadily increasing pool of forces – which include elements of its regular armed forces, Vevak, and other elements of its intelligence community and cells within its embassies. Their growing regional role is shown in **Figure III.22**. The potential impact of Iran's ties to Hezbollah and to Hamas are shown in **Figure III.23** and **Figure III.24.**

The use of regional proxies has become a key aspect of Iran's asymmetric strategy, although these forces are largely independent and Iran has only limited leverage over their behavior. Iranian ties to such proxies and the US' response to them are discussed in detail later in region-specific chapters, but they merit discussion as a cornerstone of Iran's asymmetric military strategy in the Middle East.

While data on the specifics of Iranian assistance levels are incomplete and often inaccurate, there is general agreement that aid levels remain significant. Washington continues to view Iran as the foremost state-sponsor of US-designed foreign terrorist organizations (FTO) and non-state proxy organizations opposed to US regional interests.[42] In a September 13, 2011 hearing before the Committee on Homeland Security and Governmental Affairs, Matthew G. Olsen, the Director of the National Counterterrorism Center, added:[43]

> "Iran is still the foremost state sponsor, and since 9/11 the regime has expanded its involvement with terrorist and insurgent groups—primarily in Iraq and Afghanistan—that target US and Israeli interests. Iran's Islamic Revolutionary Guard Corps-Qods Force and Ministry of Intelligence and Security have been involved in the planning and execution of terrorist acts and the provision of lethal aid—such as weapons, money, and training—to these groups, particularly Lebanese Hizballah."

In addition to Hezbollah in Lebanon, Iran has supplied and trained a number of non-state clients across the region, including Shi'ite militias in Iraq, Afghan insurgents, Hamas in Gaza, and Houthi rebels in Yemen. These groups, while weak in comparison to larger conventional forces, provide Iran with the ability to undermine regional governments allied with the US and the West, and, as in the case of Iraq, to harass US forces in active warzones. Iranian proxies (Shi'ite militias and Hezbollah, respectively) continue to undermine the consolidation of potentially pro-Western governments in Iraq and Lebanon, and have allowed Iran to impact their local politics and foreign policy orientations. As such, Iran's proxies are an effective asymmetric tool for Iran to undermine US regional influence while maximizing its own.

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[41] Murphy, Brian. "Ambassador Plot Casts Light on Iran's Strike Force." Associated Press. October 12, 2011, http://www.google.com/hostednews/ap/article/ALeqM5gLiQoxfIOXE7F7fw-GQMaNq1ebqQ?docId=d3a283b005ee493c8703ec2a717dbfd7

[42] "Are We Safer?" Hearing Before the Senate Committee on Homeland Security and Governmental Affairs. September 13, 2011 http://www.dni.gov/testimonies/20110913_testimonies_olsen.pdf

[43] "Are We Safer?" Hearing Before the Senate Committee on Homeland Security and Governmental Affairs. September 13, 2011 http://www.dni.gov/testimonies/20110913_testimonies_olsen.pdf

US and Arab Gulf Options for Competing with Iranian Asymmetric Threats

The US, Britain and France, the southern Gulf states, and other Arab states have already reacted to both the threat posed by Iran's growing asymmetric capabilities**,** and its ties to non-state actors. Nevertheless, the net impact of Iran's extensive asymmetric assets and doctrine on Iranian, US, and Gulf capabilities is uncertain. Neither the US nor any other conventional power has ever engaged asymmetric forces of the same size and magnitude of those of Iran, and a net assessment of Iran's capabilities on the Gulf military balance is problematic and theoretical at best.

What is certain is that Iran's doctrine of using light fast-attack watercraft, submarines, mines, missile barrages, and other irregular warfare assets provides Iran with the ability to strike at critical infrastructure, Gulf commerce, larger conventional forces with little or no warning, and theoretically close the Strait of Hormuz for a short period of time. Given their ability to disrupt global commerce and petroleum shipments, Iran's asymmetric warfare capabilities are of key concern when assessing Iran's capacity to challenge the US and other large conventional military forces in the region.

In response to Iran's ever-expanding capacity to wage asymmetric warfare, the US and its Gulf allies have established a major conventional presence in the Gulf; the US maintains installations in Kuwait, Oman, Bahrain (where the US 5th fleet is currently based), Iraq, and Afghanistan. The US' sizeable forces in the region are complimented by those of its Gulf allies, which possess advanced armor and aircraft.

The US continues to furnish its allies with advanced weapons systems. On October 20, 2010, the US Defense Security Cooperation Agency (DSCA) notified Congress of a $60 billion US arms sale to Saudi Arabia. The deal includes 84 F-15 Saudi Advanced (SA) fighter aircraft, upgrades for the existing fleet of Royal Saudi Air Force F-15S multi-role fighters, 70 AH-64 Apache attack helicopters (24 of which will be equipped with the Longbow Fire Control Radar system), 72 UH-60M Blackhawk utility helicopters, 36 AH-6I "Little Bird" light attack helicopters, and 12 MD-530F light turbine helicopters, among other weapons systems.[44]

Similarly, the US and the UAE announced a $5 billion US arms sale on November 8, 2010 that included the sale of 60 AH-64D Apache helicopters.[45] Lastly, the UAE also opened a new naval base at Al Fujairah near the eastern entrance to the Strait of Hormuz on October 10, 2010.[46] These arms transfers and others like them represent a trend in Gulf procurement that began in the mid-1990s. Given the strong presence of US and other conventional forces in the region, any Iranian successes, while damaging and disruptive, would be limited in scope and duration by the overwhelming conventional power of the US and its allies.

In addition to traditional conventional systems, the US has developed several assets to counter the kinds of threats that Iran's asymmetric fast-attack craft and swarming tactics present –

[44] Wasserbly, Daniel. "US Reveals Details of $60bn Sale to Saudi Arabia." Jane's Defence Industry. 28 Oct. '10

[45] Gelfand, Lauren. "US Agrees $5bn Boeing Apache Deal with UAE." Jane's Defence Weekly. 9 Nov. '10

[46] "UAE Opens New Strait of Hormuz Naval Base." Jane's Intelligence Weekly. 25 Oct. '10

although most are still in the R&D stage. These assets include the Littoral Combat Ship (LCS) and the US Navy's Spike missile program. The LCS was designed to act as a counter to the kinds of threats posed by Iran's light fast-attack craft and other asymmetric assets. It has a shallow draft, and its design emphasizes speed, maneuverability, and mission flexibility.[47]

The Spike missile, while not yet in active service, is a small guided missile being developed by the US Navy as an armament for UAVs and surface ships. The Spike is an optically-guided fire-and-forget missile with a range of approximately two miles and carries a 2.2 kg warhead.[48] While versatile, the Spike could be used to great effect against Iran's light, fast-attack crafts. Although these systems are unproven, they are revealing in terms of the US' perception of asymmetric threats and its continuing efforts to counter such threats directly.

The US has taken a multifaceted approach to confronting Iran's proxies. In addition to direct military action in Iraq and Afghanistan, the US equipped and trained the security forces and intelligence services of regional allies and client states such as Saudi Arabia, the UAE, Iraq, Lebanon, and Kuwait to provide a counterweight to Iran and its own proxies. Notable examples include US assistance to the Lebanese Armed Forces, Saudi Arabia's campaign against the Houthi rebels along its border with Yemen, and US efforts to train and equip Iraq's security forces in counterinsurgency tactics.[49][50][51] Lastly, the US took steps to curb arms trafficking, and engaged in information campaigns that sought to attack and delegitimize Iran and its allies.

Yet, Iran's asymmetric assets remain formidable. Regardless of US conventional superiority, the US forces would face far more serious problems in dealing with a well-planned campaign for asymmetric or irregular warfare than it would in fighting a conventional conflict. In spite of Iran's limited resources, its asymmetric forces and doctrine potentially allow Iran to strike critical infrastructure, vulnerable targets, and larger conventional forces in the region with little or no warning, close the Gulf for a short period of time, and influence the foreign policy and undermine the stability of regional states.

However, Iran's asymmetric assets are not capable of achieving a decisive victory over the superior conventional forces of Iran's regional competitors. Nevertheless, as the Strait of Hormuz is a critical petroleum chokepoint, Iran's ability to temporarily "close the Gulf" or even disrupt its traffic would have massive regional and global ramifications. As such, Iran's asymmetric capabilities and US efforts to counter them are of key importance when considering US-Iranian strategic competition.

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[47] US Congressional Research Agency. "Navy Littoral Combat Ship (LCS) Program: Background, Issues, and Options for Congress." RL33741, March 18, 2011. Ronald O'Rourke. http://assets.opencrs.com/rpts/RL33741_20110318.pdf

[48] Felix, Steven. "U.S. Navy Spike Missile System: A New Generation of Miniature Precision Guided Weapons." May 1, 2006. http://www.dtic.mil/cgi-bin/GetTRDoc?Location=U2&doc=GetTRDoc.pdf&AD=ADA500538

[49] Arrott, Elizabeth. "Saudi Arabia Says Houthi Rebels Forced Out." Voice of America. January 27, 2010 http://www.voanews.com/english/news/middle-east/Saudi-Arabia-Says-Houthi-Rebels-Forced-Out-82801117.html

[50] US Congressional Research Service. US Security Assistance to Lebanon (R40485, January 19, 2011), by Casey L. Addis. http://www.fas.org/sgp/crs/mideast/R40485.pdf

[51] July 2011 SIGIR Report: Quarterly Report and Semiannual Report to the United States Congress. July 30, 2011 http://www.sigir.mil/files/quarterlyreports/July2011/Report_-_July_2011.pdf

Figure III.14: Key Iranian Capabilities for Asymmetric Warfare

IRGC Forces

- 125,000+ men total, drawing on 1,000,000 Basij.
- 20,000 Naval Guards, including 5,000 marines.
- Armed with HY-3 CSS-C-3 Seersucker (6-12 launchers, 100 missiles, 95-100 km), and 10 Houdong missile patrol boats with C-802s (120 km), and 40+ Boghammers with ATGMs, recoilless rifles, machine guns.
- Large-scale mine warfare capability using small craft and commercial boats.
- Based at Bandar e-Abbas, Khorramshar, Larak, Abu Musa, Al Farsiyah, Halul, Sirri. IRGC air branch reported to fly UAVs and UCAVs, and control Iran's strategic missile force.
- 1 Shahab SRBM Bde (300-500-700 km) with 12-18 launchers, 1 Shahab 3 IRBM Btn (1,200-1,280 km) with 6 launchers and 4 missiles each.

Figure III.15: Key Elements of the IRGC

- **125,000+ men, capable of drawing upon drawing on 1,000,000 Basij.**
- **Key is 20,000 Naval Guards, including 5,000 marines.**
- **Armed with HY-3 CSS-C-3 Seersucker (6-12 launchers, 100 missiles, 95-100 km), and 10 Houdong missile patrol boats with C-802s (120 km), and 40+ Boghammers with ATGMs, recoilless rifles, machine guns.**
- **Large-scale mine warfare capability using small craft and commercial boats.**
- **Based at Bandar e-Abbas, Khorramshar, Larak, Abu Musa, Al Farsiyah, Halul, Sirri.**
- **• IRGC air branch reported to fly UAVs and UCAVs, and control Iran's strategic missile force.**
- **1 Shahab SRBM Bde (300-500-700 km) with 12-18 launchers, 1 Shahab 3 IRBM Btn (1,200-1,280 km) with 6 launchers and 4 missiles each.**
- **The IRGC has a wide variety of assets at its disposal to threaten shipping lanes in the Gulf, Gulf of Oman, and the Caspian Sea.**
- **3 Kilo (Type 877) and unknown number of midget (Qadr-SS-3) submarines; smart torpedoes, (anti-ship missiles?) and smart mine capability.**
- **Use of 5 minelayers, amphibious ships, small craft, commercial boats.**
- **Attacks on tankers, shipping, offshore facilities by naval guards.**
- **Raids with 8 P-3MP/P-3F Orion MPA and combat aircraft with anti-ship missiles(C-801K (8-42 km), CSS-N-4, and others).**
- **Free-floating mines, smart and dumb mines, oil spills.**
- **Land-based, long-range anti-ship missiles based on land, islands (Seersucker HY-2, CSS-C-3), and ships (CSS-N-4, and others. Sunburn?).**
- **Forces whose exercises demonstrate the capability to raid or attack key export and infrastructure facilities.**

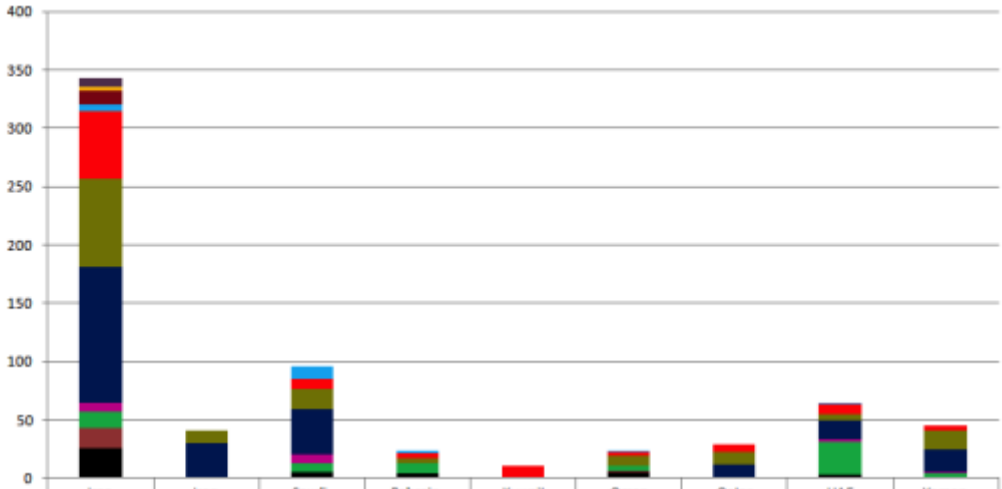
Figure III.16: The Evolving Capabilities of the IRGC

- **Iran's Deputy Army Commander Brigadier General Abdolrahim Moussavi has announced that Iran is committed to expanding its strategic reach, arguing that, "In the past, our military had to brace itself for countering regional enemies. This is while today we are faced with extra-regional threats."**
- **Iran upgraded a naval base at Assalouyeh in Iran's southern Bushehr province.**
- **This base is the fourth in a string of IRGC bases along the waterway that will extend from Bandar Abbas to Pasa Bandar near the Pakistan border.**
- **Part of, what IRGC's Navy Commander Rear Admiral Morteza Saffari describes as a new mission to establish an impenetrable line of defense at the entrance to the Sea of Oman.**
- **Forces can carry out extensive raids against Gulf shipping, carry out regular amphibious exercises with the land branch of the IRGC against objectives like the islands in the Gulf, and could conduct raids against countries on the southern Gulf coast.**
- **Iran could launch a coordinated attack involving explosives-laden remote-controlled boats, swarming speedboats, semi-submersible torpedo boats, FACs, kamikaze UAVs, midget and attack submarines, and shore-based anti-ship missile and artillery fire.**
- **Could "swarm" a US-escorted convoy or surface action group transiting the Strait of Hormuz, and barrages of rockets with cluster warheads could be used to suppress enemy defensive fire and carrier air operations.**
- **Naval Guards work closely with Iranian intelligence and appear to be represented unofficially in some embassies, Iranian businesses and purchasing offices, and other foreign fronts.**
- **Iran has launched a domestic weapons procurement campaign aimed at improving its defense capabilities and has announced the development of 109 types of advanced military equipment over the past two years.**
- **In December 2008 Iranian Navy Rear Admiral Habibollah Sayyari confirmed the delivery of two new domestically-built missile boats, Kalat (Fortress) and Derafsh (Flag), as well as a Ghadir-class light submarine to the Iranian navy.**
- **The deputy commander of the IRGC's navy, Rear Admiral Ali Fadavi, told the Fars News Agency on 11 November 2008 that both unmanned speedboats and UAVs are now mass-produced in the country.**
- **On December 6, 2008 the Iranian Navy test-fired a new surface-to-surface missile from a warship as part of exercises along a strategic shipping route. "The Nasr-2 was fired from a warship and hit its target at a distance of 30 km (19 miles) and destroyed it," Iranian state run radio reported.**

Figure III.17: The Impact of the IRGC Naval Guards: Force Strength, Roles, and Missions

- **The IRGC has a naval branch consists of approximately 20,000 men, including marine units of around 5,000 men.**
- **The IRGC is now reported to operate all mobile land-based anti-ship missile batteries and has an array of missile boats; torpedo boats; catamaran patrol boats with rocket launchers; motor boats with heavy machine guns; mines as well as Yono (Qadir)-class midget submarines; and a number of swimmer delivery vehicles.**
- **The IRGC naval forces have at least 40 light patrol boats, 10 Houdong guided missile patrol boats armed with C-802 anti-ship missiles.**
- **The IRGC controls Iran's coastal defense forces, including naval guns and an HY-2 Seersucker land-based anti-ship missile unit deployed in five to seven sites along the Gulf coast.**
- **The IRGC has numerous staging areas in such places and has organized its Basij militia among the local inhabitants to undertake support operations.**
- **IRGC put in charge of defending Iran's Gulf coast in September 2008 and is operational in the Gulf and the Gulf of Oman, and could potentially operate elsewhere if given suitable sealift or facilities.**
- **Can deliver conventional weapons, bombs, mines, and CBRN weapons into ports and oil and desalination facilities.**
- **Force consists of six elements: surface vessels, midget and unconventional submarines, missiles and rockets, naval mines, aviation, and military industries.**
- **Large numbers of anti-ship missiles on various types of launch platforms.**
- **Small fast-attack craft, heavily armed with rockets or anti-ship missiles.**
- **More fast mine-laying platforms.**
- **Enhanced subsurface warfare capability with various types of submarines and sensors.**
- **More small, mobile, hard-to-detect platforms, such as semi-submersibles and unmanned aerial vehicles.**
- **More specialized training.**
- **More customized or purpose-built high-tech equipment.**
- **Better communications and coordination between fighting units.**
- **More timely intelligence and effective counterintelligence/deception.**
- **Enhanced ability to disrupt the enemies command, control, communications, and intelligence capability.**
- **The importance of initiative, and the avoidance of frontal engagements with large US naval surface warfare elements.**
- **Means to mitigate the vulnerability of even small naval units to air and missile attack.**
- **The IRGC has numerous staging areas in such places and has organized its Basij militia among the local inhabitants to undertake support operations.**
- **The naval branch has bases and contingency facilities 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.**
- **Iran recently started constructing new naval bases along the coasts of the Gulf and the Sea of Oman for an "impenetrable line of defense."**
- **On October 27, 2008, Iran opened a new naval base at Jask, located at the southern mouth of the Strait of Hormuz, a strategic chokepoint for Persian Gulf oil.**

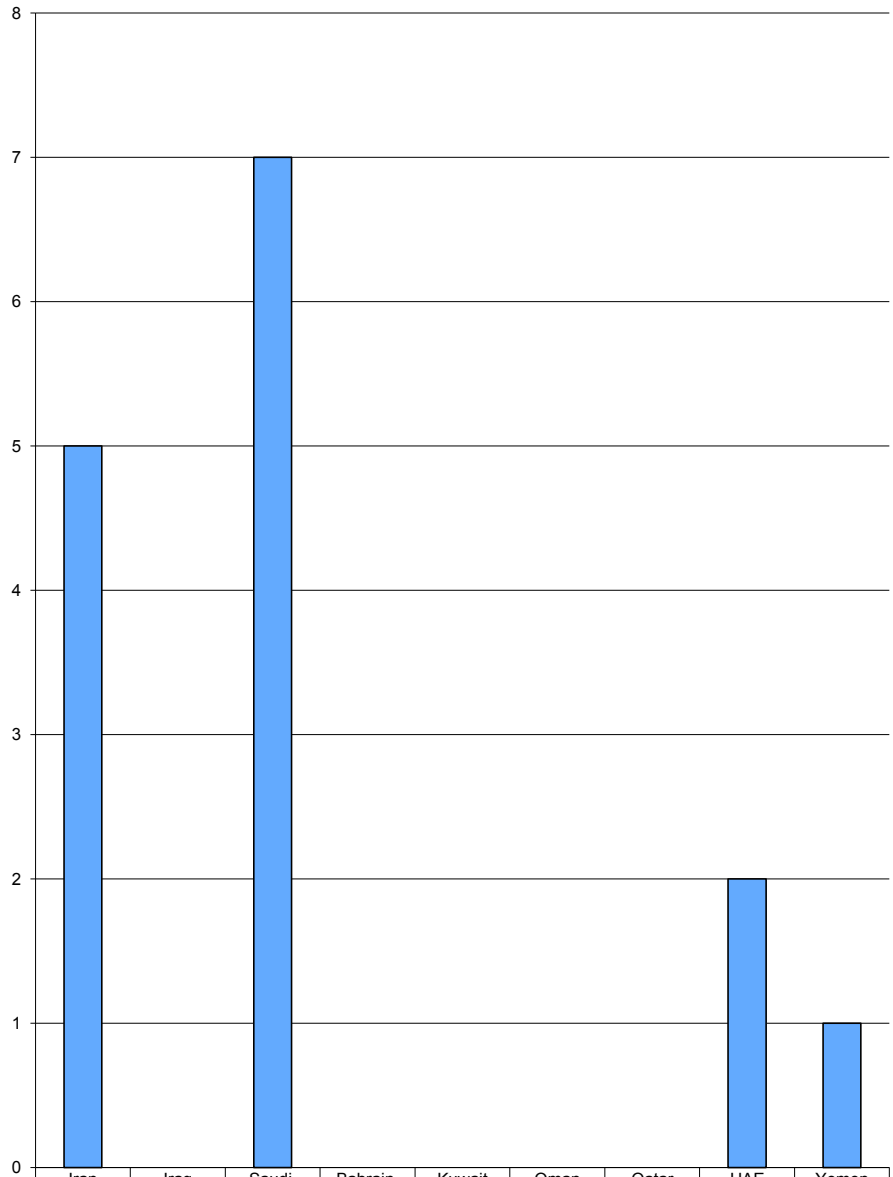
Figure III.18: Iranian Naval Capabilities for Asymmetric Warfare



	Iran	Iraq	Saudi	Bahrain	Kuwait	Oman	Qatar	UAE	Yemen
SDVs	8								
Submarines	3								
Midget Submarines	12								
Major Missile Combat	5		11	3		2		2	
Major Other Combat	1								
Missile Patrol	57		9	4	10	3	7	8	4
Other Patrol	76	11	17	4		8	10	6	16
Armed Boats	117	30	39				11	16	20
Mine	7		7					2	1
Landing Craft	14		8	9		5		28	3
Amphibious Ships	17					1	1		1
Support	26		5	4	1	5		3	

Source: Adapted from IISS, The Military Balance, various editions; Jane's Sentinel series; Saudi experts

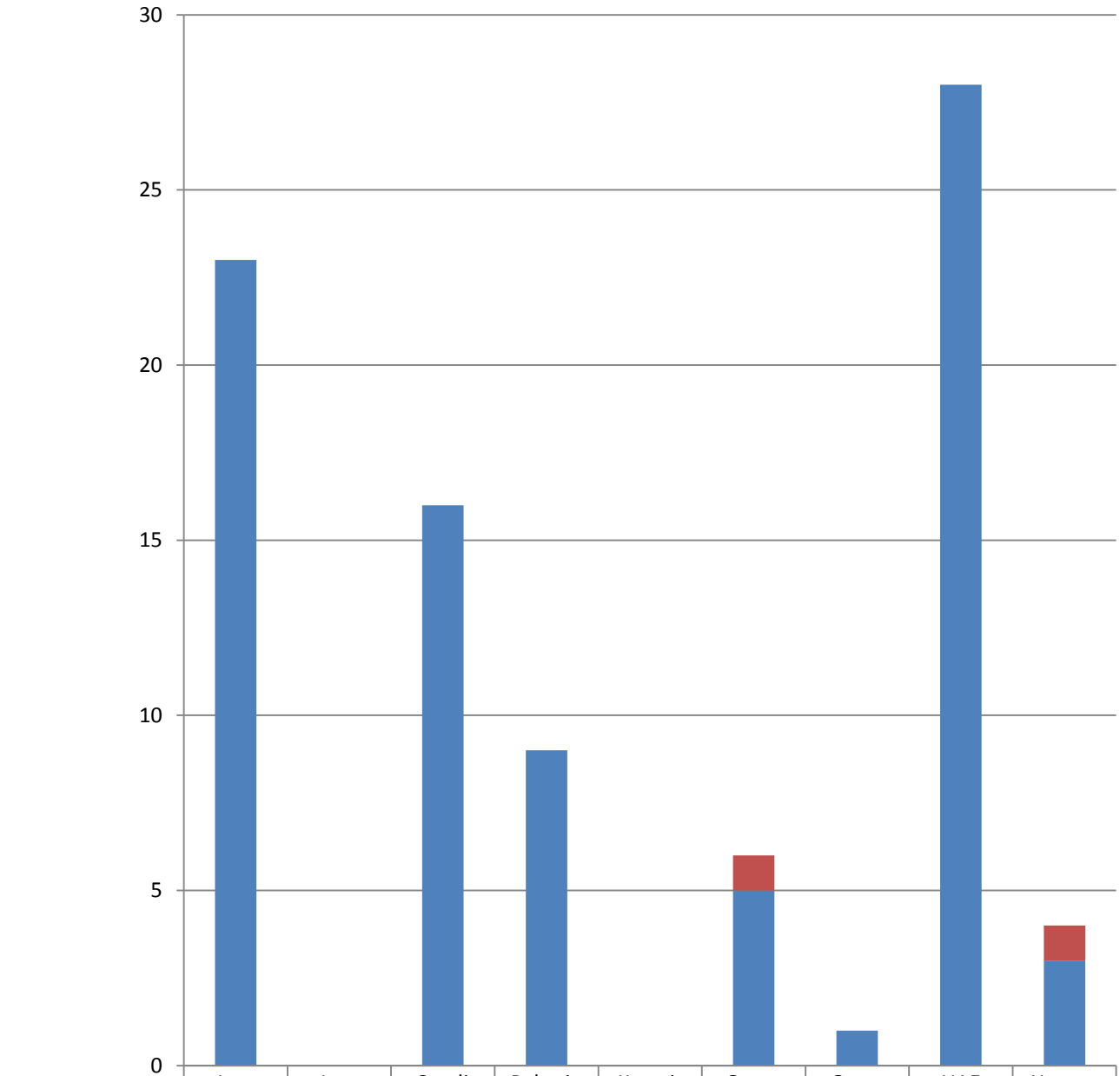
Figure III.19: Iranian Capabilities for Mine Warfare



	Iran	Iraq	Saudi	Bahrain	Kuwait	Oman	Qatar	UAE	Yemen
Mine Layers	0	0	0	0	0	0	0	0	0
Mine Countermeasure	5	0	7	0	0	0	0	2	1

Source: Adapted from IISS, The Military Balance, various editions; Jane's Sentinel series; Saudi experts

Figure III.20: Iranian Amphibious Warfare Capabilities



	Iran	Iraq	Saudi	Bahrain	Kuwait	Oman	Qatar	UAE	Yemen
Amphibious Ships						1			1
Landing Craft	23		16	9		5	1	28	3

Source: Adapted from IISS, The Military Balance, various editions; Jane's Sentinel series; Saudi experts

Figure III.21: The Iranian Al Qods Force

- **Comprised of 5,000 - 15,000 members of the IRGC (Increased size of force in 2007)**
- **Equivalent of one Special Forces division, plus additional smaller units**
- **Special priority in terms of training and equipment**
- **Plays a major role in giving Iran the ability to conduct unconventional warfare overseas using various foreign movements as proxies**
- **Specialize in unconventional warfare mission**
- **Control many of Iran's training camps for unconventional warfare, extremists, and terrorists**
- **Has offices or "sections" in many Iranian embassies throughout the world**
- **Through its Al Qods Force, Iran provides aid to Palestinian terrorist groups such as Hamas, Lebanese Hezbollah, Iraq-based militants, and Taliban fighters in Afghanistan.**
- **Despite its pledge to support the stabilization of Iraq, Iranian authorities continued to provide lethal support, including weapons, training, funding, and guidance through its Al Qods Force.**
- **Al Qods Force continues to provide Iraqi and Afghani militants with:**
    - **specialized training,**
    - **funding,**
    - **Iranian-produced advanced rockets,**
    - **sniper rifles,**
    - **automatic weapons,**
    - **mortars,**
    - **Improvised Explosive Devices (IEDs)**
    - **and explosively formed projectiles (EFPs) that have a higher lethality rate than other types of IEDs**
- **Since 2006, Iran has arranged a number of shipments of small arms and associated ammunition, rocket propelled grenades, mortar rounds, 107mm rockets, and plastic explosives, possibly including man-portable air defense systems (MANPADs), to the Taliban.**
- **Israeli defense experts continue to state that they believe the IRGC and Al Qods Force not only played a major role in training and equipping Hezbollah, but may have assisted it during the Israeli-Hezbollah War in 2006, and played a major role in the Hezbollah anti-ship missile attack on an Israeli Navy Sa'ar-class missile patrol boat.**
- **The Al Qods Force is widely believed to have been behind the plot to assassinate Saudi Arabia's ambassador to the US, Adel al-Jubeir in 2011.**

Figure III.22: Iranian Use of Other States and Non-State Actors

Iranian Actors	*Revolutionary Guards Related State/ Non-State Actors*	*Target/Country Where Operating*
Vevak/other intelligence	**Iran**	**Iraq**
		Lebanon
Al Qods Force	**Syria**	
		Israel
Arms transfers	**Hezbollah**	
		West Bank/Gaza
Military and security Advisors	**Hamas**	**Yemen?**
Clerics, pilgrims, shrines	**Mahdi Army, Promised Day Brigades**	**Egypt**
Commercial training	**Special Groups**	**Kuwait**
Finance/investment	**Yemeni "Shi'ites"?**	**Bahrain**
Investment/training companies	**Bahrani Shi'ites?**	**Afghanistan**
	Afghan Hazara?	**Venezuela**
Education: scholarships, teachers	**Saudi "Shi'ites"**	
Cultural exchanges		
Athletic visits		

Figure III.23: Iranian and the Hezbollah

- **Hezbollah was originally formed in 1982 by Iranian seminarians.**
- **Iran's aid packages (arms and money) to Hezbollah are said to exceed $100 million per year.**
- **Iran has gone from supplying small arms, short-range missiles and training to providing more sophisticated long-range missiles and other higher-end weaponry**
- **Iran exported thousands of 122-mm rockets and Fajr-4 and Fajr-5 long-range rockets to Hezbollah in Lebanon, including the Arash with a range of 21–29 kilometers.**
- **Between 1992 and 2005, Hezbollah received approximately 11,500 missiles and rockets; 400 short- and medium-range pieces of artillery; and Aresh, Nuri, and Hadid rockets and transporters/launchers from Iran.**
- **In 2005, Iran sent Hezbollah a shipment of large Uqab missiles with 333-millimeter warheads and an enormous supply of SA-7 and C-802 missiles, two of which were used in an attack on an Israeli ship.**
- **Iran also supplied Hezbollah with an unknown number of UAV's, the *Mersad*, that Hezbollah briefly flew over the Israel-Lebanon border on November 7, 2004, and April 11, 2005; at least three were shot down by Israel during the summer 2006 war.**
- **Iran supplied Hezbollah advanced surface-to-air missiles, including Strela-2/2M, Strela-3, Igla-1E, and the Mithaq-1. The same missiles were reported to have been used to target Israeli helicopters.**
- **During Hezbollah's summer 2006 war with Israel, Iran resupplied the group's depleted weapons stocks.**
- **Hezbollah has recovered from its 2006 confrontation with Israel and has been able to rearm and regroup, and Iran has been an important part of that recovery.**
- **Various Types of Rockets, reportedly increasing its stockpile to 27,000 rockets, more than double what Hezbollah had at the start of the 2006 war.**
- **Among the deliveries were 500 Iranian-made "Zelzal" (Earthquake) missiles with a range of 186 miles, enough to reach Tel Aviv from south Lebanon. Syria may have delivered Scuds.**
- **Fighting in Lebanon in 2006 seems to have increased Hezbollah's dependence on Iran. Both Hezbollah's loss of weapons and fighters in the conflict with Israel and the resulting damage to its reputation and position within Lebanon made it more reliant upon Iran.**
- **Elements of Hezbollah planned attacks in Egyptian Sinai; operate in Iraq**

Figure III.24: Iran and Hamas

- **Iran openly supported Hamas and spoke out against the lack of support for Hamas by Arab regimes throughout the Middle East during engagements between the IAF and Hamas in late 2008 and early 2009 in Gaza.**
- **Iran provided training, arms and logistical support to Hamas during the fighting in Gaza between Israeli forces and Hamas militants in late December 2008 and early January 2009.**
- **Israeli intelligence sources continued to report Iranian efforts to rearm Hamas after a ceasefire agreement was reached in January 2009.**
- **Arms transfers come through Sudan and Sinai.**
- **Level of Iranian financial support uncertain**

Competition Over Nuclear Threats, Missiles, and Other Weapons of Mass Destruction

Iran's potential acquisition of nuclear weapons and the ability to arm its missiles and aircraft with such weapons represents the most serious risk that shapes US, Arab, Israeli and other international perceptions. It is an area where the exact details of threat perceptions are particularly critical, although many key aspects of Israeli, US, and Gulf perceptions – as well as the perceptions of the decision makers in other states – are again impossible to determine at an unclassified level.

Estimates of Iranian nuclear weapons capabilities vary although most US, European, Gulf, and Israeli policymakers and experts agree that Iran is actively working towards the production of nuclear weapons. Similarly, they agree that Iran possesses a large and growing missile force, with some missiles capable of hitting Israel, and that Iran has begun developing long range solid fuel missiles, but unclassified estimates disguise the fact that the Iranian program is in constant flux and many systems are still in a development phase where their range, accuracy, warhead, and reliability is impossible to predict.

Iran's Ballistic Missile Program and its Role in US and Iranian Military Competition

Since the early 1980s, Iran has been developing ballistic missile capabilities based on Russian, North Korean, and Chinese technology. Iran currently possesses the largest ballistic missile inventory in the Middle East, and the country's military and scientific establishments are working to increase the sophistication, scale, and reach of its missiles.[52] Iran sees its missile capabilities as a way to compensate for its conventional shortcomings, as well as a means to strike at high-value targets with little warning, such as population centers, and Western and Western-backed forces in the region, including US bases in the Gulf. As such, ballistic missiles play an integral role in Iran's asymmetric warfare doctrine. Given the emphasis Iran places on its missile program, it is clear that Iran considers its ballistic missile arsenal among its most important assets as both a deterrent to attack and leverage over other regional players.

- **Figure III.25** shows the ranges of Iran's ballistic missiles. While Iran does not yet possess missiles with a range of 4,000 km, the possibility exists that Iran may soon produce missiles with such a capability given scale of its R&D into its ballistic missile program.
- **Figure III.26** reflects key developments in Iran's ballistic missile program in the last several years. Key points include the possibility that Iran could produce and intercontinental ballistic missile by 2015, and indicators that Iran is developing a nuclear warhead for its Shahab-3 intermediate range ballistic missile.
- **Figure III.27** provides a table that indicates the names, fuel types, estimated ranges, and likely payloads of the missiles in Iran's arsenal

[52] Statement for the Record on the Worldwide Threat Assessment of the U.S. Intelligence Community for the House Permanent Select Committee on Intelligence, James R. Clapper, 11 Feb. "11

As **Figure III.27** shows, Iran possesses a robust, diverse arsenal of ballistic missiles. Of particular note are Iran's medium-range ballistic missiles (MRBMs), which include the Shahab-3 and its longer range variants. Based on the North Korean Nodong-1, the Shahab-3 has a range of 1,000 to 1,500 km, and can potentially reach targets throughout the Middle East.[53] Other Iranian MRBMs include variants of the Shahab-3, such as the Shahab-3A, Shahab-3B, Shahab-4 (Ghadr-1), Sajjil, and the BM-25. These missiles have ranges of 1,500 to 2,500 km, and are thought to be able to strike at targets throughout the Middle East, Turkey, and southeast Europe.[54] Although Iran's missiles do not possess the precision accuracy necessary for conventionally armed missiles to be effective against point or high value targets, even conventionally armed missiles can be used as tool of terror and intimidation and to strike at targets throughout the region with little, if any, warning.

The net effect of Iran's ballistic missiles and US efforts at missile defense on both countries' capabilities is uncertain. Although Iran boasts a large arsenal of conventionally-armed missiles of varying ranges and payloads (**Figure III.27)**, US countermeasures and Iran's lack of precision guidance largely mitigate their effectiveness in a traditional conventional confrontation. The psychological impact of Iran's ability to launch a sudden, massive missile barrage on regional population centers and military installations, however, should not be underestimated. While there is still no evidence that Iran has installed warheads with anything other than a conventional payload on its missiles, Iran's ability to launch a large volume of missiles with little warning renders them as a means of leveraging regional competitors.

While Iran's ballistic missile arsenal lacks the proven ability to carry out precision strikes, the commander of the IRGC, Brigadier General Mohammed Ali Jafari, announced the deployment of a "smart" anti-ship ballistic missile, the *Khalij Fars*, in a February 2011 press conference. According to Iranian press reports, the *Khalij Fars* is allegedly capable of striking at moving ships in the Gulf at ranges of up to 150 km.[55]

While these capabilities remain unconfirmed and Iran's claims seem sharply exaggerated, if Iran did reach such a level of sophistication in guidance, reliability, and operational accuracy, it could potentially upset the regional balance. It not only would threaten the naval balance, but potentially allow Iran to develop conventionally armed missiles that could strike at high-value targets such as desalination plants, power plants, oil platforms, and military installations with precision.

As long as Iran's missiles remain conventionally armed and lack precision guidance, they will not have a decisive or significant impact on the conventional military balance in the Middle East. They do, nevertheless, have the aforementioned capabilities of intimidating and leveraging Iran's neighbors, and force the US and its regional allies to devote resources to missile defense. If Iran

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[53] U.S. Congressional Research Service. "Iran‟s Ballistic Missile Programs: An Overview." RS22758, 04 Feb. ‟09, Steven A. Hildreth.

[54] U.S. Congressional Research Service. "Iran‟s Ballistic Missile Programs: An Overview." RS22758, 04 Feb. ‟09, Steven A. Hildreth.

[55] "Iran mass producing smart ballistic missiles: IRGC chief." Tehran Times, February 8, 2011.

were to arm its missiles with CBRN warheads, however, it would dramatically upset the regional balance. Such action would provide Iran with a solid deterrent, and a greater capability to exercise a bolder and more aggressive regional foreign policy

The situation will be very different if they are armed with weapons of mass destruction. With chemical, biological, radiological, or nuclear (CBRN) warheads, Iran's ballistic missiles would provide a much more effective deterrent to attack and provide Tehran with the ability to strike at major population centers. Given such payloads, even a small number of missiles armed with CBRN warheads that bypassed US and Arab Gulf defenses and countermeasures could potentially cause massive casualties, and do considerable damage to the militaries, economies, and critical infrastructure of regional countries. These capabilities, in combination with the deterrent and the psychological impact they would produce, would have a profound impact on the strategic balance between Iran and the US and its Arab Gulf allies.

What Iran's Actions and Statements Say About Its View of Competition: Ballistic Missiles

Iran continues to deny it is seeking a number of weapons but it is much more forthright about its missile programs:

- *"Our missiles have tactically offensive and strategically deterrent and defensive features… Our fingers are still kept on the trigger, but the number of these triggers has increased."* – Brigadier General Hossein Salami, Lieutenant Commander of the IRGC, June 28, 2011.
- *"We feel to be threatened by no county but the US and the Zionist regime and the ranges of our missile have been designed based on the distances between us and the US bases in the region and the Zionist regime."* – Brigadier General Amir Ali Hajizadeh, commander of the IRGC's Aerospace Division, June 28, 2011.
- *"The mass production of the Qiyam missile, the first without stabilizer fins, shows the Islamic Republic of Iran's self-sufficiency in producing various types of missiles."* – Iranian Defense Minister Ahmad Vahidi, May 22, 2011.
- *"As the enemy's threats will likely come from the sea, air, and by missiles, the Revolutionary Guard has been equipped to neutralize the enemy's advanced technology."* – Mohammed Ali Jafari, commander of the IRGC on a new anti-ship ballistic missile that Iran has allegedly developed, February 7, 2011.
- *"Iran is mass producing a smart ballistic missile for sea targets with a speed three times more than the speed of sound."* – Major General Mohammed Ali Jafari, commander of the IRGC, February 7, 2011.
- *"The operational capabilities of the missile unit of the IRGC Aerospace Force will be remarkably enhanced."* – Iranian Minister of Defense Ahmad Vahidi regarding the new indigenously produced Fateh-110 ballistic missile, September 21, 2010.
- *"Those who are hostile to the Islamic Republic of Iran definitely have the right to be concerned about the drills, but we didn't hear any feeling of concern from the side of the regional countries since our moves and actions have always been in pursuit of defensive goals.*

  We are entitled to the right to growingly strengthen ourselves to protect the Islamic Iran and we naturally increase our power on a daily basis until we acquire full (power of) deterrence." – General Amir Ali Hajizadeh, commander of the IRGC's Aerospace Division in reference to Iran's most recent missile tests, July 9, 2011.[56]

[56] Quotes taken from a number of Iranian news sources such as Fars News, PressTV, the Tehran Times, and others. Also included are quotes from Western news outlets such as CNN, the New York Times, and the Washington Post.

As these statements show, Iran views its ballistic missiles as a critical component of its national defense. In addition to an effective means for delivering a nuclear warhead, Iran's military establishment firmly believes that an effective ballistic missile program provides the country with increased strategic and asymmetric capabilities.

Iranian officials regularly make references to their missile forces as an effective deterrent to attack, and the Iranian leadership is not shy about its country's advancements concerning ballistic missile technology. High-ranking officials in Iran's political and military establishments regularly boast of their country's progress in this field.

On February 8, 2011, the *Tehran Times* reported that IRGC chief Mohammed Ali Jafari' had claimed at a press conference that Iran had developed "supersonic" smart ballistic missiles which "cannot be tracked and can hit targets with high precision" as well as "coastal radars with a range of 300 km."[57] General Jafari also stated at the conference that the IRGC had recently completed studies on two mobile radars with a range of 60 km, which could be attached to small destroyers. Similarly, the Islamic Republic News Agency quoted General Jafari as stating that, "Iran is mass producing a smart ballistic missile for sea targets with a speed three times more than the speed of sound." The Iranian Students News Agency quoted General Jafari as stating the following regarding the new weapon:

> "As the enemy's threats will likely come from the sea, air, and by missiles, the Revolutionary Guard has been equipped with capabilities to neutralize the enemy's advanced technology."[58]

Such statements made by the commander of the IRGC cannot be taken lightly. While General Jafari's statements do not mention the US directly, his mention of an enemy with "advanced technology" threatening Iran from the sea and air most likely alludes to US air and naval power. This statement and others like it reflect Iran's strategic priority of denying foreign access to its waters, and what Iran perceives as an effective measure for countering the US presence in the Gulf.

Other senior officials in Iran's government have recently highlighted the importance of ballistic missile development. During the Great Prophet 6 war games in late June 2011, the commander of the IRGC's Aerospace Division, Brigadier General Amir Ali Hajizadeh, stated that,

> "We feel to be threatened by no county [sic] but the US and the Zionist regime and the ranges of our missile [sic] have been designed based on the distances between us and the US bases in the region and the Zionist regime."[59]

Later, on July 9, 2011, General Hajizadeh stated the following about the war games:

> "Those who are hostile to the Islamic Republic of Iran definitely have the right to be concerned about the drills, but we didn't hear any feeling of concern from the side of regional countries since our moves and actions have always been in pursuit of defensive goals.
>
> We are entitled to the right to growingly strengthen ourselves to protect the Islamic Iran and we naturally increase our power on a daily basis until we acquire full (power of) deterrence."[60]

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[57] "Iran mass producing smart ballistic missiles: IRGC chief." Tehran Times, February 8, 2011.

[58] Iranian Students News Agency, February 7, 2011.

[59] "All US, Israeli Bases Within Iran's Missile Range." Islamic Republic of Iran Broadcasting. June 28, 2011, http://english.irib.ir/voj/news/top-stories/item/79921-all-us-israeli-bases-within-irans-missile-range

On June 28, 2011, Lieutenant Commander of the IRGC, Brigadier General Hossein Salami, also made reference to the deterrent that Iran perceives in its missile forces:

> "Our missiles have tactically offensive and strategically deterrent and defensive features… Our fingers are still kept on the trigger, but the number of these triggers has increased."[61]

Remarks made by such a high-ranking figure are revealing. They are a direct indication of the Iranian regime's continued willingness to improve its ballistic missile arsenal as a component of its asymmetric warfare capabilities and the deterrent it generates against the US and regional US allies. Given Iran's foreign policy objectives, conventional shortcomings, and ever-expanding missile program, it is clear that Iran sees its missile program as an effective tool to improve its strategic standing and assert itself in the region.

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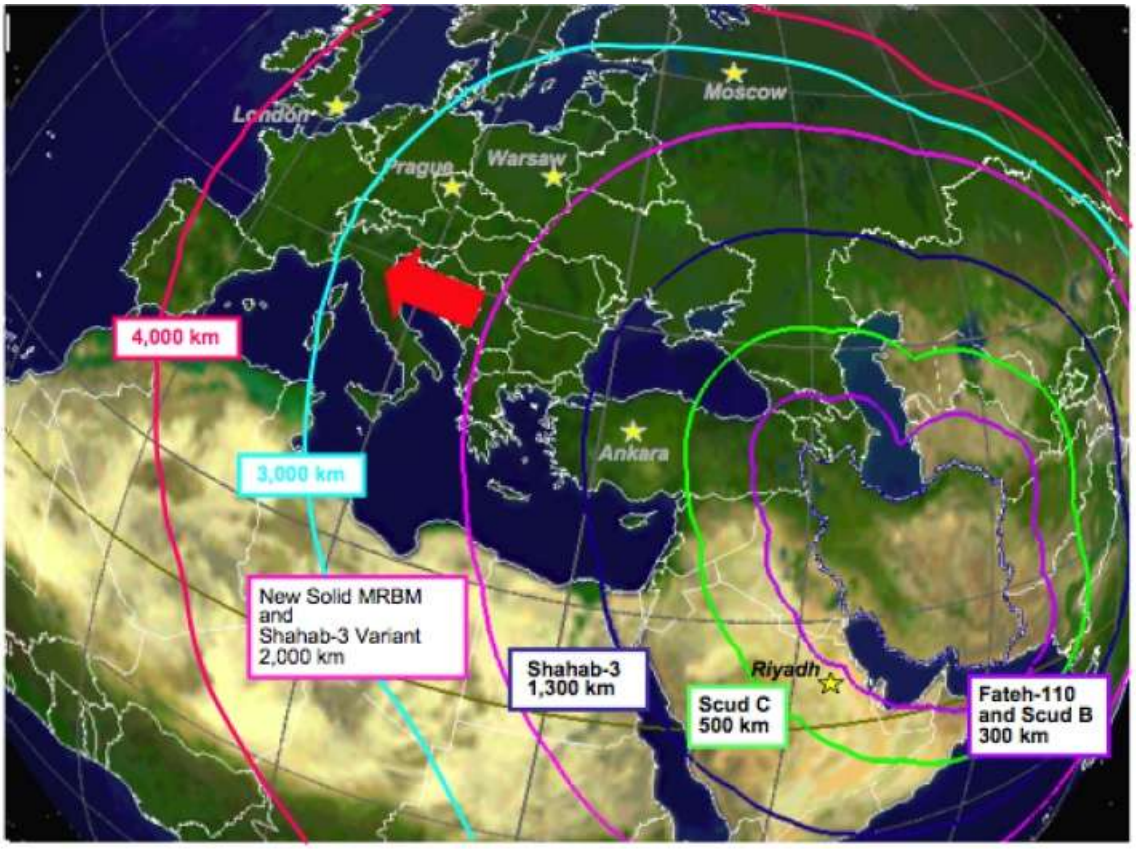
[60] "Iran Reiterates Deterrent Nature of Recent Missile Drills." Fars News. July 9, 2011, http://english.farsnews.com/newstext.php?nn=9004183678

[61] "Commander: IRGC Able to Launch Rapid, Massive Missile Strikes." Fars News, June 28, 2011, http://english.farsnews.ir/newstext.php?nn=9004074141

Figure III.25: Estimated Range of Iranian Long-range Missile Forces



Source: NASIC, B&CM Threat 2006, Jacoby Testimony March 2005

Figure III.26: Iran's Ballistic Missile Arsenal

Shahab-3 ("Meteor")	800-mile range. The Defense Department report of April 2010, cited earlier, has the missiles as "deployed." Still, several of its tests (July 1998, July 2000, and September 2000) reportedly were unsuccessful or partially successful, and US experts say the missile is not completely reliable. Iran tested several of the missiles on September 28, 2009, in advance of the October 1 meeting with the P5+1.
Shahab-3 "Variant"/Sajjil	1,200-1,500-mile range. The April 2010 Defense Department report has the liquid fueled Shahab-3 "variant" as "possibly deployed." The solid fuel version, called the Sajjil, is considered "not" deployed by the Defense Department. The Sajjil is alternatively called the "Ashoura." These missiles potentially put large portions of the Near East and Southeastern Europe in range, including US bases in Turkey.
BM-25	1,500-mile range. On April 27, 2006, Israel's military intelligence chief said that Iran had received a shipment of North Korean-supplied BM-25 missiles. Missile said to be capable of carrying nuclear warheads. The *Washington Times* appeared to corroborate this reporting in a July 6, 2006 story, which asserted that the North Korean-supplied missile is based on a Soviet-era "SS-N-6" missile. Press accounts in December 2010 indicate that Iran may have received components but not the entire BM-25 missile from North Korea.
ICBM	US officials believe Iran might be capable of developing an intercontinental ballistic missile (3,000 mile range) by 2015, a time frame reiterated by the April 2010 DOD report.
Other Missiles	On September 6, 2002, Iran said it successfully tested a 200 mile range "Fateh-110" missile (solid propellant), and Iran said in late September 2002 that it had begun production. Iran also possesses a few hundred short-range ballistic missiles, including the *Shahab-1* (Scud-B), the *Shahab-2* (Scud-C), and the *Tondar-69* (CSS-8). In January 2009, Iran claimed to have tested a new air-to-air missile. On March 7, 2010, Iran claimed it was now producing short-range cruise missiles that it claimed are highly accurate and can destroy heavy targets. At a February 8, 2011 press conference, IRGC chief Mohammed Ali Jafari announced that Iran had developed the Khalij Fars ("Persian Gulf"), a "smart" anti-ship ballistic missile based on the Fateh-110 which is allegedly able to hit high-value targets throughout the Gulf.
Space Vehicle	In February 2008, Iran claimed to have launched a probe into space, suggesting its missile technology might be improving to the point where an Iranian ICBM is realistic. Following an August 2008 failure, in early February 2009, Iran successfully launched a small, low-earth satellite on a Safir-2 rocket (range about 155 miles). The Pentagon said the launch was "clearly a concern of ours" because "there are dual-use capabilities here which could be applied toward the development of long-range missiles." Additionally, Iran has embarked on an ambitious satellite launch program since early-mid 2011.
Warheads	A *Wall Street Journal* report of September 14, 2005, said that US intelligence believes Iran is working to adapt the Shahab-3 to deliver a nuclear warhead. Subsequent press reports say that US intelligence captured an Iranian computer in mid-2004 showing plans to construct a nuclear warhead for the Shahab. The IAEA is seeking additional information from Iran.

Sources: US Congressional Research Service. "Iran: US Concerns and Policy Responses." RL32048, 14 Feb. '11, Kenneth Katzman, Iranian Reporting

Figure III.27: Iranian Rockets and Missiles

Missile	**Translation**	**Fuel Type**	**Estimated Range**	**Payload**
Fajr-3	*Dawn-3*	Solid	45 km	45 kg
Fajr-5	*Dawn-5*	Solid	75 km	90 kg
Fateh-110	*Victorious*	Solid	20 km	500 kg
Ghadr-1	*Powerful-1*	Liquid	1600 km	750 kg
Iran-130/Nazeat	*Removal*	Solid	90-120 km	150 kg
Kh-55		Liquid	2500-3000 km	400-450 kg
Nazeat-6	*Removal-6*	Solid	100 km	150 kg
Nazeat-10	*Removal-10*	Solid	140-150 km	250 kg
Oghab	*Eagle*	Solid	40 km	70 kg
Sajjil-2	*Baked Clay-2*	Solid	2200-2400 km	750 kg
Shahab-1	*Meteor-1*	Liquid	300 km	1000 kg
Shahab-2	*Meteor-2*	Liquid	500 km	730 kg
Shahab-3	*Meteor-3*	Liquid	800-1000 km	760-1100 kg
Shahin-1	*Hawk-1*	Solid	13 km	
Shahin-2	*Hawk-2*	Solid	20 km	
Zelzal-1	*Earthquake-1*	Solid	125 km	600 kg
Zelzal-2	*Earthquake-2*	Solid	200 km	600 kg

Source: 2010 IISS Iran's Ballistic Missile Capabilities: A Net Assessment

Estimating the Iranian Nuclear Threat

Iran's nuclear programs represent the most controversial and uncertain aspect of its military efforts. **Figures III.28** to **Figure III.42** provide a summary range of data and views **of** developments in the Iranian nuclear and missile programs, Iran's lack of cooperation with the IAEA, and indicate the possible weaponization of Iran's nuclear program.

These Figures are provided in such detail so they can clearly distinguish sources and the individual aspects of Iran's programs. This is necessary There are still many aspects of the Iranian nuclear and missile programs that remain uncertain and controversial. Hard data are lacking on many aspects of Iran's current efforts, and experts are forced to speculate. There are still experts who question whether Iran is seeking nuclear weapons, and there is no consensus over how soon it will be able to get the weapons-grade fissile material it needs.

- **Figure III.28** reflects the cumulative production of low-enriched uranium (LEU) at Iran's principal enrichment site, Natanz. As of September 2011, more than 4,500 kg of LEU has been produced. As of February 2008, less than 200 kg had been produced.
- **Figure III.29** reflects the likely impact that Stuxnet had on the production of LEU at the Natanz enrichment site. The figure reflects the fact that as of January 31, 2010, 11 cascades in Module A26 were disconnected. There were 1,804 IR-1 centrifuges in these 11 cascades. As of May 24, 2010, five cascades were disconnected. It also reflects that in the time period between August 12, 2009 and August 29, 2010, between 14 and 18 cascades were installed but not under vacuum, and up to two had their centrifuges disconnected.
- **Figure III.30** shows trends in the number of centrifuges operating at Natanz. While the number has increased dramatically since February 2007, the number of centrifuges in operation since August 2009 has fluctuated, possibly due to the Stuxnet virus.
- **Figure III.31** shows trends in the number of cascades enriching uranium, the amount of LEU produced monthly, and the amount of UF6 produced monthly. Note that there has been a general increase in each, with intermittent drops in production starting in June 2008. It is likely that equipment restrictions due to sanctions and the effects of the Stuxnet virus are to blame for the sporadic drops in production.
- **Figure III.32** indicates Iran's rate of production of LEU as well as levels of centrifuge operation at the Natanz Fuel Enrichment Plant (FEP). It indicates that as of November 1, 2011, Iran has produced 4,922 kg of LEU at the FEP, which is enough to produce four nuclear weapons if further enriched to weapons grade HEU. Moreover, it indicates that the average production of LEU at the FEP was 145 kg per month of LEU hexafluoride a rate that has fallen slightly from the last reporting period, where Iran produced 148 kg per month. Lastly, as of November 2, 2011, Iran was enriching in 37 cascades containing a total of 6,208 IR-1 centrifuges
- **Figure III.33** indicates that as of October 22, 2011, Iran has installed a 164-machine cascade of IR-2 centrifuges, all of which are under vacuum. 66 IR-4 centrifuges have been installed, but none have been are being fed with uranium hexafluoride. It also indicates that during the reporting period, Iran produced 19.75% enriched uranium at a rate of 3.94 kg/month, approximately a 20 percent decrease from the previous reporting period. In total, Iran has fed 765.5 kg of 3.5% LEU to produce 79.7 kg 19.75% uranium since the beginning of operations in February 2010. Such an increase in the production of 19.75% enriched uranium accelerates Iran's ability to reach a nuclear breakout capability, and would allow the country to produce more nuclear weapons in a shorter period of time.
- **Figure III.34** indicates that Iran is moving forward with uranium enrichment at the Fordow Fuel Enrichment Plant. Moreover, Iran has indicated that it will follow through with its plans to use the facility to enrich uranium to 19.75%.
- **Figure III.35** shows the Bipartisan Research Center's timeline of Iran's monthly enrichment rate as well as Iran's IAEA-confirmed 3.5% LEU stockpile. It reveals that the Stuxnet worm did not have any kind of

significant effect on the country's ability to enrich uranium, and that the country's enrichment rate has nearly doubled in comparison to the pre-Stuxnet rate. Moreover, it shows that Iran's LEU stockpile surpassed the 1,850 kg needed for one nuclear explosive device in August 2010.

- **Figure III.36** provides the Bipartisan Policy Center's timeline of Iran's enrichment rate vs. the number of operational centrifuges it has at the Natanz FEP. It reveals that Stuxnet may have had a deleterious effect on the number of operational centrifuges Iran operated, but that Iran's rate of enrichment has nevertheless increased, as has the number of operational centrifuges since the last major Stuxnet attack in May of 2010.
- **Figure III.37** shows the location of Iran's major/principle nuclear facilities which are concentrated in the west-central part of the country.
- **Figure III.38** shows the Bipartisan Policy Center's projections for the growth of Iran's stockpile of 19.75% HEU at the PFEP. It shows that at the current production rate of 3.2 kg/month, Iran will be able to have enough 19.75% HEU to produce one nuclear explosive device some time after December 2012. At a 300% increased rate (9.6 kg/month), it projects that Iran could have enough material to produce a nuclear weapon by approximately October 2012.
- **Figure III.39** gives the Bipartisan Policy Center's projections for the time it would take for Iran to produce the necessary 20 kg of 90% HEU for a nuclear device. The estimate given is 62 days.
- **Figure III.40** provides the Bipartisan Policy Center's projections for the time it would take Iran to produce 20 kg of HEU at Natanz given variable stockpile enrichment levels, centrifuge efficiency, and number.
- **Figure III.41** contrasts the different estimates of both the Bipartisan Policy Center and the IISS of Iran's nuclear breakout ability. According to the BPC itself, its estimate is vastly lower than that of the IISS for the following reasons:
    1) IISS assumes Iran will use a slower enrichment process because it is more efficient, our analysis is based on a faster method;
    2) IISS assumes Iran will only use 3,936 centrifuges, while they have 5,184 currently operational at Natanz;
    3) IISS estimates that Iran will need 37.5kg of HEU for a nuclear weapon, compared to our estimate of 20kg;
    4) the IISS assessment is of the time to go from LEU stockpile to a manufactured, spherical uranium metal core for a nuclear device, our calculations only include enriching LEU into HEU. When updated with our assumptions (faster enrichment, more centrifuges, less HEU), the IISS calculation is actually closely in line with our own: 2.5 months to produce HEU at Natanz.
- **Figure III.42** shows the amount of fissile material needed to build a basic fission weapon.
- **Figure III.43** summarizes the February 25, 2011 IAEA report. It shows that continues to refuse to cooperate with the IAEA regarding weaponization issues, heavy water production, R&D into uranium enrichment, and enrichment locations.
- **Figure III.44** provides a detailed account of Iran's lack of cooperation with the IAEA in matters pertaining weapons production and the militarization of its nuclear program as of February 25, 2011. These areas include production of LEU up to U-235 20% at Natanz; construction of the Fordow Fuel Enrichment Plant; heavy water production; locations, equipment, persons, or documentation related to the possible military dimensions of Iran's program; high explosives manufacturing and testing, exploding bridgewire detonator studies, particularly in involving applications necessitating simultaneity, and missile re-entry vehicle redesign activities for a new payload assessed as being nuclear in nature; IR-40 reactors.
- **Figure III.45** shows that Iran continued to show a lack of cooperation with the IAEA on seven key matters relating to weaponization as of May 24, 2011 that were objects of the IAEA's concern in February 2011.
- **Figure III.46** provides details regarding enrichment activities at the Fuel Enrichment Plant (FEP) and Pilot Fuel Enrichment Plant (PFEP) as of May 24, 2011. Both the FEP and PFEP are located at the Natanz enrichment facility.

- **Figure III.47** provides details on Iran's efforts to increase the production of 19.75% enriched uranium. Stockpiling uranium enriched to 19.75% would enhance Iran's ability to achieve a fast nuclear breakout capability.
- **Figure III.48** provides regarding the purpose and the capabilities of the Fordow enrichment plant it is constructing near Qom. Iran stated that the purpose of this facility would be the production of UF6 enriched to 5.0%, and that it would contain roughly 3,000 centrifuges.
- **Figure III.49** details Iran's plans to install 64-centrifuge cascades at the previously hidden Fordow facility, and triple its enrichment output of 19.75% LEU. Such a move would provide Iran with a much faster breakout ability should it choose to produce nuclear weapons.
- **Figure III.50** describes continuing work on heavy water-related projects as of May 24, 2011, contrary to the resolutions of the IAEA Board of Governors and the UN Security Council. Moreover, Iran had not allowed access to these facilities as of May 24, 2011.
- **Figure III.51** describes IAEA concerns as of June 2011. According to Yukiya Amano, the head of the IAEA, makes it clear that certain undisclosed nuclear-related activities in Iran seem to indicate military dimensions to the program. It also indicates that Iran has repeatedly rebuffed IAEA requests to inspect its facilities.
- **Figure III.52** shows that as of September 2, 2011, Iran's total LEU production at the FEP is reported to be 4,543 kg of low enriched uranium. If enriched further to weapons grade, it would be enough to produce four nuclear weapons. It also indicates that as of August 28, 2011, Iran was enriching uranium using 5,860 IR-1 centrifuges in 35 cascades. Moreover, it indicates that Iran has not installed any new centrifuges since the last reporting period, and that Iran has approximately 8,000 centrifuges installed total.
- **Figure III.53** indicates that Iran has installed two cascades of advanced centrifuges at the PFEP as it said it would. As of August 28, 2011, Iran had installed 136 IR-2m centrifuges in cascade 5, and 27 IR-4 centrifuges in cascade 4. It also indicates that Iran produces 19.75% enriched uranium at a rate of 4.80%/month, a 23% increase from 3.91%/month in the last reporting period.
- **Figure III.54** indicates that Iran told the IAEA during an August 9, 2011 visit to the Arak IR-40 reactor that the start of the operation of the reactor is planned for 2013. On August 17, 2011, the IAEA visited the Arak Heavy Water Production Plant for the first time since 2005. Iran informed the IAEA that the plant was operational, and had produced a total of 60 tons of heavy water to that date. Iran continues to deny the IAEA access to the heavy water it has produced.

There are other uncertainties as to how many nuclear facilities Iran really has and how far it has gotten in producing more advanced centrifuges like the IR-2 and IR-4. Some experts estimate that even the IR-2 could be far more reliable and have some six times the output of the IR-1, making it far easier to disperse and conceal. "Guesstimates," however, are notoriously unreliable – particularly in their worst-case form. As of November 8, 2011, however, the IAEA reported that had installed 164 IR-2 centrifuges at the Pilot Fuel Enrichment Plant at Natanz, all of which were under vacuum. The Agency also discovered 66 IR-4 centrifuges at the facility, but none had been fed with UF6 at the time.[62]

As yet, there are no meaningful unclassified data on the size and nature of Iran's plans to deploy a nuclear-armed force, what role aircraft and various types of missile will play, how such a force will be based, and what kinds of command, control, computer, communications, and intelligence (C4I) systems Iran intends to deploy. Iran is constantly testing variants of its existing missiles

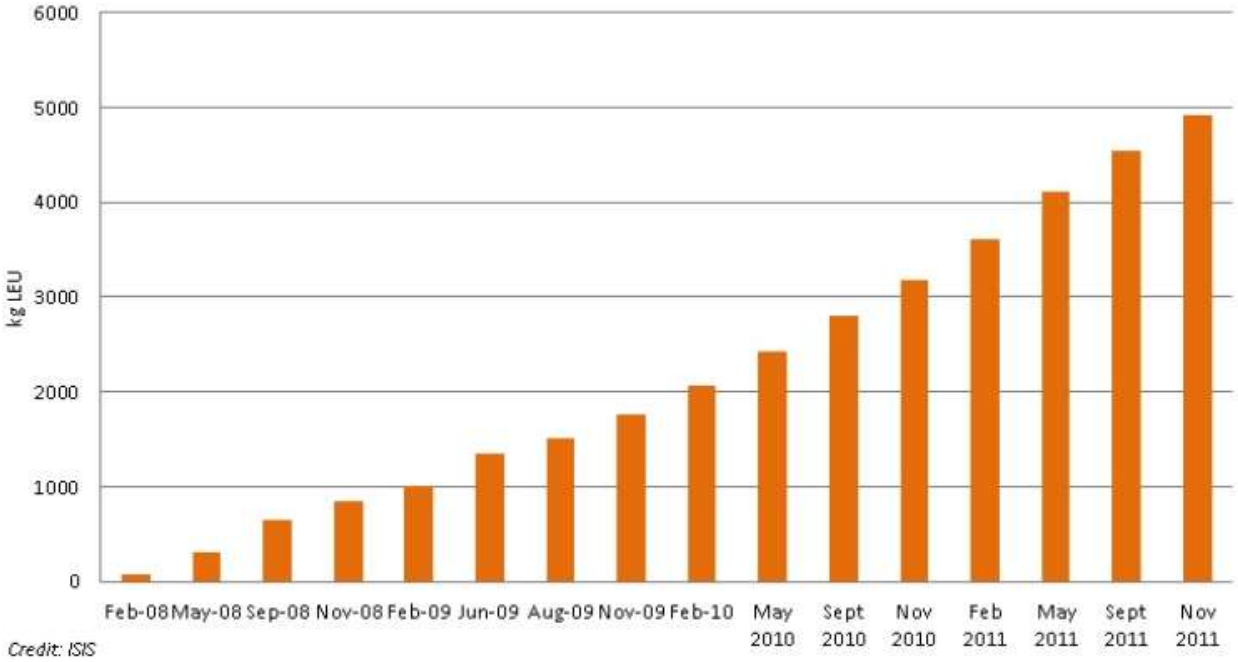
[62] IAEA, *Implementation of the NPT Safeguards Agreement and relevant provisions of Security Council resolutions in the Islamic Republic of Iran*, November 8, 2011
http://isis-online.org/uploads/isis-reports/documents/IAEA_Iran_8Nov2011.pdf

and claiming it is producing new types, as well as using alleged satellite launches as a vehicle for research and development into ballistic missile technology. It may be shifting from liquid-fueled missiles to solid-fuel types, and it keeps changing warhead configurations.

Nevertheless, most regional governments and experts do perceive Iran's nuclear and missile programs as directed towards giving Iran nuclear weapons and nuclear-armed missiles. Where they differ is over how quickly Iran can move forward, over the extent Iran is committed to deploying nuclear forces, and how serious the resulting threat may become. There are few indications, for example, that Americans, Europeans, or the Gulf states see this threat as "existential," or assign anything approaching the same sense of urgency as Israel does.

They see Iranian efforts to acquire nuclear weapons more as a way Iran can increase its strategic leverage and influence, increase its ability to intimidate and exert political pressure, and deter any military action against Iran in the face of a confrontation or crisis. While there is no consensus among them, many are more likely than their Israeli counterparts to believe that Iran is containable and deterrable through a mix of steps like missile defenses and regional extended deterrence.

Figure III.28: Cumulative LEU Production at Natanz



Source: ISIS Report. *ISIS Analysis of IAEA Iran Safeguards Report: Part 1.* David Albright, Paul Brannan, Andrea Stricker, and Christina Walrond. November 8, 2011, http://isis-online.org/uploads/isis-reports/documents/IAEA_Iran_Report_ISIS_analysis_08Nov2011.pdf

Figure III.29: Number of Centrifuge Cascades enriching, under vacuum, installed, or with centrifuges disconnected, January 31, 2010

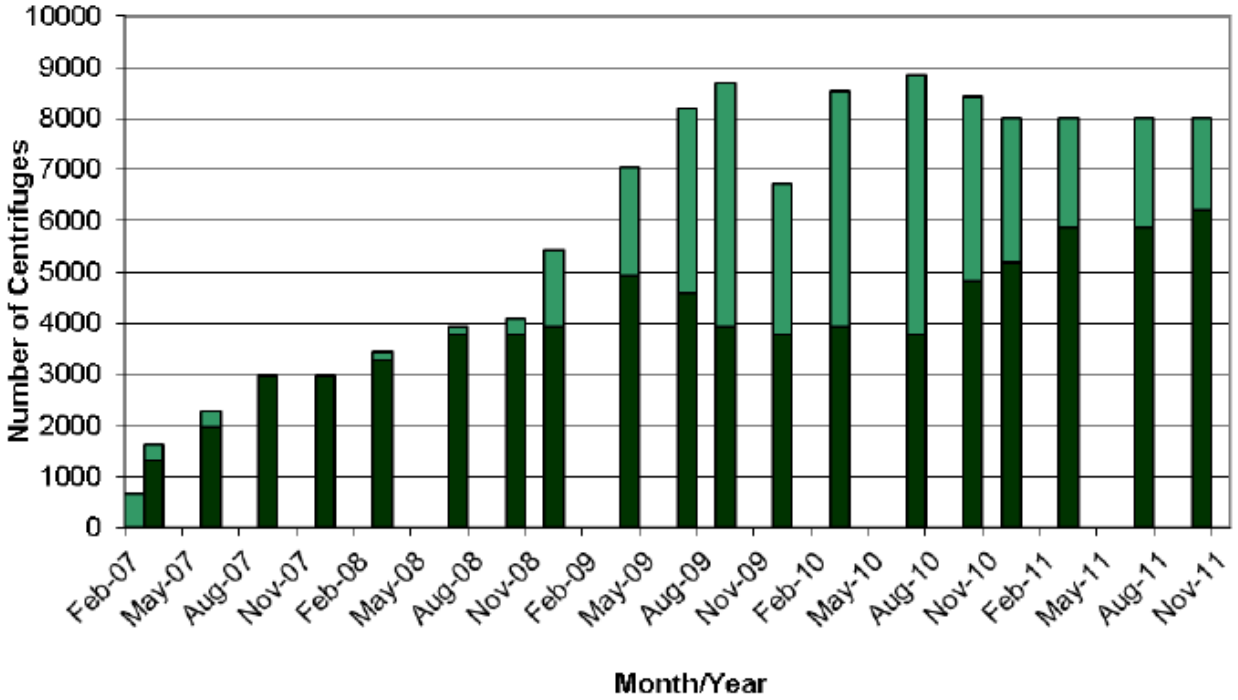
	Fed with UF_6	Under Vacuum	Installed, not Under vacuum	With Centrifuges Disconnected	Total
Module A24					
Aug. 12, 2009	18	0	0	0	18
Nov. 2, 2009	18	0	0	0	18
Jan. 31, 2010	17	1	0	0	18
May 24, 2010	18	0	0	0	18
Aug. 28, 2010	17	0	1?	0	18
Module A26					
Aug. 12, 2009	10	8	0	0	18
Nov. 2, 2009	6	12	0	0	18
Jan. 31, 2010	6	1	0	11	18
May 24, 2010	6	7	0	5	18
Aug. 28, 2010	6	6	6	?	18
Module A28					
Aug. 12, 2009	0	0	14-15	0	14-15
Nov. 2, 2009	0	0	17 (1 being installed)	0	18
Jan. 31, 2010	0	0	16	2*	18
May 24, 2010	0	0	16	2?	18
Aug. 28, 2010	0	0	18	0	18

* In these two cascades in module A28, Iran had removed all the centrifuges in one cascade and was removing the ones in the other one.

ISIS Report: *Did Stuxnet Take Out 1,000 Centrifuges at the Natanz Enrichment Plant?*

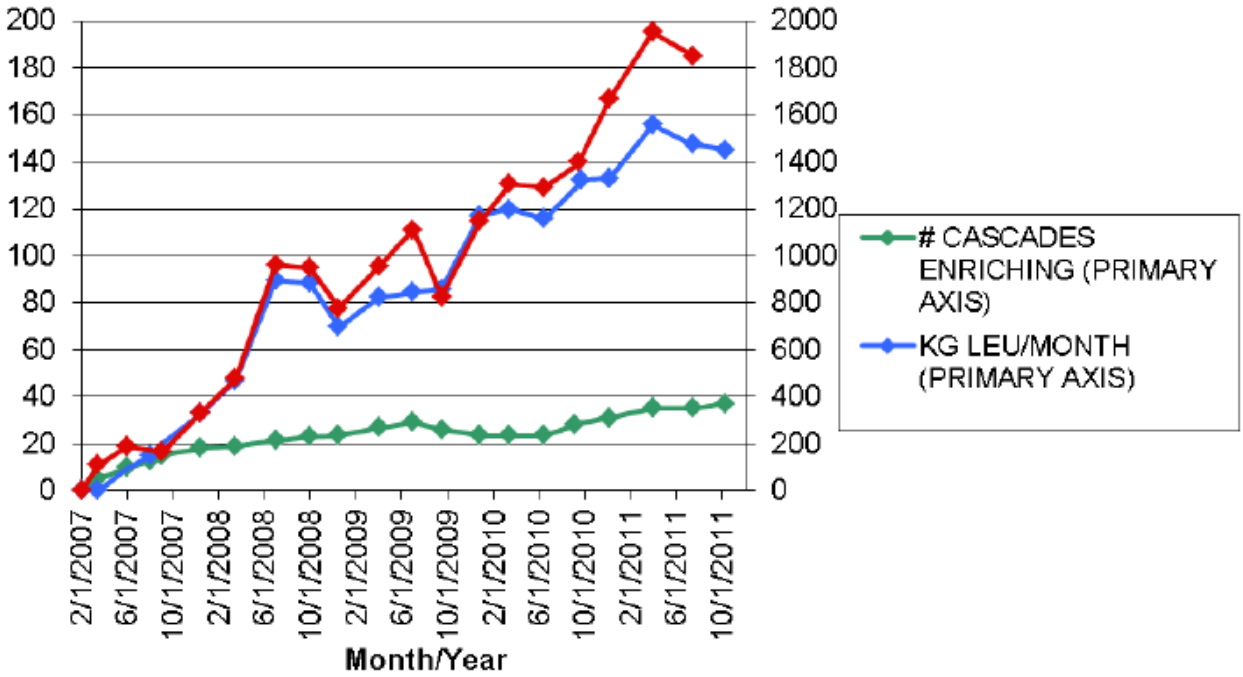
David Albright, Paul Brannan, and Christina Walrond. December 10, 2010, http://isis-online.org/isis-reports/detail/did-stuxnet-take-out-1000-centrifuges-at-the-natanz-enrichment-plant/

Figure III.30: Centrifuge Trends at Natanz



Source: ISIS Report. *ISIS Analysis of IAEA Iran Safeguards Report: Part 1*. David Albright, Paul Brannan, Andrea Stricker, and Christina Walrond. November 8, 2011, http://isis-online.org/uploads/isis-reports/documents/IAEA_Iran_Report_ISIS_analysis_08Nov2011.pdf

Figure III.31: ISIS Estimate of Monthly Trends at Natanz



Source: ISIS Report. *ISIS Analysis of IAEA Iran Safeguards Report: Part 1*. David Albright, Paul Brannan, Andrea Stricker, and Christina Walrond. November 8, 2011, http://isis-online.org/uploads/isis-reports/documents/IAEA_Iran_Report_ISIS_analysis_08Nov2011.pdf

Figure III.32: ISIS on the IAEA's November 8, 2011 Report on Iran – LEU production and Centrifuge Levels at Natanz Fuel Enrichment Plant (FEP)

Iran's total LEU production at the FEP through November 1, 2011 is reported to be 4,922 kg of low enriched uranium hexafluoride, including 379 kg estimated by Iran to have been produced since August 14, 2011. **This amount of low enriched uranium if further enriched to weapon grade is enough to make four nuclear weapons. The FEP is Iran's primary enrichment facility, where the majority of its IR-1 centrifuges are installed.**

The average production of LEU at the FEP was 145 kg per month of LEU hexafluoride a rate that has fallen slightly from the last reporting period, where Iran produced 148 kg per month.

As of November 2, 2011, Iran was enriching in 37 cascades containing a total of 6,208 IR-1 centrifuges. The IAEA noted that "not all of the centrifuges in the cascades being fed with uranium hexafluoride may have been working." At the end of the last reporting period, Iran was enriching in two fewer cascades and 348 fewer centrifuges. While Iran is enriching in more cascades, Iran has also not installed any new centrifuges since the last reporting period. According to the report, the total number of centrifuges installed is about 8,000 centrifuges, the same as in the last two reports. Uranium hexafluoride feed rates are not given.

This situation can also be understood by using an equivalent method that is easier to compare to historical enrichment output at the FEP, namely the output measured in separative work units (swu). ISIS derives this value from the declared LEU production. In the most recent reporting period, the LEU value is used with an assumption that the material is 3.5 percent enriched and the waste has a tails assay of 0.4 percent. The IAEA did not provide updated numbers in this report, but these older numbers can be used. Using standard enrichment calculators, 379 kg LEU translates to 932 kg of separative work units (swu), or 11.65 kg swu/day. On an annualized basis, this is about 4,252 swu per year (see Figure 6). The number of centrifuges declared as enriching was 5,860 at the beginning of the reporting period and rose to 6,208 at the end of the reporting period, corresponding with a swu/centrifuge-year of 0.73 and 0.68 respectively. For most of 2010, this value was about 0.9 kg U swu per year per centrifuge. These numbers imply that not all of Iran's centrifuges in cascades fed with uranium are actually enriching, and that these centrifuges are enriching less efficiently.

Source: ISIS Report. *ISIS Analysis of IAEA Iran Safeguards Report: Part 1.* David Albright, Paul Brannan, Andrea Stricker, and Christina Walrond. November 8, 2011, http://isis-online.org/uploads/isis-reports/documents/IAEA_Iran_Report_ISIS_analysis_08Nov2011.pdf

Figure III.33: ISIS on the IAEA's November 8, 2011 Report on Iran – Deployment of Advanced Centrifuges at Pilot Fuel Enrichment Plant (PFEP), 20 Percent Enrichment Continues

Over the last reporting period, Iran completed its installation of one, 164-machine cascade of IR-2m centrifuges and continued to install a cascade of IR-4 centrifuges. As of October 22, 2011, Iran had installed 164 IR-2m centrifuges in cascade 5 and 66 IR-4 centrifuges in cascade 4. All 164 IR-2m machines were under vacuum, and the IAEA report does not state whether they are being fed uranium hexafluoride. None of the IR-4 centrifuges had been fed with uranium hexafluoride. The purpose of operating these cascades is likely to demonstrate performance prior to installation of such cascades at Natanz, Fordow, or other enrichment sites. Iran continues to feed natural uranium hexafluoride into single machines as well as ten and twenty machine cascades of IR-1, IR-2m, and IR-4 centrifuges.

Iran has designated two cascades at the smaller, above-ground pilot fuel enrichment plant for the production of LEU enriched to nearly 20 percent uranium-235 for the Tehran Research Reactor (TRR). One of these cascades enriches from 3.5 percent LEU to almost 20 percent LEU, while the second one takes the tails from the first one and outputs about 10 percent LEU and a tails of natural uranium. The ten percent material is fed into the first cascade in addition to 3.5 percent LEU. This process allows Iran to more efficiently use its 3.5 percent LEU stock.

Between August 21, 2011 and October 28, 2011, 93 kg of 3.5 percent low enriched uranium in the form of uranium hexafluoride was introduced into the two, interconnected cascades, an slight decrease from the last reporting period. Iran withdrew a total of 8.9 kg of nearly 20 percent LEU hexafluoride. **During the reporting period, Iran produced 19.75 percent enriched uranium at a rate of 3.94 kg/month, approximately a 20 percent decrease from the previous reporting period. In total, Iran has fed 765.5 kg of 3.5% LEU to produce 79.7 kg 19.75% uranium since the beginning of operations in February 2010.**

Source: ISIS Report. *ISIS Analysis of IAEA Iran Safeguards Report: Part 1.* David Albright, Paul Brannan, Andrea Stricker, and Christina Walrond. November 8, 2011, http://isis-online.org/uploads/isis-reports/documents/IAEA_Iran_Report_ISIS_analysis_08Nov2011.pdf

Figure III.34: ISIS on the IAEA's November 8, 2011 Report on Iran – Fordow Fuel Enrichment Plant

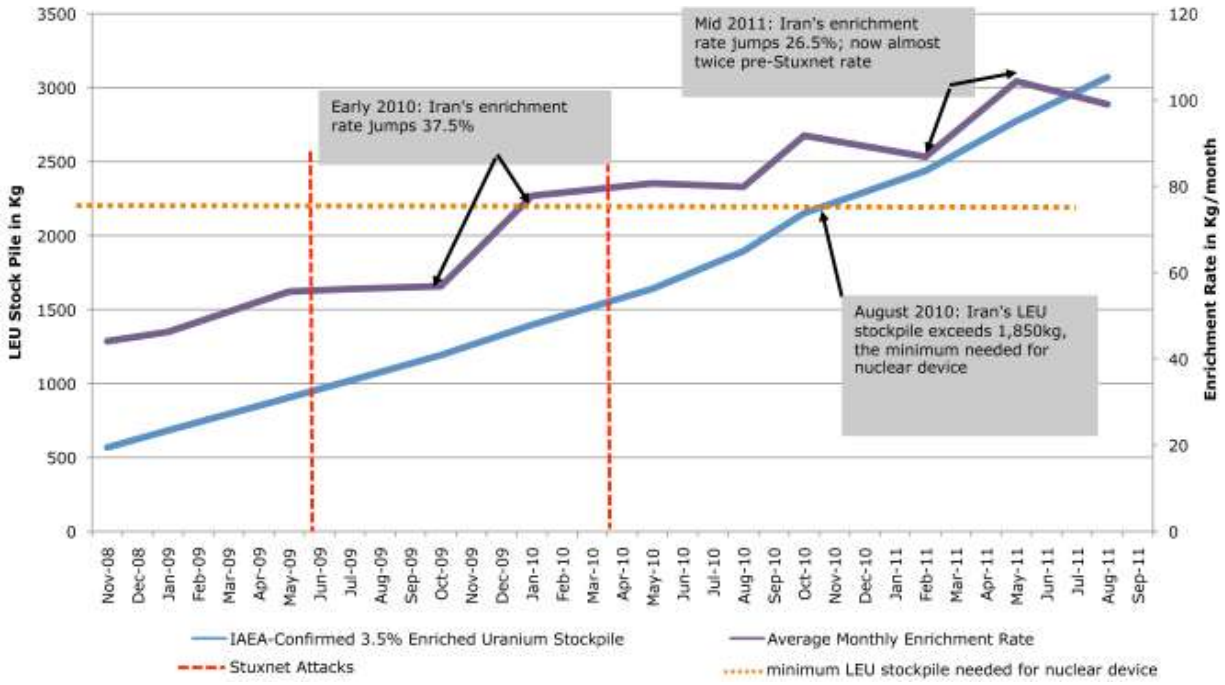
On October 17, 2011, Iran transferred from the FEP at Natanz a large cylinder of LEU in the form of uranium hexafluoride and a smaller cylinder containing depleted uranium. Iran informed the Agency of this action in an October 11, 2011 letter and stated that LEU will be used as feed at Fordow. Iran also requested that the IAEA remove the seal on the cylinder containing LEU on November 8, 2011.

During an inspection on October 23 and 24, 2011, the IAEA observed that Iran had installed all 174 IR-1 centrifuges in two tandem cascades in accordance with the third revised design information questionnaire (DIQ) from June 25, 2011. Iran plans to install a fourth cascade. This latest revised DIQ states that these cascades will be used for the production of 19.75 percent enriched uranium. The IAEA also noted that 64 IR-1 centrifuges had been installed in a third cascade. Iran informed the IAEA that the main power supply had been connected to the Fordow facility.

That Iran was caught building the Fordow plant in secret, and since Iran has subsequently changed the DIQ for this facility three times, raises concerns that the plant was built in order to provide Iran with the ability to quickly and securely make highly enriched uranium in the event of a breakout to make nuclear weapons. The IAEA has asked Iran for clarification on the circumstances that led to the construction of this facility.

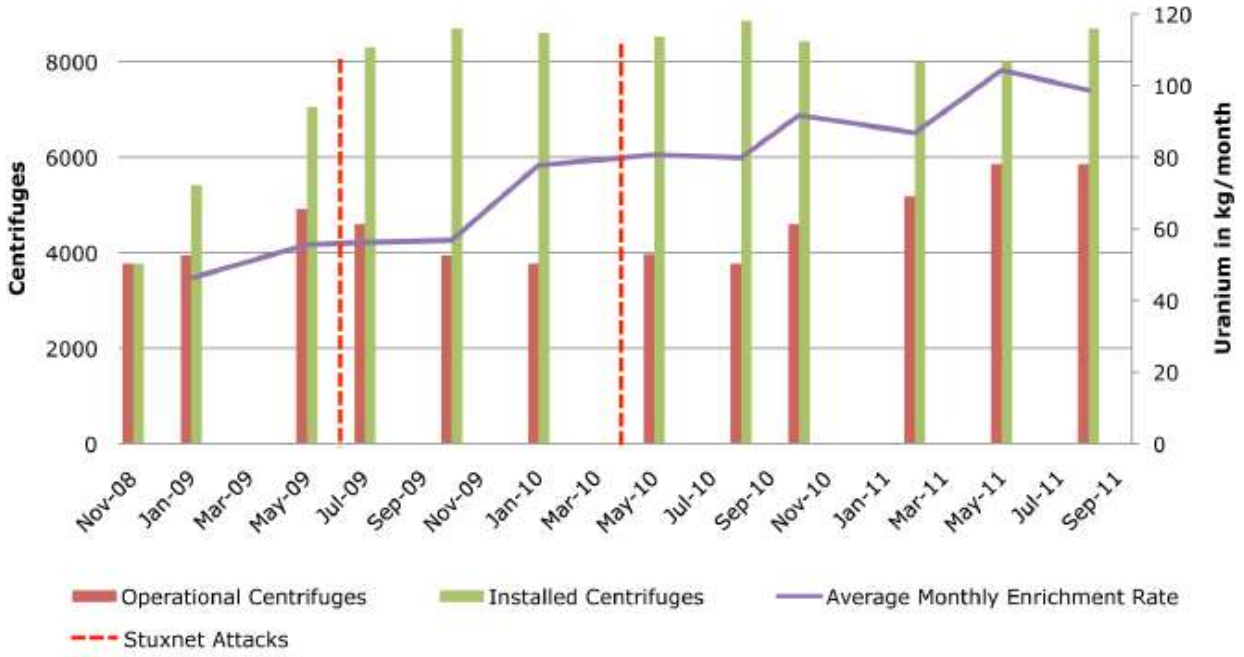
Source: ISIS Report. *ISIS Analysis of IAEA Iran Safeguards Report: Part 1*. David Albright, Paul Brannan, Andrea Stricker, and Christina Walrond. November 8, 2011, http://isis-online.org/uploads/isis-reports/documents/IAEA_Iran_Report_ISIS_analysis_08Nov2011.pdf

Figure III.35: Iran's LEU Stockpile and Enrichment Rate



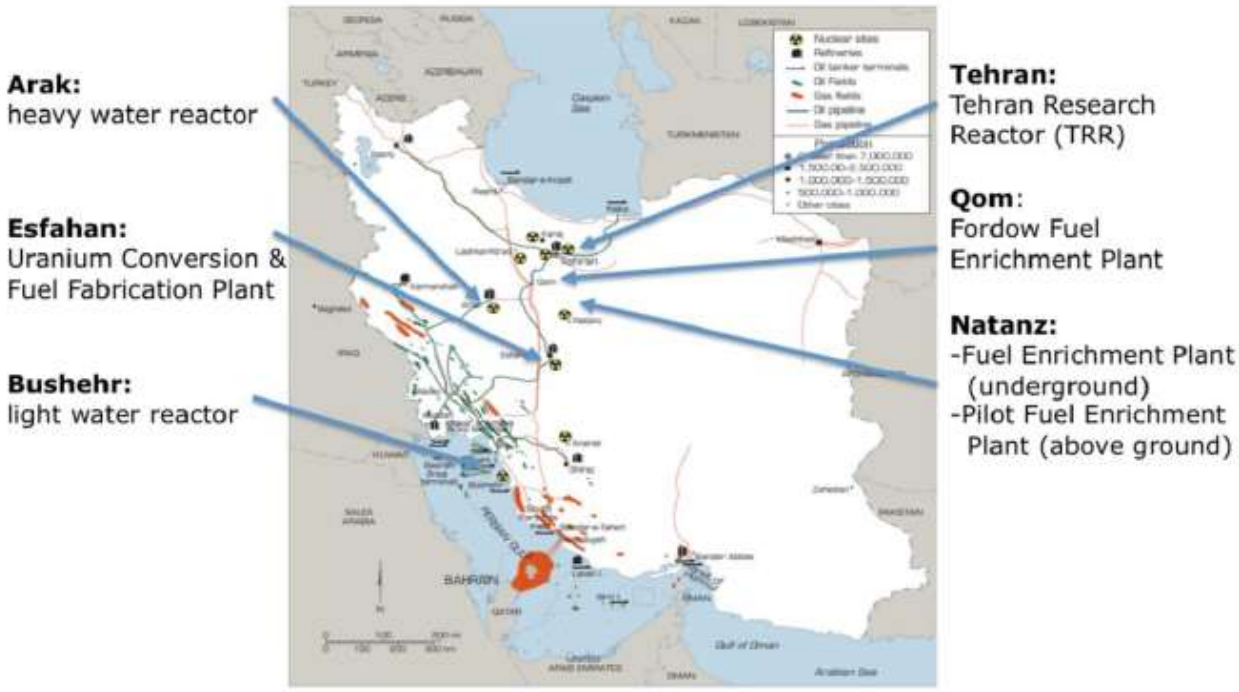
Source: Bipartisan Policy Center. "Iran's Nuclear Program: Status and Breakout Timing." September 12, 2011. http://www.bipartisanpolicy.org/sites/default/files/Iran%20Nuclear%20Program.pdf

Figure III.36: Enrichment Rate vs. Operational Centrifuges at Natanz Fuel Enrichment Plant



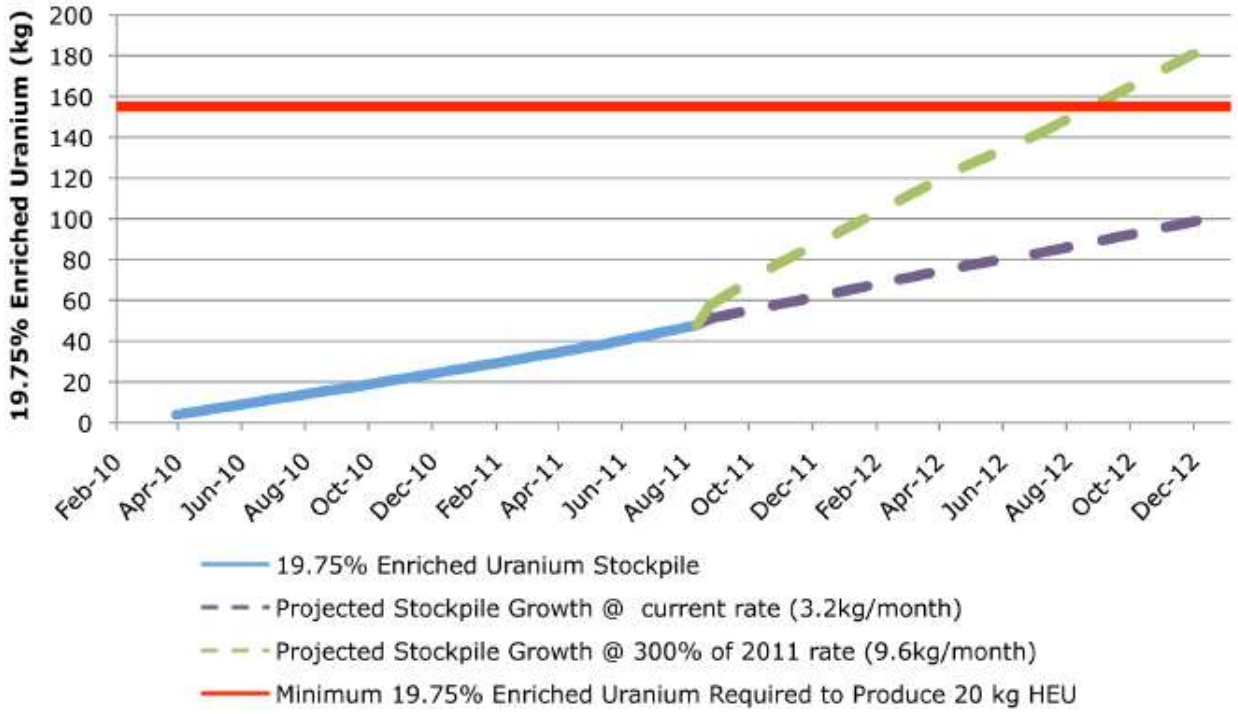
Source: Bipartisan Policy Center. "Iran's Nuclear Program: Status and Breakout Timing." September 12, 2011. http://www.bipartisanpolicy.org/sites/default/files/Iran%20Nuclear%20Program.pdf

Figure III.37: Iran's Main Nuclear Facilities



Source: Bipartisan Policy Center. "Iran's Nuclear Program: Status and Breakout Timing." September 12, 2011. http://www.bipartisanpolicy.org/sites/default/files/Iran%20Nuclear%20Program.pdf

Figure III.38: Bipartisan Policy Center's Projections for the Growth Iran's Stockpile of 19.75% HEU at Iran's Pilot Fuel Enrichment Plant



Source: Bipartisan Policy Center. "Iran's Nuclear Program: Status and Breakout Timing." September 12, 2011. http://www.bipartisanpolicy.org/sites/default/files/Iran%20Nuclear%20Program.pdf

Figure III.39: Time to Produce 20 kg of HEU at Natanz (assuming 5,184 centrifuges and .87 SWU/machine year)

CYCLE	FEEDSTOCK ENRICHMENT	FEEDSTOCK QUANTITY	PRODUCT ENRICHMENT	PRODUCT QUANTITY	TIME
First	3.5%	1,415 kg	19.7%	119.9 kg	46 days
Second	19.8%	153.2 kg (119.9 kg from 1st cycle + 38.3 kg from stockpile)	90%	20 kg	12 days
Total					62 days

- If Iran used (a) 3.5% enriched uranium feedstock for the first round of the batch recycling process and then added in its existing 19.8% enriched uranium stockpile, with (b) the efficiency of its centrifuges currently remaining at 0.87 Separative Work Units (SWU) per machine year and (c) using all 5,184 centrifuges currently enriching uranium at the FEP, Iran could produce 20 kg of HEU in 62 days.

- If Iran used (a) only 19.8% enriched uranium feedstock, which it does not currently possess but could have by the end of 2012, at the (b) the current efficiency and if it used (c) 5,184 centrifuges, it could produce 20 kg HEU in 12 days.

- If Iran used (a) only 3.5% enriched uranium feedstock, at (b) the current efficiency, it could breakout in between 43 and 105 days, depending on the number of centrifuges used.

- If Iran used (a) 3.5% enriched uranium feedstock and its (b) centrifuges' efficiency remained at the previous level of 0.5 SWU per machine year, it could break out in between 73 and 181 days, depending on the number of centrifuges used.

Source: Bipartisan Policy Center. "Iran's Nuclear Program: Status and Breakout Timing." September 12, 2011. http://www.bipartisanpolicy.org/sites/default/files/Iran%20Nuclear%20Program.pdf

Figure III.40: Time to Produce 20 kg of HEU at Natanz (with variable stockpile enrichment levels, centrifuge efficiency and number)

CENTRIFUGES USED:	STOCKPILE ENRICHMENT LEVEL:	CENTRIFUGE EFFICIENCY (IN SWU/MACHINE YEARS):	REQUIRED STOCKPILE:	TIME TO PRODUCE:
3,772	3.5%	0.5	1,960 kg	181 days
	3.5%	0.87	1,860 kg	105 days
	19.75%	0.87	157 kg	19 days
8,528	3.5%	0.5	1,920 kg	84 days
	3.5%	0.87	1,920 kg	50 days
	19.75%	0.87	162 kg	10 days
10,004	3.5%	0.5	1,930 kg	73 days
	3.5%	0.87	1,930 kg	43 days
	19.75%	0.87	163 kg	8 days

Source: Bipartisan Policy Center. "Iran's Nuclear Program: Status and Breakout Timing." September 12, 2011. http://www.bipartisanpolicy.org/sites/default/files/Iran%20Nuclear%20Program.pdf

Figure III.41: Differences Between BPC and IISS estimates of Iranian Nuclear Breakout

	ESTIMATE OF WHAT?	ENRICHMENT PROCESS	AMOUNT OF HEU	NUMBER OF CENTRIFUGES	TIME
BPC	HEU production	Batch recycling	20kg	5,184	62 days
IISS	HEU production	"Pakistan" method	37.5kg	3,936	1 year, 7 months
	HEU production	Batch recycling	37.5kg	3,936	Six months
	Metal core production				Six months

Source: Bipartisan Policy Center. "Iran's Nuclear Program: Status and Breakout Timing." September 12, 2011. http://www.bipartisanpolicy.org/sites/default/files/Iran%20Nuclear%20Program.pdf

Figure III.42: Amount of Fissile Material Need to Build a Basic Fission (Non-Boosted) Weapon

Highly Enriched Uranium HEU (90% U-235)	
Simple gun-type weapon	**90-110 lbs/40-50 kg**
Simple implosion weapon	**33lbs/15 kg**
Sophisticated implosion weapon	**20-26lbs/9-12kg**
Weapons Grade Plutonium	
Simple implosion weapon	**14lbs/6 kg**
Sophisticated implosion weapon	**4.5-9lbs/2-4 kg**

Extract from the unclassified estimates in Union of Concerned Scientists, "Preventing Nuclear Terrorism Fact Sheet," April 2004, and work by Abdullah Toukan

Figure III.43: February 25, 2011 IAEA Report

Iran's total LEU production at the Natanz fuel enrichment plant (FEP): To date is 3606 kg of low enriched uranium, including 471 kg estimated by Iran to have been produced from October 18, 2010 to February 5, 2011. The average monthly has remained at approximately 120 kg per month

Activity at the Pilot Fuel Enrichment Plant: Since February 2010, approximately 43.6 kg of UF6 enriched up to 20% U-235 has been produced.

Continued R&D of advanced centrifuges: In the R&D area between November 20, 2010 and February 11, 2011, a total of 169 of natural UF6 was fed into centrifuges, but no low enriched uranium was withdrawn. In an updated design information questionnaire (DIQ) submitted to the Agency on January 19, 2011, Iran indicated that it would install two new 164-centrifuge cascades (Cascades 4 and 5) in the R&D area. These two cascades, one of which will comprise IR-4 centrifuges and the other IR-m centrifuges, will be fed with natural UF6.

No progress on IAEA requests for Fordow design information: To date, Iran has "not provided supporting information regarding the chronology of the design and construction of the Fordow Fuel Enrichment Plant (FFEP), as well as its original purpose, particularly in light of extensive information from a number of sources alleging that design work on the facility had started in 2006." The Agency has verified that construction of FFEP is ongoing. As of February 19, 2011, no centrifuges had been introduced into the facility. On February 21, 2011, Iran stated that it planned to begin feeding nuclear material in to the cascades "by this summer."

Diminishing cooperation on centrifuge production, uranium enrichment R&D, and the locations thereof: "Since early 2008, Iran has not responded to Agency quests for access to addition locations, inter alia, to the manufacturing of centrifuges, and to R&D on uranium enrichment. As a result, the Agency's knowledge about Iran's enrichment activities continues to diminish."

Other enrichment activities: "The Agency is still awaiting a substantive response from Iran to Agency requests for further information in relation to announcements made by Iran concerning the construction of ten new uranium enrichment facilities, the sites for five of which, according to Iran, have been decided, and the construction of which will begin by the end of the current Iranian year (March 20, 2011) or the start of the next year." Additionally, Iran has provided further information regarding its possession of laser enrichment technology or its development of third generation centrifuges.

Heavy water production: To date, the Agency has not been given access to the Heavy Water Production Plant, the Uranium Conversion Facility, or "any other location in Iran where projects related to heavy water are being carried out" in spite of UN Security Council resolution 1737 (2006) that stipulates Iran do so. Iran has objected to the Agency's requests on the basis that they go beyond the Safeguards Agreement and because Iran has already stated that it has not suspended its heavy water related projects.

No progress on weaponization issues: No progress made on resolving what the IAEA terms "possible military dimensions" to Iran's nuclear program. Iran continues to refuse IAEA requests to discuss such issues and insists that the documentation on which such allegations are based are forgeries. The IAEA's Director General "have detailed the outstanding issues related to possible military dimensions to Iran's nuclear programme and the actions required of Iran necessary to resolve these. Since August 2008, Iran has declined to discuss these outstanding issues with the Agency, or to provide any further information, or access to locations or persons necessary to address the Agency's concerns." Additionally, "the Agency remains concerned about the possible existence in Iran of pat or current undisclosed nuclear related activities involving military related organizations, including activities related to the development of a nuclear payload for a missile.

Bushehr Nuclear Power Plant: "On 15-16 February 2011, the Agency conducted an inspection at the Bushehr Nuclear Power Plant (BNPP) and has verified the nuclear material present in the facility. On 23 February 2011, Iran informed the Agency that it would have to unload fuel assemblies from the core, and the Agency and Iran have agreed on the necessary safeguards measures."

Source: IAEA*, Implementation of the NPT Safeguards Agreement and relevant provisions of Security Council resolutions in the Islamic Republic of Iran*, February 25, 2011
http://www.iaea.org/Publications/Documents/Board/2011/gov2011-7.pdf

Figure III.44: Lack of Iranian Cooperation with the IAEA as of February 25, 2011

Areas where Iran is not meeting its obligations, as indicated in this report and previous reports of the Director General Iran has not suspended its enrichment related activities as follows:

- Production of UF6 at UCF as feed material for enrichment
- Manufacturing centrifuge components, and assembling and testing centrifuges
- Conducting enrichment related research and development
- Conducting operations, installation work and the production of LEU up to 3.5% U-235 at the Fuel Enrichment Plant (FEP)
- Conducting operations, installation work and the production of LEU up to 20% U-235 at the Pilot Fuel Enrichment Plant (PFEP)
- Conducting construction work at the Fordow Fuel Enrichment Plant (FFEP)

Iran is not providing supporting information regarding the chronology of the design and construction, as well as the original purpose, of FFEP Iran has not suspended work on heavy water related projects as follows:

- Continuing the construction of the IR-40 Reactor
- Production of heavy water at the Heavy Water Production Plant (HWPP)
- Preparing for conversion activities for the production of natural UO2 for IR-40 Reactor fuel
- Manufactured a fuel assembly, fuel rods and fuel pellets for the IR-40 Reactor

Iran has not permitted the Agency to verify suspension of its heavy water related projects by:

- Not permitting the Agency to take samples of the heavy water stored at UCF
- Not providing access to HWPP

Iran is not cooperating with the Agency regarding the outstanding issues which give rise to concern about possible military dimensions to Iran's nuclear programme:

- Iran is not providing access to relevant locations, equipment, persons or documentation related to possible military dimensions to Iran's nuclear programme; nor has Iran responded to the many questions the Agency has raised with Iran regarding procurement of nuclear related items
- Iran is not engaging with the Agency in substance on issues concerning the allegation that Iran is developing a nuclear payload for its missile programme. These issues refer to activities in Iran dealing with, inter alia:

  - neutron generation and associated diagnostics
  - uranium conversion and metallurgy
  - high explosives manufacturing and testing
  - exploding bridgewire detonator studies, particularly involving applications necessitating high simultaneity
  - multipoint explosive initiation and hemispherical detonation studies involving highly instrumented experiments
  - high voltage firing equipment and instrumentation for explosives testing over long distances and possibly underground
  - missile re-entry vehicle redesign activities for a new payload assessed as being nuclear in nature

Iran is not providing the requisite design information in accordance with the modified Code 3.1 in connection with:

- The IR-40 Reactor
- The announced new enrichment facilities

- The announced new reactor similar to TRR

Source: IAEA, *Implementation of the NPT Safeguards Agreement and relevant provisions of Security Council resolutions in the Islamic Republic of Iran*, February 25, 2011
http://www.iaea.org/Publications/Documents/Board/2011/gov2011-7.pdf

Figure III.45: IAEA on Possible Military Dimensions as of May 24, 2011

Previous reports by the Director General have listed the outstanding issues related to possible military dimensions to Iran's nuclear programme and the actions required of Iran necessary to resolve these.

On 6 May 2011, in light of Iran not having engaged with the Agency on the substance of these issues since August 2008, the Director General sent a letter to H.E. Mr. Fereydoun Abbasi, Vice President of Iran and Head of the Atomic Energy Organization of Iran (AEOI), reiterating the Agency's concerns about the existence of possible military dimensions to Iran's nuclear programme and expressing the importance of Iran clarifying these issues. In the same letter, the Director General also requested that Iran provide prompt access to relevant locations, equipment, documentation and persons, and noted that, with Iran's substantive and proactive engagement, the Agency would be able to make progress in its verification of the correctness and completeness of Iran's declarations.

Based on the Agency's continued study of information which the Agency has acquired from many Member States and through its own efforts, the Agency remains concerned about the possible existence in Iran of past or current undisclosed nuclear related activities involving military related organizations, including activities related to the development of a nuclear payload for a missile.

Since the last report of the Director General on 25 February 2011, the Agency has received further information related to such possible undisclosed nuclear related activities, which is currently being assessed by the Agency. As previously reported by the Director General, there are indications that certain of these activities may have continued beyond 2004.

The following points refer to examples of activities for which clarifications remain necessary in seven particular areas of concern:

- Neutron generator and associated diagnostics: experiments involving the explosive compression of uranium deuteride to produce a short burst of neutrons.
- Uranium conversion and metallurgy: producing uranium metal from fluoride compounds and its manufacture into components relevant to a nuclear device.
- High explosives manufacture and testing: developing, manufacturing and testing of explosive components suitable for the initiation of high explosives in a converging spherical geometry.
- Exploding bridgewire (EBW) detonator studies, particularly involving applications necessitating high simultaneity: possible nuclear significance of the use of EBW detonators.
- Multipoint explosive initiation and hemispherical detonation studies involving highly instrumented experiments: integrating EBW detonators in the development of a system to initiate hemispherical high explosive charges and conducting full scale experiments, work which may have benefitted from the assistance of foreign expertise.
- High voltage firing equipment and instrumentation for explosives testing over long distances and possibly underground: conducting tests to confirm that high voltage firing equipment is suitable for the reliable firing of EBW detonators over long distances.
- Missile re-entry vehicle redesign activities for a new payload assessed as being nuclear in nature: conducting design work and modeling studies involving the removal of the conventional high explosive payload from the warhead of the Shahab-3 missile and replacing it with a spherical nuclear payload.

Source: IAEA, *Implementation of the NPT Safeguards Agreement and relevant provisions of Security Council resolutions in the Islamic Republic of Iran*, May 24, 2011.

Figure III.46: IAEA on Natanz, May 24, 2011

Fuel Enrichment Plant (FEP): There are two cascade halls at FEP: Production Hall A and Production Hall B. According to the design information submitted by Iran, eight units are planned for Production Hall A, with 18 cascades in each unit. No detailed design information has yet been provided for Production Hall B.

On 14 May 2011, 53 cascades were installed in three of the eight units in Production Hall A, 35 of which were being fed with UF6. Initially, each installed cascade comprised 164 centrifuges. Iran has modified 12 of the cascades to contain 174 centrifuges each. To date, all the centrifuges installed are IR-1machines. As of 14 May 2011, installation work in the remaining five units was ongoing, but no centrifuges had been installed. There had been no installation work in Production Hall B.

Following a physical inventory verification (PIV) at FEP, the Agency confirmed that, as of 17 October 2010, 34 737 kg of natural UF6 had been fed into the cascades since the start of operations in February 2007, and a total of 3135 kg of low enriched UF6 had been produced.

Iran has estimated that, between 18 October 2010 and 13 May 2011, it produced an additional 970 kg of low enriched UF6, which would result in a total production of 4105 kg of low enriched UF6 since

February 2007. The nuclear material at FEP (including the feed, product and tails), as well as all installed cascades and the feed and withdrawal stations, are subject to Agency containment and surveillance. In a letter dated 4 April 2011, Iran informed the Agency that a metal seal in the feed and withdrawal area of FEP had been accidentally broken by the operator. The consequences for safeguards of this seal breakage will be evaluated by the Agency upon completion of the next PIV.

Pilot Fuel Enrichment Plant (PFEP): PFEP is a research and development (R&D) facility and a pilot, low enriched uranium (LEU) production facility, which was first brought into operation in October 2003. It has a cascade hall that can accommodate six cascades, and is divided between an area designated for the production of LEU enriched up to 20% U-235 and an area designated for R&D.

In the production area, Iran first began feeding low enriched UF6 into Cascade 1 on 9 February 2010, for the stated purpose of producing UF6 enriched up to 20% U-235 for use in the manufacture of fuel for the Tehran Research Reactor (TRR). Since 13 July 2010, Iran has been feeding low enriched UF6 into two interconnected cascades (Cascades 1 and 6), each of which consists of 164 centrifuges.

Iran has estimated that, between 19 September 2010 and 21 May 2011, a total of 222.1 kg of UF6 enriched at FEP was fed into the two interconnected cascades and that approximately 31.6 kg of UF6 enriched up to 20% U-235 was produced. This would result in a total of approximately 56.7 kg of UF6 enriched up to 20% U-235 having been produced since the process began in February 2010.

In the R&D area, between 12 February 2011 and 21 May 2011, a total of approximately 331 kg of natural UF6 was fed into centrifuges, but no LEU was withdrawn as the product and the tails of this R&D activity are recombined at the end of the process

Source: IAEA*, Implementation of the NPT Safeguards Agreement and relevant provisions of Security Council resolutions in the Islamic Republic of Iran*, May 24, 2011.

Figure III.47: 20% Enrichment and Weapons Production

May 31 IAEA safeguards report on Iran is the first to contain any data on the production of 19.75 percent enriched uranium in IR-1 centrifuges at the Natanz Pilot Fuel Enrichment Plant (PFEP.

The Natanz PFEP is configured to hold six 164-centrifuge cascades in total. Iran uses one of these cascade bays to test several more advanced types of centrifuges configured in 10, 20 and single unit cascades for R&D purposes. When Iran started making 19.75 percent enriched uranium, the PFEP held only one 164-centrifuge cascade, called cascade 1. It has now reinstalled a second cascade, called cascade 6, also designated for production of LEU enriched up to 20 percent. As of late May, cascade 6 had been prepared for enrichment but was not enriching pending the application of more sophisticated safeguards arrangements.

Between 18 and 29 September 2010, the Agency conducted a PIV at PFEP and verified that, as of 18 September 2010, 352 kg of low enriched UF6 had been fed into the cascade(s) since 9 February 2010, and that a total of 25.1 kg of UF6 enriched up to 20% U-235 had been produced. Iran declared that the enrichment level of the UF6 product was 19.89%. The Agency is continuing with its assessment of the PIV.9

Iran has estimated that, between 19 September 2010 and 19 November 2010, a total of 62.5 kg of UF6 enriched at FEP was fed into the two interconnected cascades and that approximately 7.8 kg of UF6 enriched up to 20% U-235 was produced. This would result in a total of approximately 33 kg of UF6 enriched up to 20% U-235 having been produced since the process began in February 2010.

How quickly Iran might produce 19.75 percent enriched uranium will depend on whether it uses only one cascade or decides to use more cascades at the PFEP. Although Iran has said that it will expand the enrichment effort beyond a single cascade, it has not revealed the enrichment level of the product of the second cascade.

...if Iran installs more cascades at the PFEP, it can speed up its production of 19.75 percent LEU. Nonetheless, one or two cascades would require several years to have enough 19.75 percent LEU to then further enrich and have sufficient weapon-grade uranium for a nuclear weapon. If Iran deploys five cascades it would produce this material in 0.5-1.7 years.

Iran has not stated how much 19.75 percent LEU it plans to produce or, for that matter, how many cascades it will ultimately devote to the production of this material. .

.As long as Iran maintains its centrifuge capability, it can incrementally strengthen its nuclear weapons capabilities under the guise of "peaceful" declarations, and shorten the time needed to make enough weapon-grade uranium for a nuclear weapon.

Source: ISIS Report: *Moving 20 Percent Enrichment to Fordow: Slow Motion Breakout Continues?* David Albright, Paul Brannan and Andrea Stricker. June 8, 2011, http://isis-online.org/isis-reports/detail/moving-20-percent-enrichment-to-fordow-slow-motion-breakout-continues/8

Figure III.48: IAEA on Qom (Fordow) as of May 24, 2011

In September 2009, Iran informed the Agency that it was constructing the Fordow Fuel Enrichment Plant (FFEP), located near the city of Qom. In its DIQ of 10 October 2009, Iran stated that the purpose of the facility was the production of UF6 enriched up to 5.0% U-235, and that the facility was being built to contain 16 cascades, with a total of approximately 3000 centrifuges. In September 2010, Iran provided the Agency with a revised DIQ in which it stated that the purpose of FFEP was now to include R&D as well as the production of UF6 enriched up to 5.0% U-235.

While the Agency continues to verify that FFEP is being constructed according to the latest DIQ provided by Iran, it is still not in a position to confirm the chronology of the design and construction of FFEP or its original purpose. Iran has stated that there is no legal basis upon which the Agency may request information on the chronology and purpose of FFEP, and that the Agency is not mandated to raise questions that are beyond its Safeguards Agreement. The Agency considers that the questions it has raised are within the terms of the Safeguards Agreement, in that the information requested is essential for the Agency to confirm that the declarations of Iran are correct and complete.

As stated in the Director General's previous report, on 21 February 2011, Iran informed the Agency that it planned to begin feeding nuclear material into cascades "by this summer". As of 21 May 2011, no centrifuges had been introduced into the facility. The results of the analysis of the environmental samples taken at FFEP up to February 2010 did not indicate the presence of enriched uranium.

Source: IAEA, *Implementation of the NPT Safeguards Agreement and relevant provisions of Security Council resolutions in the Islamic Republic of Iran*, May 24, 2011.

Figure III.49: Enrichment to 20% at Fordow

On June 8, Iran's vice president and head of the Atomic Energy Organization of Iran (AEOI), Fereydoun Abbasi, announced that Iran would install164-machine cascades of advanced centrifuges at the previously hidden Fordow enrichment plant and triple its enrichment output of 19.75 percent low enriched uranium (LEU) by the end of the year. By moving its 19.75 percent LEU production to Fordow and tripling its output of 19.75 percent LEU, Iran positions itself to stockpile a large amount of 19.75 percent LEU more quickly in a facility better protected against military strikes. A year after starting, Iran would have enough 19.75 percent LEU to more quickly break out and produce enough weapon-grade uranium for a nuclear weapon, if it chose to do so.

Iran's announcement indicates that as few as one centrifuge cascade of advanced centrifuges could produce the 19.75 percent LEU at Fordow. ISIS is interpreting that the threefold increase in this case refers to the greater enrichment output of the advanced centrifuges compared to the IR-1 centrifuges at Natanz.

Based on its output at the pilot enrichment plant at Natanz, Iran's monthly output of this LEU would increase threefold to almost 12 kilograms per month. Iran has already produced about 60 kilograms of 19.75 percent LEU at its pilot plant at Natanz. With increased production, Iran could accumulate about 200 kilograms of LEU one year after starting the cascade at Fordow, assuming the cascade at Natanz stops producing this material, as Iran has indicated will happen. Two hundred kilograms of 19.75 percent LEU are enough material, if further enriched, to make sufficient weapon-grade uranium for one nuclear weapon.

All of this supports a possible on-going effort by Iran to slowly acclimatize the international community to conditions that would make a breakout to nuclear weapons more feasible. Although Iran claims that it needs 19.75 percent LEU to operate its Tehran research reactor and additional ones it plans to build, it does not yet have the capability to build these new reactors and it has produced several years' worth of enriched uranium for the Tehran research reactor. If Iran proceeds with its plan, it will accumulate a large stockpile of 19.75 percent LEU at Fordow, and this stock and the centrifuges producing it would be heavily fortified inside the Fordow mountain facility and rendered less vulnerable to aerial strikes. Iran could quickly move its stock of 19.75 percent LEU elsewhere for enrichment to weapon-grade in a small, easily hidden centrifuge facility or kick out IAEA inspectors and quickly enrich to weapon-grade, though it may risk a ground strike.

Source: ISIS Report: *Moving 20 Percent Enrichment to Fordow: Slow Motion Breakout Continues?* David Albright, Paul Brannan and Andrea Stricker. June 8, 2011, http://isis-online.org/isis-reports/detail/moving-20-percent-enrichment-to-fordow-slow-motion-breakout-continues/8

Figure III.50: IAEA on Plutonium/ Heavy Water Facilities as of May 24, 2011

Contrary to the relevant resolutions of the Board of Governors and the Security Council, Iran has not suspended work on all heavy water related projects, including the construction of the heavy water moderated research reactor, the IR-40 Reactor, which is under Agency safeguards.

As indicated in the Director General's previous reports, in light of the request by the Security Council to report to it on whether Iran has established full and sustained suspension of, inter alia, all heavy water related projects,30 the Agency has requested that Iran make the necessary arrangements to provide the Agency, at the earliest possible date, with access to: the Heavy Water Production Plant (HWPP); the heavy water stored at the Uranium Conversion Facility (UCF) in order to take samples; and any other location in Iran where projects related to heavy water are being carried out. Iran has objected to the Agency's requests on the basis that they go beyond the Safeguards Agreement and because Iran has already stated that it has not suspended its heavy water related projects. The Security Council has decided that Iran shall provide such access and cooperation as the Agency requests to be able to verify the suspension of its heavy water related projects. To date, Iran has not provided the requested access.

While Iran has made statements to the effect that it has not suspended work on all its heavy water related projects, without full access to the heavy water at UCF, to HWPP, and any other heavy water related projects there may be in Iran, the Agency is unable to verify such statements and therefore to report fully on this matter.

On 10 May 2011, the Agency carried out a DIV at the IR-40 Reactor at Arak and observed that construction of the facility was ongoing and that the moderator heat exchangers had been delivered to the site. According to Iran, the operation of the IR-40 Reactor is planned to commence by the end of 2013.

Source: IAEA, *Implementation of the NPT Safeguards Agreement and relevant provisions of Security Council resolutions in the Islamic Republic of Iran*, May 24, 2011
http://www.iaea.org/Publications/Documents/Board/2011/gov2011-29.pdf

Figure III.51: IAEA Concerns as of June 2011

The head of the IAEA, Yukiya Amano, disclosed on June 3, 2011 that the IAEA had received "further information related to possible past or current undisclosed nuclear-related activities that seem to point to the existence of possible military dimensions to Iran's nuclear program…The activities in Iran related to the possible military dimension seem to have been continued until quite recently."

Amano said he had written last month to the head of Iran's Atomic Energy Organization, Fereydoun Abbasi-Davani, "reiterating the agency's concerns about the existence of possible military dimensions." He had asked for Iran to "provide prompt access" to locations, equipment, documentation and officials to help resolve the agency's queries, and had sent a new letter to Abbasi-Davani on June 3 "in which I reiterated the agency's requests to Iran."

In his May 26 letter to Amano, Abbasi-Davani reiterated Iran's position that the allegations were fabricated, and said U.N. sanctions resolutions against the country were "illegal and unacceptable."

Amano stated that, Iran was "not providing the necessary cooperation to enable the agency to provide credible assurance about the absence of undeclared nuclear material and activities in Iran… I urge Iran to take steps toward the full implementation of all relevant obligations in order to establish international confidence in the exclusively peaceful nature of its nuclear program."

On June 8, 2011 Reuters reported that Iran had announced major new underground enrichment activity to start at Fordow, a mountain bunker near the clerical city of Qom. This facility was secret until September 2009, when Western intelligence revealed its existence and it and said it was evidence of covert nuclear work.

"This year, under the supervision of the (International Atomic Energy) Agency, we will transfer 20 percent enrichment from the Natanz site to the Fordow site and we will increase the production capacity by three times," (Iranian state broadcaster IRIB, quoting Fereydoun Abbasi-Davani, head of Iran's atomic energy agency, in briefing after a cabinet meeting.)

EU issued a statement at IAEA meeting stating: "We note with particular concern the announcement made only today by Iran that it will increase its capacity to enrich (uranium) to 20 percent, thereby further exacerbating its defiance of the United Nations Security Council." It also calls on IAEA chief Yukiya Amano to submit "at the earliest possible date a comprehensive analysis of the possible military dimensions of Iran's nuclear program" to the IAEA governing board.

Source: IAEA, "June Board of Governors Meeting Convenes." June 6, 2011 http://www.iaea.org/newscenter/news/2011/bog060611.html

Figure III.52: September 2, 2011 IAEA Reporting on Natanz: LEU Production and Centrifuge Levels at the Fuel Enrichment Plant (FEP)

Iran's total LEU production at the FEP through August 13, 2011 is reported to be 4,543 kg of low enriched uranium hexafluoride, including 438 kg estimated by Iran to have been produced since May 14, 2011. This amount of low enriched uranium if further enriched to weapon grade is almost enough to make four nuclear weapons. The FEP is Iran's primary enrichment facility, where the majority of its IR-1 centrifuges are installed.

The average production of LEU at the FEP reached 148 kg per month of LEU hexafluoride (for the last reporting period ISIS noted it was 156 kg per month of LEU hexafluoride). This monthly rate is only slightly lower than Iran's rate from the previous reporting period. The current average represents about a five percent decrease compared to the last reporting period.

As of August 28, 2011, Iran was enriching in 35 cascades containing a total of 5,860 IR-1 centrifuges. The IAEA noted that some of these centrifuges "were possibly not being fed" with uranium hexafluoride. At the end of the last reporting period, Iran was enriching in the same number of cascades containing the same number of centrifuges. Iran has also not installed any new centrifuges since the last reporting period. According to the report, the total number of centrifuges installed is about 8,000 centrifuges, the same as in the last report. Uranium hexafluoride feed rates are not given.

This situation can also be understood by using an equivalent method that is easier to compare to historical enrichment output at the FEP, namely the output measured in separative work units (swu). ISIS derives this value from the declared LEU production. In the most recent reporting period, the LEU value is used with an assumption that the material is 3.5 percent enriched and the waste has a tails assay of 0.4 percent. The IAEA did not provide updated numbers in this report, but these older numbers can be used. Using standard enrichment calculators, 438 kg LEU translates to 1,077 kg of separative work units (swu), or 11.84 kg swu/day. On an annualized basis, this is about 4,320 swu per year. The number of centrifuges declared as enriching was 5,860 at both the end and the beginning of the reporting period, so the swu per centrifuge remains constant at 0.74 during this time. For most of 2010, this value was about 0.9 kg U swu per year per centrifuge. These numbers imply that not all of Iran's centrifuges in cascades fed with uranium are actually enriching, or that these centrifuges are enriching less efficiently.

Source: ISIS Report. *IAEA Iran Safeguards Report, September 2, 2011.* David Albright, Paul Brannan, Andrea Stricker, and Christina Walrond. September 2, 2011, http://www.isis-online.org/uploads/isis-reports/documents/IAEA_Iran_Report_ISIS_analysis_2Sept2011.pdf

Figure III.53: September 2, 2011 IAEA Reporting on Natanz: Deployment of Advanced Centrifuges at the Pilot Fuel Enrichment Plant (PFEP), 20 Percent Enrichment Continues

Iran has started installing two cascades of advanced centrifuges at the PFEP as it said it would. As of August 28, 2011, Iran had installed 136 IR-2m centrifuges in cascade 5 and 27 IR-4 centrifuges in cascade 4. Iran started feeding 54 of the 136 IR-2m centrifuges with natural uranium hexafluoride. The purpose of operating these cascades is likely to demonstrate performance prior to installation of such cascades at Natanz, Fordow, or other enrichment sites.

Iran has designated two cascades at the smaller, above-ground pilot fuel enrichment plant for the production of LEU enriched to nearly 20 percent uranium-235 for the Tehran Research Reactor (TRR). One of these cascades enriches from 3.5 percent LEU to almost 20 percent LEU, while the second one takes the tails from the first one and outputs about 10 percent LEU and a tails of natural uranium. The ten percent material is fed into the first cascade in addition to 3.5 percent LEU. This process allows Iran to more efficiently use its 3.5 percent LEU stock.

Between May 22, 2011 and August 20, 2011, 98.4 kg of 3.5 percent low enriched uranium in the form of uranium hexafluoride was introduced into the two, interconnected cascades, an 8 percent increase in the feed rate. Iran withdrew a total of 14.1 kg of nearly 20 percent LEU hexafluoride. During the reporting period, Iran produced 19.75 percent enriched uranium at a rate of 4.80 kg/month, a 23 percent increase from the average rate of 3.91 kg per month in the last reporting period. In total, Iran has fed 672.5 kg of 3.5% LEU to produce 70.8 kg 19.75% uranium since the beginning of operations in February 2010. The relatively small number of centrifuges in these cascades likely allows Iran to pay greater attention to improving their performance, accounting for the marked improvement of the IR-1 centrifuges at the PFEP in comparison to the decline in performance of IR-1 machines installed at the FEP.

Source: ISIS Report. *IAEA Iran Safeguards Report, September 2, 2011.* David Albright, Paul Brannan, Andrea Stricker, and Christina Walrond. September 2, 2011, http://www.isis-online.org/uploads/isis-reports/documents/IAEA_Iran_Report_ISIS_analysis_2Sept2011.pdf

Figure III.54: September 2, 2011 IAEA Report: Heavy Water Production

Iran told the IAEA during an August 9 visit to the Arak IR-40 Reactor that the start of the operation of the reactor is planned for the end of 2013. During the visit, the IAEA observed the reactor's construction was ongoing. Moderator heat exchangers had been installed and coolant heat exchangers had been delivered to the site.

On August 17, the IAEA visited the Arak Heavy Water Production Plant (HWPP) for the first time since 2005. Iran told the IAEA that the plant was operational and it had produced a total of 60 tonnes of heavy water to date. Iran continues to refuse the IAEA access to the heavy water stored at the Uranium Conversion Facility (UCF) for sampling.

Source: ISIS Report. *IAEA Iran Safeguards Report, September 2, 2011.* David Albright, Paul Brannan, Andrea Stricker, and Christina Walrond. September 2, 2011, http://www.isis-online.org/uploads/isis-reports/documents/IAEA_Iran_Report_ISIS_analysis_2Sept2011.pdf

The Data in the IAEA Report of November 8, 2011

The IAEA's report of November 8, 2011 provided strong new indicators that Iran is weaponizing its program, which have been shown from **Figure III.55** through **Figure III.72**:

- **Figure III.55** describes Iran's lack of cooperation with the IAEA regarding heavy water at the Iran Nuclear Research Reactor (IR-40) at Arak. Although the Agency was allowed access to the site on October 17, 2011, it has not been permitted access since then. According to Iran, operation of the IR-40 reactor is due to commence by the end of 2013. Although the Agency has not been permitted access Heavy Water Production Plant (HWPP) since August 17, 2011, satellite imagery has indicated that the HWPP is appears to be in operation. Lastly, to date Iran has not allowed the Agency access to the heavy water stored at the Uranium Conversion Facility (UCF) to take samples.
- **Figure III.56** provides a description of the IAEA's knowledge of the Uranium Conversion Facility (UCF) as of October 18, 2011. It reflects that Iran is continuing enrichment and heavy water production at the site in contravention of international demands and regulations. It indicates that as of October 18, 2011, the Agency observed the ongoing installation of the process equipment for the conversion of UF6 (uranium hexafluoride) enriched to 20% into U3O8 (triuranium octoxide).
- **Figure III.57** provides an introduction and summary of the possible military dimensions of Iran's nuclear program. Importantly, it indicates that Iran has not engaged the IAEA substantively regarding the military dimensions of its program since August 2008, and it stresses the following:

  I. Efforts, some successful, to procure nuclear related and dual-use equipment and materials by military-related individuals and entities.

  II. Efforts to develop undeclared pathways for the production of nuclear material.

  III. The acquisition of nuclear weapons development information and the documentation from a clandestine nuclear supply network.

  IV. Work on the development of indigenous nuclear weapon design, including the testing of components.

  In all, this section of the report states that the Agency has "serious concerns regarding possible military dimensions to Iran's nuclear program."
- **Figure III.58** provides a historical overview of the possible military dimensions of Iran's nuclear program. It reveals that the IAEA discovered that the Iran's program has roots going back nearly 40 years, and that it has had ongoing undeclared R&D into nuclear testing, experimentation, uranium conversion, enrichment, fabrication, and irradiation activities, including the separation of plutonium. Moreover, it reports that Iran admitted to engaging in undeclared activities at clandestine locations, and procured nuclear material via a clandestine supply network.

  Iran has further acknowledged that it received a package of information related to centrifuge enrichment technology that also included a 15-page document which describes processes for the conversion of uranium fluoride compounds into uranium metal and the production of hemispherical enriched uranium metallic components, which are integral in the construction of a rudimentary fission device.

  This portion of the report also indicates that between 2007 and 2010, Iran continued to conceal nuclear activities by not informing the Agency in a timely manner of the decision to construct or to authorize construction of a new nuclear power plant at Darkhovin, as well as a third enrichment facility near Qom (known throughout this text as the Fordow Fuel Enrichment Plant, or FFEP).
- **Figure III.59** reflects what the IAEA believes to be the structure of Iran's nuclear production, which is thought to involve the participation of a number of research centers, government bodies, universities, committees, all of which operate under the Ministry of Defense Armed Forces Logistics (MODAFL). Moreover, it indicates that the program's nuclear activity was consolidated under the AMAD Plan in the late 1990s and early 2000s, although it was halted in 2003.

The report further indicates that some activities previously carried out under the AMAD Plan were resumed later, and that Mohsen Fakhrizadeh, the former Executive Officer of the AMAD Plan, retained the principal organizational role. He served in this capacity under a new organization known as the Section for Advanced Development Applications and Technologies (SADAT), which continued to report to MODAFL, and later, in mid-2008, as the head of the Malek Ashtar University of Technology (MUT) in Tehran. Fakhrizadeh now leads the Organization of Defensive Innovation and Research. Lastly, the Agency stresses that some his "activities undertaken after 2003 would be highly relevant to a nuclear weapon program."

- **Figure III.60** provides the IAEA's knowledge of Iran's nuclear procurement activities relevant to nuclear weapons production, many of which were allegedly undertaken by private front companies. For instance, Kimia Maadan, a private Iranian company, was a company for chemical engineering operations under the AMAD Plan, while also being used to help with procurement for the Atomic Energy Organization of Iran (AEOI).

  Among the equipment procured relevant to nuclear weapons production include high-speed electronic switches and spark gaps (useful for triggering and firing detonators); high-speed cameras (useful in experimental diagnostics); neutron sources (useful for calibrating neutron measuring equipment); radiation detection and measuring equipment (useful in a nuclear material production environment); and training courses on topics relevant to nuclear explosives development (such as neutron cross section calculations and shock wave interactions/hydrodynamics).

- **Figure III.61** describes the IAEA's knowledge of Iran's attempts to acquire nuclear material relevant to nuclear weapons production, and states that "Iran was working on a project to secure a source of uranium suitable for use in an undisclosed enrichment program, the product of which would be converted into metal for use in the new warhead which was the subject of missile re-entry studies."

  It also emphasizes that Iran only declared a number of facilities once the IAEA was made aware of their existence by sources other than Iran. Taken with Iran's additional past efforts to conceal nuclear activity, this reality creates more concern about the possible existence of further undeclared nuclear facilities, material, and activities in Iran.

- **Figure III.62** provides the IAEA's analysis of Iran's alleged ongoing efforts to acquire nuclear components for use in an explosive device. It reiterates that Iran received documents which describe the processes for the conversion of uranium compounds into uranium metal and the production of hemispherical enriched uranium metallic components, which are integral in the production of a rudimentary fission device.

  Furthermore, it goes on to state that the "uranium metal document is known to have been available to the clandestine nuclear supply network that provided Iran with assistance in developing its centrifuge enrichment capability, and is also known to be part of a larger package of information which includes elements of a nuclear explosive design. A similar package of information, which surfaced in 2003, was provided by the same network to Libya. The information in the Libyan package, which was first reviewed by Agency experts in January 2004, included details on the design and construction of, and the manufacture of components for, a nuclear device." Such a document would likely provide Iran with the technical guidance necessary to build a nuclear weapon.

  Additionally, the Agency indicates that during a 2007 interview with a member of Iran's clandestine supply network, it was told that Iran had been provided with nuclear explosive design information. Lastly, this portion of the report stresses that the Agency is concerned that Iran may have obtained more advanced design information than the information identified in 2004.

- **Figure III.63** discusses the IAEA's knowledge of Iran's R&D into and acquisition of "safe, fast-acting detonators, and equipment suitable for firing the detonators," an integral component to constructing an implosion type nuclear device. It indicates that the Agency discovered that Iran had developed fast-functioning detonators known as "exploding bridgewire detonators" (EBWs) during the period 2002-2003 as safe alternatives to previous detonator technology it had developed.

  Moreover, in 2008, Iran told the Agency that before the period 2002-2004, it had already achieved EBW technology. It also provided the Agency with a short, undated document in Persian, which was understood to be the specifications for a detonator development program, and a document from a foreign source that

showed the example of a civilian application in which detonators fired simultaneously. Iran, however, has not explained its own need or application for such detonators.

- **Figure III.64** describes development of a multipoint initiation system, which is used to reshape the detonation wave into a converging smooth implosion to ensure uniform compression of the core fissile material to supercritical density. As such, it is a vital component of a fission weapon. According to the Agency, Iran has had access to information on the design concept of a multipoint initiation system that can be used to initiate a high explosive charge over its surface effectively and simultaneously. This information was reportedly supplied to the IAEA by a Member State.

  According to the Agency, "information provided to the Agency by the same Member State referred to in the previous paragraph describes the multipoint initiation concept referred to above as being used by Iran in at least one large scale experiment in 2003 to initiate a high explosive charge in the form of a hemispherical shell. According to that information, during that experiment, the internal hemispherical curved surface of the high explosive charge was monitored using a large number of optical fibre cables, and the light output of the explosive upon detonation was recorded with a high speed streak camera. It should be noted that the dimensions of the initiation system and the explosives used with it were consistent with the dimensions for the new payload which, according to the alleged studies documentation, were given to the engineers who were studying how to integrate the new payload into the chamber of the Shahab 3 missile re-entry vehicle (Project 111) (see Section C.11 below). Further information provided to the Agency by the same Member State indicates that the large scale high explosive experiments were conducted by Iran in the region of Marivan.

  The Agency has strong indications that the development by Iran of the high explosives initiation system, and its development of the high speed diagnostic configuration used to monitor related experiments, were assisted by the work of a foreign expert who was not only knowledgeable in these technologies, but who, a Member State has informed the Agency, worked for much of his career with this technology in the nuclear weapon programme of the country of his origin. The Agency has reviewed publications by this foreign expert and has met with him. The Agency has been able to verify through three separate routes, including the expert himself, that this person was in Iran from about 1996 to about 2002, ostensibly to assist Iran in the development of a facility and techniques for making ultra-dispersed diamonds ("UDDs" or "nanodiamonds"), where he also lectured on explosion physics and its applications."

  Lastly, this portion of the report states that Iran has engaged in experimental research involving a scaled down version of the hemispherical initiation system and high explosive charged used to detonate an implosion type nuclear weapon. This technology is critical to the construction of a functioning implosion type device. Iran has not been willing to engage the Agency regarding this activity.

- **Figure III.65** discusses Iran's efforts to evaluate the theoretical design of implosion device using computer simulations, as well as high explosive tests referred to as "hydrodynamic experiments" in which fissile and nuclear components may be replaced with surrogate materials.

  According to information provided to the IAEA by a Member State, some of which the Agency has been able to examine directly, indicates that Iran has manufactured simulated nuclear explosive components using high density materials such as tungsten. Such experiments have also been linked to experiments involving the use of high-speed diagnostic equipment, including flash X-ray, to monitor the symmetry of the compressive shock of the simulated core of an explosive device. Such experiments would have little, if any, civilian application, and represent a serious source of concern regarding the potential weaponization of Iran's nuclear program.

- **Figure III.66** provides an overview of the IAEA's knowledge of Iran's studies that focus on the modeling of spherical geometries, consisting of components of the core of a HEU nuclear device subjected to shock compression, for their neutronic behavior at high density, and a determination of the subsequent nuclear explosive yield. Moreover, the Agency has acquired information that indicates Iran has conducted studies and done calculations relating to the state of criticality of a solid sphere of uranium being compressed by high explosives. Such efforts provide an additional indication of the potential weaponization of Iran's nuclear program.

- **Figure III.67** discusses Iran's research and development into neutron initiators, which, if placed in the center of a nuclear core of an implosion type nuclear device and compressed, could produce a burst of neutrons suitable for initiating a fission chain reaction. Iran has yet to explain its objectives and capabilities in this field.
- **Figure III.68** discusses what the IAEA perceives as Iran's efforts to plan and undertake preparatory experimentation which would be useful were Iran to carry out a test of a nuclear explosive device. It also indicates that these efforts directly reflect those undertaken by declared nuclear-weapon states. These indicators could perhaps point to a potential Iranian nuclear weapons test in the future.
- **Figure III.69** reflects what the IAEA perceives as a structured Iranian program to carry out "engineering studies to examine how to integrate a new spherical payload into the existing payload chamber which would be mounted in the re-entry vehicle of the Shahab 3 missile." Such explorations into warhead development provide a key indicator that Iran's program is military in nature.
- **Figure III.70** describes Iran's efforts at developing a prototype firing system that would enable a nuclear warhead on a Shahab 3 missile to explode both in the air above a target, or upon impact of the re-entry vehicle with the ground. It presents further indication that Iran is at least considering the possibility of installing nuclear warheads on its existing arsenal of Shahab 3 missiles.
- **Figure III.71** provides an overview of the different bodies and projects which constitute the Iranian nuclear program (according to the IAEA).
- **Figure III.72** provides an analysis of the likely payload of an Iranian missile, given the above indicators. It shows that Iran's R&D into its ballistic missile and nuclear programs reflect a probable effort to develop both nuclear warheads and an effective delivery vehicle thereof.

Figures **III.55** through **Figure III.72** indicate that Iran has engaged in substantial R&D activities to develop technology that is critical to developing a functional nuclear weapons program. These include the research into and experimentation with detonator technology, multipoint initiators, neutron initiators, exploding bridgewire (EBW), and other technology that has little, if any, use outside of military applications. Moreover, as **Figure III.68** indicates, Iran has "planned and undertaken preparatory experimentation which would be useful were to Iran to carry out a test of a nuclear explosive device." While it is impossible to know Iran's true intentions regarding its nuclear program, these indicators taken with Iran's refusal to engage the IAEA or the international community substantively on these matters indicate a probable military dimension to the country's program.

Furthermore, the as **Figure III.69** and **Figure III.70** show, Iran has taken steps to integrate a spherical payload into the existing payload chamber on the re-entry vehicle of the Shahab-3 missile, as well as developed fusing, arming, and firing systems that would give re-entry vehicles an airburst capability, or explode on impact with the Earth's surface. Lastly, **Figure III.72** reflects the IAEA's analysis of the likely payload of an Iranian ballistic missile given the developments in the country's nuclear and ballistic missile programs. While the diagram indicates that an Iranian missile could carry a range of payloads, a nuclear payload is most likely. Although by no means certain, these indicators reflect that Iran likely intends to arm its missiles with nuclear warheads, or achieve the capability to do so.

The IAEA report provides limited insight into the foreign sources that supplied Iran with nuclear equipment and technical know-how. One of these sources is referred to in the document as a "clandestine nuclear supply network," purported to be the now-disbanded A.Q. Khan network. According to the report, Iran admittedly had contact with the network in the late 1980s and early 1990s. The document also asserts that this network supplied Iran with technical know-how

regarding the production of neutron initiators and spherical hemispherical enriched uranium metallic component, neither of which have any real civilian application.

According to the document Iran admitted to having received a 15-page document which provided detailed instructions for the construction of components critical to building a nuclear device. This document, known as the "uranium metal document" was also provided to Libya, and is known to have been part of a larger package of information which includes elements of a nuclear explosive design.[63] Given the circumstances surrounding the Iran's acquisition of the document as well as well-known role the A.Q. Khan network played in jump-starting nuclear weapons programs in Pakistan, Libya, and North Korea, it remains doubtful that Iran's program is purely peaceful.

The IAEA's report of November 8, 2011 also states that there are "strong indications that the development by Iran of the high explosives initiation system, and its development of the high speed diagnostic configuration used to monitor related experiments, were assisted by the work of a foreign expert who was not only knowledgeable in these technologies, but who, a Member State has informed the Agency, worked for much of his career with this technology in the nuclear weapon programme of the country of his origin."[64] The ISIS identifies this individual as former Soviet weapons engineer Vyacheslav Danilenko. According to the IAEA, Danilenko worked in Iran from 1996 to 2002, returning to Russia in 2002.[65] Moreover, given the small size and sophistication of a multipoint initiation system the IAEA observed in Iran in 2004, it was likely to have been developed using the Danilenko's expertise as a springboard.[66] Iran's strides in detonator technology are, in all likelihood, the result of Danilenko's technical expertise.

This report provides the most detailed and convincing evidence of the probable weaponization of Iran's nuclear program to date; Iran's R&D into detonator technology, multipoint initiation systems, neutron initiators, and the construction of what appears to be a nuclear missile warhead leave little room for doubt. Although it is impossible to know Iran's intentions with certainty, these indicators, Iran's efforts to accelerate its production of HEU, and its lack of cooperation with the international community regarding said matters provide strong evidence that Iran either seeks to build a nuclear explosive device, or achieve the ability to do so.

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[63] Source: IAEA, *Implementation of the NPT Safeguards Agreement and relevant provisions of Security Council resolutions in the Islamic Republic of Iran*, November 8, 2011
http://isis-online.org/uploads/isis-reports/documents/IAEA_Iran_8Nov2011.pdf

[64] Source: IAEA, *Implementation of the NPT Safeguards Agreement and relevant provisions of Security Council resolutions in the Islamic Republic of Iran*, November 8, 2011

http://isis-online.org/uploads/isis-reports/documents/IAEA_Iran_8Nov2011.pdf

[65] ISIS Report. "Iran's Work and Foreign Assistance on a Multipoint Initiation System for a Nuclear Weapon." David Albright, Paul Brannan, Mark Gorwitz, and Andrea Strick. November 13, 2011. http://isis-online.org/uploads/isis-reports/documents/Foreign_Assistance_Multipoint_Initiation_System_14Nov2011.pdf

[66] ISIS Report. "Iran's Work and Foreign Assistance on a Multipoint Initiation System for a Nuclear Weapon." David Albright, Paul Brannan, Mark Gorwitz, and Andrea Strick. November 13, 2011. http://isis-online.org/uploads/isis-reports/documents/Foreign_Assistance_Multipoint_Initiation_System_14Nov2011.pdf

The US View of Iran's Nuclear and Missile Efforts

The difficulties in measuring this aspect of US and Iranian military competition are compounded by the fact there are serious limits to how much information US officials can disclose about official US estimates of Iran's nuclear programs, and how they affect US and Iranian military competition. The annual unclassified reports to Congress by the US Director of National Intelligence do, however, offer a cleared and coordinated overview of US perceptions – which now seems to track closely with the views of many European and Gulf officials and experts.

An unclassified March 2010 report produced by the Office of the Director of National Intelligence has been partly overtaken by the pace of Iran's rapidly developing program, but it still represents a useful unclassified national intelligence estimate of Iran's capabilities: [67]

> **Nuclear**
>
> We continue to assess Iran is keeping open the option to develop nuclear weapons though we do not know whether Tehran eventually will decide to produce nuclear weapons. Iran continues to develop a range of capabilities that could be applied to producing nuclear weapons, if a decision is made to do so.
>
> During the reporting period, Iran continued to expand its nuclear infrastructure and continued uranium enrichment and activities related to its heavy water research reactor, despite multiple United Nations Security Council Resolutions since late 2006 calling for the suspension of those activities. Although Iran made progress in expanding its nuclear infrastructure during 2001, some obstacles slowed progress during this period.
>
> > • In 2009, Iran continued to make progress enriching uranium at the underground cascade halls at Natanz with first-generation centrifuges, and in testing and operating advanced centrifuges at the pilot plant there.
> >
> > As of mid-November, Iran had produced about 1,800 kilograms of low-enriched uranium hexafluoride (LEUF6) gas product at Natanz, compared to 555 kilograms of LEUF6 in November 2008. Between January and November 2009, Iran increased the number of installed centrifuges from about 5,000 to about 8,700, but the number reported to be operating remains at about 3,000~100.
> >
> > • In September, Iran disclosed that it was constructing a second gas-centrifuge uranium enrichment plant near the city of Qom that is designed to house approximately 3,000 centrifuges.
> >
> > • Iran in 2009 continued construction of the IR-40 Heavy Water Research Reactor. Iran during National Nuclear Day inaugurated its fuel manufacturing plant and claimed to have manufactured a fuel assembly for the IR-40.
>
> Iran in 2009 continued to make progress on completing its Bushehr Nuclear Power Plant but did not load fuel in the reactor. Iran currently plans to load fuel in the reactor in 2010.
>
> Iran's Uranium Conversion Facility (UCF) at Esfahan shut down for maintenance in August and had not resumed UF6 production as of late October. International Atomic Energy Agency reports indicate Iran has almost exhausted its imported stockpile of yellowcake that may have contributed to its decision to extend the shutdown of the UCF.
>
> **Missiles**
>
> Iran has continued to develop its ballistic missile program that it views as its primary deterrent. Iran is fielding increased numbers of short- and medium-range ballistic missiles (SRBMs, MRBMs) and we judge

[67] ODDNI, Report to Congress on Acquisition of Technology Relating to Weapons of Mass Destruction and Advanced Conventional Munitions, March 2010, http://www.dni.gov/reports/2009_721_Report.pdf

that producing more capable MRBMs remains one of its highest priorities. Iran's ballistic missile inventory is one of the largest in the Middle East.

In late November 2007, Iran's defense minister claimed Iran had developed a new 2,000 km-range missile called the Ashura. Iranian officials on 12 November 2008 claimed to have launched a two stage, solid propellant missile called the Sajjil with a range of 2,000 km. In 2009, Iran conducted three flight tests of this missile.

As early as 2005, Iran stated its intentions to send its own satellites into orbit. As of January 2008, Tehran reportedly had allocated $250 million to build and purchase satellites. Iran announced it would launch four more satellites by 2010 to improve land and mobile telephone communications.

Iran's President Ahmadinejad also announced Tehran would launch a "home- produced" satellite into orbit in 2008, and several Iranian news websites released photos of a new rocket called "Safic."

In mid-August 2008, Iran first launched its Safir space launch vehicle, carrying the Omid satellite. Iran claimed the launch a success; however US officials believed the vehicle did not successfully complete its mission. Iran successfully launched the Omid satellite aboard the Safir 2 SLV in early February 2009 according to press reports.

Russian entities at least in the past, have helped Iran move toward self-sufficiency in the production of ballistic missiles. Iran still remains dependent on foreign suppliers for some key missile components, however. Iran also has marketed for export at trade shows guidance components suitable for ballistic missiles.

Chemical and Biological

We assess that Iran maintains the capability to produce chemical warfare (CW) agents and conducts research that may have offensive applications. Tehran continues to seek dual-use technologies that could advance its capability to produce CW agents. We judge that Iran is capable of weaponizing CW agents in a variety of delivery systems.

Iran probably has the capability to produce some biological warfare (BW) agents for offensive purposes, if it made the decision to do so. We assess that Iran has previously conducted offensive BW agent research and development. Iran continues to seek dual- use technologies that could be used for BW.

Clapper gave a less detailed statement to Congress on March 3, 2011, but noted that the US estimate of operating centrifuges had now risen to 4,100 in late 2010, and Iran had used them to produce over 3,000 kilograms of low enriched uranium. He also stated that the US intelligence community assessed that,[68]

Iran is keeping open the option to develop nuclear weapons in part by developing various nuclear capabilities that better position it to produce such weapons, should it choose do so. We do not know, however, if Iran will eventually decide to build nuclear weapons…Iran is technically capable of producing enough highly enriched uranium for a weapon in the next few years, if it chooses to do so.

…We judge Iran would likely choose missile delivery as its preferred method of delivering a nuclear weapon. Iran already has the largest inventory of ballistic missiles in the Middle East. It continues to expand the scale, research, and sophistication of its ballistic missile forces, many of which are inherently capable of carrying a nuclear payload…Iran's growing inventory of ballistic missiles and its acquisition and indigenous production of anti-ship cruise missiles provide capabilities to enhance its power projection. Tehran views its conventionally armed missiles as an integral part of its strategy to deter – and if necessary retaliate against—forces in the region, including those of the US. Its ballistic missiles are inherently capable of delivering WMD, and if so armed, would fit into this same strategy.

[68] James R. Clapper, "Statement for the Record on the Worldwide Threat Assessment of the US Intelligence Community for the Senate Committee on Armed Services, March 10, 2011.

Most US, European, and Arab assessments focus on Iran's progress in nuclear and missile programs rather than the force it may intend to build and its strategic goals in doing so. As yet, US officials have not issued any unclassified estimate of the possible size and character of Iranian nuclear-armed forces. They have, however, consistently warned that Iran is moving progressively towards a nuclear breakout capability, and have highlighted IAEA and other reports that show that Iran has acquired at least some nuclear weapons design data, has explored nuclear armed missiles, and has all of the technology to produce nuclear weapons, except weapons grade fissile material.

US officials have highlighted Iran's activity in enriching uranium to the 20% level, although they have that Iran's known enrichment programs ran into trouble in 2010, that its overt centrifuge program has had serious problems in the past, and Iran is still several years away from the point where it has enough weapons grade fissile material for a single device. (It is unclear what role, if any, Israeli and US actions played in the reported cyber attacks on Iran's centrifuge program; and it seems likely that the US did not play any role in attacks on Iranian nuclear scientists, although Israel may have played such a role.)

Iran's Statements about Nuclear Competition: Nuclear Program

While Iran denies it is seeking nuclear weapons, it has made statements regarding the nature of its nuclear program and its role in competition with the US and other countries that provide useful insights into Iranian attitudes:

- *"Iranian nation cannot be defeated. Not only should we be able to use all our capacities and potentials in nuclear technology, we should also export nuclear know-how."* – Iranian President Mahmoud Ahmadinejad, April 11, 2011.

- *"Iran plans to build four to five new reactors with a capacity of 10 to 20 megawatts in different provinces within the next few years to produce radio-medicine and perform research.*

  Fuel production or uranium enrichment to a purity level of 20 percent will not be halted. Iran will produce fuel for the Tehran Research Reactor in due course.

  To provide the fuel for these reactors, we need to continue with the 20-percent enrichment of uranium." – Fereydoon Abbasi, head of the Atomic Energy Organization of Iran, April 12, 2011.

- *"We will transfer the 20 percent enrichment from Natanz to the [Qum] site this year, under the supervision of the (International Atomic Energy) Agency.*

  We will also triple the (production) capacity. The 20 percent enrichment will not be stopped at Natanz until the production level is three times higher than its current rate." – Fereydoon Abbasi, head of the Atomic Energy Organization of Iran, June 8, 2011.

- *"The day after the first Iranian nuclear test for us Iranians will be an ordinary day, but in the eyes of many of us, it will have a new shine, from the power and dignity of the nation."* – Excerpt from a text entitled "The Day After the First Iranian Nuclear Test -- a Normal Day," which was posted on the IRGC-run Gerdab website, June 9, 2011.

- *"No offer from world leaders could stop Iran from enriching uranium."* – Iranian President Mahmoud Ahmadinejad, June 7, 2011.

- *"When we say we do not want to make bomb it means we do not want to. If we want to make a bomb we are not afraid of anyone and we are not afraid to announce it, no one can do a damn thing."* – Iranian President Mahmoud Ahmadinejad, June 23, 2011. [69]

It is difficult to draw any certain conclusions regarding its purposes, given the opacity and controversial nature of Iran's nuclear program. More often than not, Iranian officials make blanket statements that insist that their country's nuclear program is for solely peaceful purposes, namely research and the production of nuclear power and medical isotopes. It is clear, though, that Iran perceives its nuclear program as a source of national pride.

Other statements made by Iranian officials regarding the nature of the country's nuclear program, however, are often ambiguous and contradictory. While Iranian officials often affirm that the program is peaceful, they also regularly make defiant statements about increasing the production of uranium enriched to 20%, and implied, indirect statements about producing a nuclear weapon.

Iranian President Mahmoud Ahmadinejad stated the following at a June 23, 2011 inauguration of a sewage treatment plant in southern Tehran:

> "When we say we do not want to make bomb it means we do not want to. If we want to make a bomb we are not afraid of anyone and we are not afraid to announce it, no one can do a damn thing."[70]

On June 9, 2011, the IRGC-run website Gerdab published a text entitled "The Day after the First Iranian Nuclear Test – a Normal Day," which stated the following:

> "The day after the first Iranian nuclear test for us Iranians will be an ordinary day, but in the eyes of many of us, it will have a new shine, from the power and dignity of the nation."[71]

The text also contained the following excerpt from the Quran,

> "And prepare against them whatever you are able of power and of steeds of war by which you may terrify the enemy of Allah."[72]

Such statements, while almost always indirect, hypothetical, and lacking in specifics, have a hostile bent, and indicate that Iran does not perceive its nuclear program as solely for peaceful purposes. Contrarily, such statements can be construed as defiant, veiled threats leveled at Iran's perceived enemies.

Although such statements seem plainly indicative as to Iran's nuclear intentions, they must be kept in context, as the tone and the nature of Iranian statements regarding the country's nuclear problem often vary depending on the audience. Consequently, it is difficult to discern which statements actually reflect Iran's true intentions as opposed to posturing to serve its foreign

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[69] Quotes taken from a number of Iranian news sources such as Fars News, PressTV, the Tehran Times, and others. Also included are quotes from Western news outlets such as CNN, the New York Times, and the Washington Post.

[70] Pouladi, Farhad. "Ahmadinejad Insists Iran Not Seeking Nuclear Bomb." AFP, June 23, 2011. http://www.google.com/hostednews/afp/article/ALeqM5hH8mB4iW9MJ6ElbozG5o8-QlZDqA?docId=CNG.34a096065d43eb06d18ea86500b8f1a9.01

[71] Timmerman, Ken. "Iran Eager for Nuclear Test." Newsmax.com, June 10, 2011. http://www.newsmax.com/KenTimmerman/RevolutionaryGuards-iran-nuclear-powerplant/2011/06/10/id/399582

[72] Timmerman, Ken. "Iran Eager for Nuclear Test." Newsmax.com, June 10, 2011. http://www.newsmax.com/KenTimmerman/RevolutionaryGuards-iran-nuclear-powerplant/2011/06/10/id/399582

policy goals. Although Iran's exact intentions regarding its nuclear program are uncertain, the above statements and others like them reflect that Iran has at the very least contemplated producing nuclear weapons, and perceives its nuclear program as having a military dimension.

Figure III.55: IAEA Report of November 8, 2011 – Heavy Water Production

Contrary to the relevant resolutions of the Board of Governors and the Security Council, Iran has not suspended work on all heavy water related projects, including the construction of the heavy water moderated research reactor, the Iran Nuclear Research Reactor (IR-40 Reactor), which is subject to Agency safeguards.

On 17 October 2011, the Agency carried out a DIV at the IR-40 Reactor at Arak and observed that construction of the facility was ongoing and the coolant heat exchangers had been installed. According to Iran, the operation of the IR-40 Reactor is planned to commence by the end of 2013.

Since its visit to the Heavy Water Production Plant (HWPP) on 17 August 2011, the Agency, in a letter to Iran dated 20 October 2011, requested further access to HWPP. The Agency has yet to receive a reply to that letter, and is again relying on satellite imagery to monitor the status of HWPP. Based on recent images, the HWPP appears to be in operation. To date, Iran has not provided the Agency access to the heavy water stored at the Uranium Conversion Facility (UCF) in order to take samples.

Source: IAEA*, Implementation of the NPT Safeguards Agreement and relevant provisions of Security Council resolutions in the Islamic Republic of Iran*, November 8, 2011
http://isis-online.org/uploads/isis-reports/documents/IAEA_Iran_8Nov2011.pdf

Figure III.56: IAEA Report of November 8, 2011 – Uranium Conversion Facility

Although it is obliged to suspend all enrichment related activities and heavy water related projects, Iran is conducting a number of activities at UCF and the Fuel Manufacturing Plant (FMP) at Esfahan which, as described below, are in contravention of those obligations, although both facilities are under Agency safeguards.

Uranium Conversion Facility: On 18 October 2011, the Agency carried out a DIV at UCF during which the Agency observed the ongoing installation of the process equipment for the conversion of UF6 enriched up to 20% U-235 into U3O8. During the DIV, Iran informed the Agency that the initial tests of this conversion line, originally scheduled to start on 6 September 2011, had been postponed and would not involve the use of nuclear material.

As previously reported, Iran informed the Agency in July 2011 that it would start R&D activities at UCF for the conversion of UF6 enriched up to 5% U-235 into UO2. During the aforementioned DIV, Iran informed the Agency that 6.8 kg of DU in the form of UF6 had been processed and that Iran had produced 113 g of uranium in the form of UO2 that met its specifications. According to Iran, this UO2 has been sent to FMP to produce test pellets. Iran has also started using UF6 enriched to 3.34% U-235 to produce UO2. During the DIV, Iran further informed the Agency that this UO2 would also be sent to FMP to produce fuel pellets, which would then be sent to TRR for "performance test studies".

In a letter dated 4 October 2011, Iran informed the Agency of the postponement of the production of natural UF6, involving the use of uranium ore concentrate (UOC) produced at the Bandar Abbas Uranium Production Plant, originally scheduled to restart on 23 October 2011. In a letter dated 11 October 2011, Iran informed the Agency that, from 11 November 2011, it intended to use UOC produced at the Bandar Abbas Uranium Production Plant for the production of natural uranium in the form of UO2. During the DIV on 18 October 2011, the Agency took a sample of this UOC. During the same DIV, Iran informed the Agency that, since 23 July 2011, it had fed into the process 958.7 kg of uranium in the form of UOC31 and produced about 185.6 kg of natural uranium in the form of UO2, and further indicated that some of the product had been fed back into the process. In a letter dated 8 October 2011, Iran informed the Agency that it had transferred about 1 kg of this UO2 to the R&D section of FMP in order to "conduct research activities and pellet fabrication."

Source: IAEA, *Implementation of the NPT Safeguards Agreement and relevant provisions of Security Council resolutions in the Islamic Republic of Iran*, November 8, 2011
http://isis-online.org/uploads/isis-reports/documents/IAEA_Iran_8Nov2011.pdf

Figure III.57: IAEA Report of November 8, 2011 – Possible Military Dimensions

Previous reports by the Director General have identified outstanding issues related to possible military dimensions to Iran's nuclear programme and actions required of Iran to resolve these. Since 2002, the Agency has become increasingly concerned about the possible existence in Iran of undisclosed nuclear related activities involving military related organizations, including activities related to the development of a nuclear payload for a missile, about which the Agency has regularly received new information.

In resolution 1929 (2010), the Security Council reaffirmed Iran's obligations to take the steps required by the Board of Governors in its resolutions GOV/2006/14 and GOV/2009/82, and to cooperate fully with the Agency on all outstanding issues, particularly those which give rise to concerns about the possible military dimensions to Iran's nuclear programme, including by providing access without delay to all sites, equipment, persons and documents requested by the Agency. Since August 2008, Iran has not engaged with the Agency in any substantive way on this matter.

The Director General, in his opening remarks to the Board of Governors on 12 September 2011, stated that in the near future he hoped to set out in greater detail the basis for the Agency's concerns so that all Member States would be kept fully informed. In line with that statement, the Annex to this report provides a detailed analysis of the information available to the Agency to date which has given rise to concerns about possible military dimensions to Iran's nuclear programme.

The analysis itself is based on a structured and systematic approach to information analysis which the Agency uses in its evaluation of safeguards implementation in all States with comprehensive safeguards agreements in force. This approach involves, inter alia, the identification of indicators of the existence or development of the processes associated with nuclear-related activities, including weaponization.

The information which serves as the basis for the Agency's analysis and concerns, as identified in the Annex, is assessed by the Agency to be, overall, credible. The information comes from a wide variety of independent sources, including from a number of Member States, from the Agency's own efforts and from information provided by Iran itself. It is consistent in terms of technical content, individuals and organizations involved, and time frames.

The information indicates that Iran has carried out the following activities that are relevant to the development of a nuclear explosive device:

- **Efforts, some successful, to procure nuclear related and dual use equipment and materials by military related individuals and entities (Annex, Sections C.1 and C.2);**
- **Efforts to develop undeclared pathways for the production of nuclear material (Annex, Section C.3);**
- **The acquisition of nuclear weapons development information and documentation from a clandestine nuclear supply network (Annex, Section C.4); and**
- **Work on the development of an indigenous design of a nuclear weapon including the testing of components (Annex, Sections C.5–C.12).**

Summary of Concerns: While the Agency continues to verify the non-diversion of declared nuclear material at the nuclear facilities and LOFs declared by Iran under its Safeguards Agreement, as Iran is not providing the necessary cooperation, including by not implementing its Additional Protocol, the Agency

is unable to provide credible assurance about the absence of undeclared nuclear material and activities in Iran, and therefore to conclude that all nuclear material in Iran is in peaceful activities.
The Agency has serious concerns regarding possible military dimensions to Iran's nuclear programme. After assessing carefully and critically the extensive information available to it, the Agency finds the information to be, overall, credible. The information indicates that Iran has carried out activities relevant to the development of a nuclear explosive device. The information also indicates that prior to the end of 2003, these activities took place under a structured programme, and that some activities may still be ongoing.

Given the concerns identified above, Iran is requested to engage substantively with the Agency without delay for the purpose of providing clarifications regarding possible military dimensions to Iran's nuclear programme as identified in the Annex to this report.

The Agency is working with Iran with a view to resolving the discrepancy identified during the recent PIV at JHL.

The Director General urges Iran, as required in the binding resolutions of the Board of Governors and mandatory Security Council resolutions, to take steps towards the full implementation of its Safeguards Agreement and its other obligations, including: implementation of the provisions of its Additional Protocol; implementation of the modified Code 3.1 of the Subsidiary Arrangements General Part to its Safeguards Agreement; suspension of enrichment related activities; suspension of heavy water related activities; and, as referred to above, addressing the Agency's serious concerns about possible military dimensions to Iran's nuclear programme, in order to establish international confidence in the exclusively peaceful nature of Iran's nuclear programme.

Source: IAEA*, Implementation of the NPT Safeguards Agreement and relevant provisions of Security Council resolutions in the Islamic Republic of Iran*, November 8, 2011
http://isis-online.org/uploads/isis-reports/documents/IAEA_Iran_8Nov2011.pdf

Figure III.58: IAEA Report of November 8, 2011 – Historical Overview of the Possible Military Dimensions of Iran's Nuclear Program

Since late 2002, the Director General has reported to the Board of Governors on the Agency's concerns about the nature of Iran's nuclear programme. Such concerns coincided with the appearance in open sources of information which indicated that Iran was building a large underground nuclear related facility at Natanz and a heavy water production plant at Arak.

Between 2003 and 2004, the Agency confirmed a number of significant failures on the part of Iran to meet its obligations under its Safeguards Agreement with respect to the reporting of nuclear material, the processing and use of undeclared nuclear material and the failure to declare facilities where the nuclear material had been received, stored and processed.

Specifically, it was discovered that, as early as the late 1970s and early 1980s, and continuing into the 1990s and 2000s, Iran had used undeclared nuclear material for testing and experimentation in several uranium conversion, enrichment, fabrication and irradiation activities, including the separation of plutonium, at undeclared locations and facilities.

In October 2003, Iran informed the Director General that it had adopted a policy of full disclosure and had decided to provide the Agency with a full picture of its nuclear activities. Following that announcement, Iran granted the Agency access to locations the Agency requested to visit, provided information and clarifications in relation to the origin of imported equipment and components and made individuals available for interviews. It also continued to implement the modified Code 3.1 of the Subsidiary Arrangements General Part, to which it agreed in February 2003, which provides for the submission of design information on new nuclear facilities as soon as the decision to construct or to authorize construction of such a facility is taken. In November 2003, Iran announced its intention to sign an Additional Protocol to its Safeguards Agreement (which it did in December 2003 following Board approval of the text), and that, prior to its entry into force, Iran would act in accordance with the provisions of that Protocol.

Between 2003 and early 2006, Iran submitted inventory change reports, provided design information with respect to facilities where the undeclared activities had taken place and made nuclear material available for Agency verification. Iran also acknowledged that it had utilized entities with links to the Ministry of Defence in some of its previously undeclared activities.

Iran acknowledged that it had had contacts with intermediaries of a clandestine nuclear supply network in 1987 and the early 1990s, and that, in 1987, it had received a handwritten one page document offering assistance with the development of uranium centrifuge enrichment technology, in which reference was also made to a reconversion unit with casting equipment. Iran further acknowledged that it had received a package of information related to centrifuge enrichment technology that also included a 15 page document (hereafter referred to as the "uranium metal document") which Iran said it did not ask for and which describes, inter alia, processes for the conversion of uranium fluoride compounds into uranium metal and the production of hemispherical enriched uranium metallic components.

The Agency continued to seek clarification of issues with respect to the scope and nature of Iran's nuclear programme, particularly in light of Iran's admissions concerning its contacts with the clandestine nuclear supply network, information provided by participants in that network and information which had been provided to the Agency by a Member State. This last information, collectively referred to as the "alleged studies documentation", which was made known to the Agency in 2005, indicated that Iran had been engaged in activities involving studies on a so-called green salt project, high explosives testing and the re-

engineering of a missile re-entry vehicle to accommodate a new payload. All of this information, taken together, gave rise to concerns about possible military dimensions to Iran's nuclear programme.

In August 2007, Iran and the Agency agreed on "Understandings of the Islamic Republic of Iran and the IAEA on the Modalities of Resolution of the Outstanding Issues" (generally referred to as the "work plan") (INFCIRC/711). By February 2008, the four items identified in the work plan as "past outstanding issues", and the two items identified as "other outstanding issues", had been determined by the Agency to be either closed, completed or no longer outstanding. The remaining issues which needed to be clarified by Iran related to the alleged studies, together with other matters which had arisen in the course of resolving the six other issues and which needed to be addressed in connection with the alleged studies, specifically: the circumstances of Iran's acquisition of the uranium metal document, procurement and research and development (R&D) activities of military related institutes and companies that could be nuclear related; and the production of nuclear equipment and components by companies belonging to defence industries.

Between February and May 2008, pursuant to the work plan, the Agency shared with Iran information (including documentation) on the alleged studies, and sought clarifications from Iran. In May 2008, Iran submitted to the Agency a 117 page assessment of that information. While Iran confirmed the veracity of some of the information which the Agency had shared with it (such as acknowledgement of names of people, places and organizations), Iran's assessment was focused on deficiencies in form and format, and dismissed the allegations as having been based on "forged" documents and "fabricated" data.

The Agency continued to receive additional information from Member States and acquired new information as a result of its own efforts. The Agency tried without success to engage Iran in discussions about the information, and finally wrote to Iran in October 2010 to inform it about this additional information.

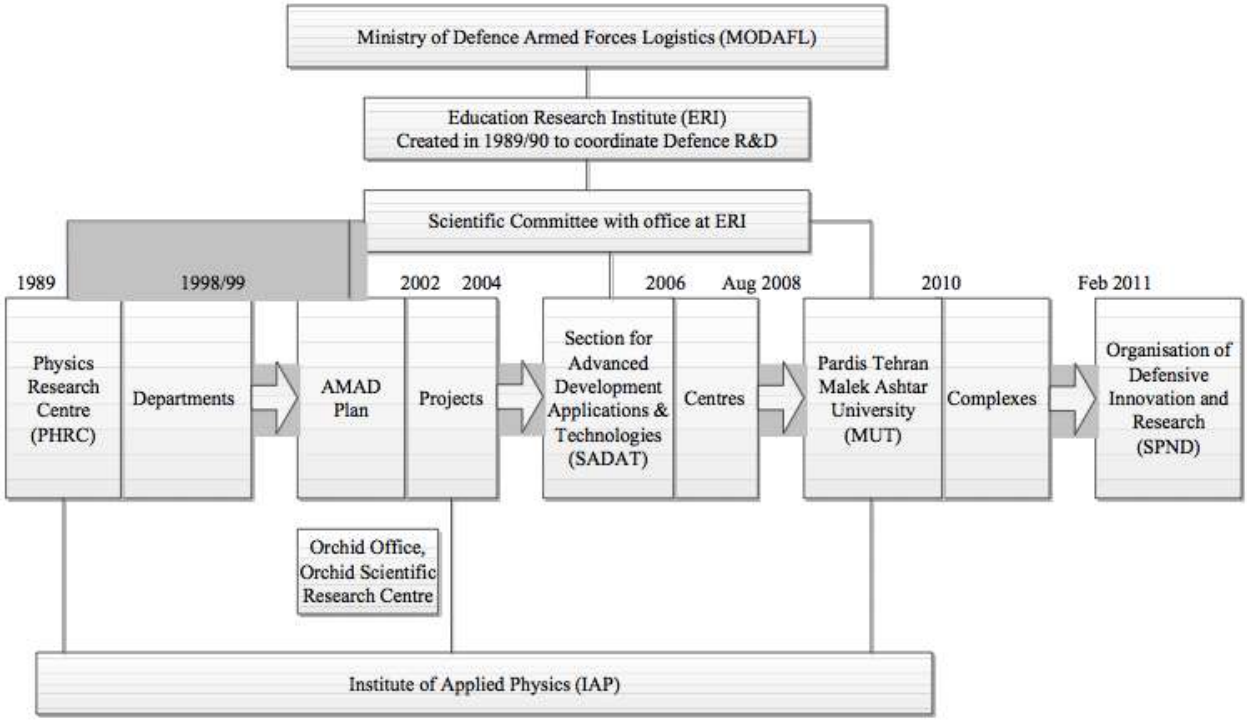
Between 2007 and 2010, Iran continued to conceal nuclear activities, by not informing the Agency in a timely manner of the decision to construct or to authorize construction of a new nuclear power plant at Darkhovin and a third enrichment facility near Qom (the Fordow Fuel Enrichment Plant). The Agency is still awaiting substantive responses from Iran to Agency requests for further information about its announcements, in 2009 and 2010 respectively, that it had decided to construct ten additional enrichment facilities (the locations for five of which had already been identified) and that it possessed laser enrichment technology.

The Agency has continued to receive, collect and evaluate information relevant to possible military dimensions to Iran's nuclear programme. As additional information has become available to the Agency, the Agency has been able, notwithstanding Iran's lack of engagement, to refine its analysis of possible military dimensions to Iran's nuclear programme.

Source: IAEA, *Implementation of the NPT Safeguards Agreement and relevant provisions of Security Council resolutions in the Islamic Republic of Iran*, November 8, 2011
http://isis-online.org/uploads/isis-reports/documents/IAEA_Iran_8Nov2011.pdf

Figure III.59: IAEA Report of November 8, 2011 – Program Management Structure

The Agency has been provided with information by Member States which indicates that the activities referred to in Sections C.2 to C.12 were, at least for some significant period of time, managed through a programme structure, assisted by advisory bodies, and that, owing to the importance of these efforts, senior Iranian figures featured within this command structure. From analysis of this information and information provided by Iran, and through its own endeavours, the Agency has been able to construct what it believes to be a good understanding of activities undertaken by Iran prior to the end of 2003. **The Agency's ability to construct an equally good understanding of activities in Iran after the end of 2003 is reduced, due to the more limited information available to the Agency.** For ease of reference, the figure below depicts, in summary form, what the Agency understands of the programme structure, and administrative changes in that structure over the years. Attachment 1 to this Annex provides further details, derived from that information, about the organizational arrangements and projects within that programme structure.



The Agency received information from Member States which indicates that, sometime after the commencement by Iran in the late 1980s of covert procurement activities, organizational structures and administrative arrangements for an undeclared nuclear programme were established and managed through the Physics Research Centre (PHRC), and were overseen, through a Scientific Committee, by the Defence Industries Education Research Institute (ERI), established to coordinate defence R&D for the Ministry of Defence Armed Forces Logistics (MODAFL). Iran has confirmed that the PHRC was established in 1989 at Lavisan-Shian, in Tehran. Iran has stated that the PHRC was created with the purpose of "preparedness to combat and neutralization of casualties due to nuclear attacks and accidents (nuclear defence) and also support and provide scientific advice and services to the Ministry of Defence". Iran has stated further that those activities were stopped in 1998. In late 2003/early 2004, Iran completely cleared the site.

According to information provided by Member States, by the late 1990s or early 2000s, the PHRC activities were consolidated under the "AMAD Plan". Mohsen Fakhrizadeh (Mahabadi) was the Executive Officer of the AMAD Plan, the executive affairs of which were performed by the "Orchid Office". Most of the activities carried out under the AMAD Plan appear to have been conducted during 2002 and 2003.

The majority of the details of the work said to have been conducted under the AMAD Plan come from the alleged studies documentation which, as indicated in paragraph 6 above, refer to studies conducted in three technical areas: the green salt project; high explosives (including the development of exploding bridgewire detonators); and re-engineering of the payload chamber of the Shahab 3 missile re-entry vehicle.

According to the Agency's assessment of the information contained in that documentation, the green salt project (identified as Project 5.13) was part of a larger project (identified as Project 5) to provide a source of uranium suitable for use in an undisclosed enrichment programme. The product of this programme would be converted into metal for use in the new warhead which was the subject of the missile re-entry vehicle studies (identified as Project 111). As of May 2008, the Agency was not in a position to demonstrate to Iran the connection between Project 5 and Project 111. However, subsequently, the Agency was shown documents which established a connection between Project 5 and Project 111, and hence a link between nuclear material and a new payload development programme.

Information the Agency has received from Member States indicates that, owing to growing concerns about the international security situation in Iraq and neighbouring countries at that time, work on the AMAD Plan was stopped rather abruptly pursuant to a "halt order" instruction issued in late 2003 by senior Iranian officials. According to that information, however, staff remained in place to record and document the achievements of their respective projects. Subsequently, equipment and work places were either cleaned or disposed of so that there would be little to identify the sensitive nature of the work which had been undertaken.

The Agency has other information from Member States which indicates **that some activities previously carried out under the AMAD Plan were resumed later, and that Mr Fakhrizadeh retained the principal organizational role, first under a new organization known as the Section for Advanced Development Applications and Technologies (SADAT), which continued to report to MODAFL, and later, in mid-2008, as the head of the Malek Ashtar University of Technology (MUT) in Tehran.** The Agency has been advised by a Member State that, in February 2011, Mr Fakhrizadeh moved his seat of operations from MUT to an adjacent location known as the Modjeh Site, and that he now leads the Organization of Defensive Innovation and Research. The Agency is concerned because some of the activities undertaken after 2003 would be highly relevant to a nuclear weapon programme.

Source: IAEA*, Implementation of the NPT Safeguards Agreement and relevant provisions of Security Council resolutions in the Islamic Republic of Iran*, November 8, 2011
http://isis-online.org/uploads/isis-reports/documents/IAEA_Iran_8Nov2011.pdf

Figure III.60: IAEA Report of November 8, 2011 – Procurement Activities

Under the AMAD Plan, Iran's efforts to procure goods and services allegedly involved a number of ostensibly private companies which were able to provide cover for the real purpose of the procurements. The Agency has been informed by several Member States that, for instance, Kimia Maadan was a cover company for chemical engineering operations under the AMAD Plan while also being used to help with procurement for the Atomic Energy Organization of Iran (AEOI).

In addition, throughout the entire timeline, instances of procurement and attempted procurement by individuals associated with the AMAD Plan of equipment, materials and services which, although having other civilian applications, would be useful in the development of a nuclear explosive device, have either been uncovered by the Agency itself or been made known to it.

Among such equipment, materials and services are: high speed electronic switches and spark gaps (useful for triggering and firing detonators); high speed cameras (useful in experimental diagnostics); neutron sources (useful for calibrating neutron measuring equipment); radiation detection and measuring equipment (useful in a nuclear material production environment); and training courses on topics relevant to nuclear explosives development (such as neutron cross section calculations and shock wave interactions/hydrodynamics).

Source: IAEA, *Implementation of the NPT Safeguards Agreement and relevant provisions of Security Council resolutions in the Islamic Republic of Iran*, November 8, 2011
http://isis-online.org/uploads/isis-reports/documents/IAEA_Iran_8Nov2011.pdf

Figure III.61: IAEA Report of November 8, 2011 – Nuclear Material Acquisition

In 2008, the Director General informed the Board that: it had no information at that time — apart from the uranium metal document — on the actual design or manufacture by Iran of nuclear material components of a nuclear weapon or of certain other key components, such as initiators, or on related nuclear physics studies, and that it had not detected the actual use of nuclear material in connection with the alleged studies.

However, as indicated in paragraph22 above, **information contained in the alleged studies documentation suggests that Iran was working on a project to secure a source of uranium suitable for use in an undisclosed enrichment programme, the product of which would be converted into metal for use in the new warhead which was the subject of the missile re-entry vehicle studies.** Additional information provided by Member States indicates that, although uranium was not used, kilogram quantities of natural uranium metal were available to the AMAD Plan.

Information made available to the Agency by a Member State, which the Agency has been able to examine directly, indicates that Iran made progress with experimentation aimed at the recovery of uranium from fluoride compounds (using lead oxide as a surrogate material to avoid the possibility of uncontrolled contamination occurring in the workplace).

In addition, although now declared and currently under safeguards, a number of facilities dedicated to uranium enrichment (the Fuel Enrichment Plant and Pilot Fuel Enrichment Plant at Natanz and the Fordow Fuel Enrichment Plant near Qom) were covertly built by Iran and only declared once the Agency was made aware of their existence by sources other than Iran. This, taken together with the past efforts by Iran to conceal activities involving nuclear material, create more concern about the possible existence of undeclared nuclear facilities and material in Iran.

Source: IAEA*, Implementation of the NPT Safeguards Agreement and relevant provisions of Security Council resolutions in the Islamic Republic of Iran*, November 8, 2011
http://isis-online.org/uploads/isis-reports/documents/IAEA_Iran_8Nov2011.pdf

Figure III.62: IAEA Report of November 8, 2011 – Nuclear Components for an Explosive Device

For use in a nuclear device, HEU retrieved from the enrichment process is first converted to metal. The metal is then cast and machined into suitable components for a nuclear core.

As indicated in paragraph 5 above, **Iran has acknowledged that, along with the handwritten one page document offering assistance with the development of uranium centrifuge enrichment technology, in which reference is also made to a reconversion unit with casting equipment, Iran also received the uranium metal document which describes, inter alia, processes for the conversion of uranium compounds into uranium metal and the production of hemispherical enriched uranium metallic components.**

The uranium metal document is known to have been available to the clandestine nuclear supply network that provided Iran with assistance in developing its centrifuge enrichment capability, and is also known to be part of a larger package of information which includes elements of a nuclear explosive design. A similar package of information, which surfaced in 2003, was provided by the same network to Libya. The information in the Libyan package, which was first reviewed by Agency experts in January 2004, included details on the design and construction of, and the manufacture of components for, a nuclear explosive device.

In addition, a Member State provided the Agency experts with access to a collection of electronic files from seized computers belonging to key members of the network at different locations. That collection included documents seen in Libya, along with more recent versions of those documents, including an up-dated electronic version of the uranium metal document.

In an interview in 2007 with a member of the clandestine nuclear supply network, the Agency was told that Iran had been provided with nuclear explosive design information. From information provided to the Agency during that interview, the Agency is concerned that Iran may have obtained more advanced design information than the information identified in 2004 as having been provided to Libya by the nuclear supply network.

Additionally, a Member State provided information indicating that, during the AMAD Plan, preparatory work, not involving nuclear material, for the fabrication of natural and high enriched uranium metal components for a nuclear explosive device was carried out.

As the conversion of HEU compounds into metal and the fabrication of HEU metal components suitable in size and quality are steps in the development of an HEU nuclear explosive device, clarification by Iran is needed in connection with the above.

Source: IAEA, *Implementation of the NPT Safeguards Agreement and relevant provisions of Security Council resolutions in the Islamic Republic of Iran*, November 8, 2011
http://isis-online.org/uploads/isis-reports/documents/IAEA_Iran_8Nov2011.pdf

Figure III.63: IAEA Report of November 8, 2011 – Detonator Development

The development of safe, fast-acting detonators, and equipment suitable for firing the detonators, is an integral part of a programme to develop an implosion type nuclear device. Included among the alleged studies documentation are a number of documents relating to the development by **Iran, during the period 2002–2003, of fast functioning detonators, known as "exploding bridgewire detonators" or "EBWs" as safe alternatives to the type of detonator described for use in the nuclear device design** referred to in paragraph 33 above.

In 2008, Iran told the Agency that it had developed EBWs for civil and conventional military applications and had achieved a simultaneity of about one microsecond when firing two to three detonators together, and provided the Agency with a copy of a paper relating to EBW development work presented by two Iranian researchers at a conference held in Iran in 2005. A similar paper was published by the two researchers at an international conference later in 2005. Both papers indicate that suitable high voltage firing equipment had been acquired or developed by Iran. **Also in 2008, Iran told the Agency that, before the period 2002–2004, it had already achieved EBW technology. Iran also provided the Agency with a short undated document in Farsi, understood to be the specifications for a detonator development programme, and a document from a foreign source showing an example of a civilian application in which detonators are fired simultaneously. However, Iran has not explained to the Agency its own need or application for such detonators.**

The Agency recognizes that there exist non-nuclear applications, albeit few, for detonators like EBWs, and of equipment suitable for firing multiple detonators with a high level of simultaneity. Notwithstanding, given their possible application in a nuclear explosive device, and the fact that there are limited civilian and conventional military applications for such technology, Iran's development of such detonators and equipment is a matter of concern, particularly in connection with the possible use of the multipoint initiation system referred to below.

Source: IAEA, *Implementation of the NPT Safeguards Agreement and relevant provisions of Security Council resolutions in the Islamic Republic of Iran*, November 8, 2011
http://isis-online.org/uploads/isis-reports/documents/IAEA_Iran_8Nov2011.pdf

Figure III.64: IAEA Report of November 8, 2011 – Initiation of High Explosives and Associated Experiments

Detonators provide point source initiation of explosives, generating a naturally diverging detonation wave. In an implosion type nuclear explosive device, an additional component, known as a multipoint initiation system, can be used to reshape the detonation wave into a converging smooth implosion to ensure uniform compression of the core fissile material to supercritical density.

The Agency has shared with Iran information provided by a Member State which indicates that Iran has had access to information on the design concept of a multipoint initiation system that can be used to initiate effectively and simultaneously a high explosive charge over its surface. The Agency has been able to confirm independently that such a design concept exists and the country of origin of that design concept. Furthermore, the Agency has been informed by nuclear-weapon States that the specific multipoint initiation concept is used in some known nuclear explosive devices. In its 117 page submission to the Agency in May 2008, Iran stated that the subject was not understandable to Iran and that Iran had not conducted any activities of the type referred to in the document.

Information provided to the Agency by the same Member State referred to in the previous paragraph describes the multipoint initiation concept referred to above as being used by Iran in at least one large scale experiment in 2003 to initiate a high explosive charge in the form of a hemispherical shell. According to that information, during that experiment, the internal hemispherical curved surface of the high explosive charge was monitored using a large number of optical fibre cables, and the light output of the explosive upon detonation was recorded with a high speed streak camera. It should be noted that the dimensions of the initiation system and the explosives used with it were consistent with the dimensions for the new payload which, according to the alleged studies documentation, were given to the engineers who were studying how to integrate the new payload into the chamber of the Shahab 3 missile re-entry vehicle (Project 111) (see Section C.11 below). Further information provided to the Agency by the same Member State indicates that the large scale high explosive experiments were conducted by Iran in the region of Marivan.

The Agency has strong indications that the development by Iran of the high explosives initiation system, and its development of the high speed diagnostic configuration used to monitor related experiments, were assisted by the work of a foreign expert who was not only knowledgeable in these technologies, but who, a Member State has informed the Agency, worked for much of his career with this technology in the nuclear weapon programme of the country of his origin. The Agency has reviewed publications by this foreign expert and has met with him. The Agency has been able to verify through three separate routes, including the expert himself, that this person was in Iran from about 1996 to about 2002, ostensibly to assist Iran in the development of a facility and techniques for making ultra-dispersed diamonds ("UDDs" or "nanodiamonds"), where he also lectured on explosion physics and its applications.

Furthermore, the Agency has received information from two Member States that, after 2003, Iran engaged in experimental research involving a **scaled down version of the hemispherical initiation system and high explosive charge** referred to in paragraph 43 above, albeit in connection with non-nuclear applications. This work, together with other studies made known to the Agency in which the same

initiation system is used in cylindrical geometry, could also be relevant to improving and optimizing the multipoint initiation design concept relevant to nuclear applications.

The Agency's concern about the activities described in this Section derives from the fact that a multipoint initiation system, such as that described above, can be used in a nuclear explosive device. However, Iran has not been willing to engage in discussion of this topic with the Agency.

Source: IAEA*, Implementation of the NPT Safeguards Agreement and relevant provisions of Security Council resolutions in the Islamic Republic of Iran*, November 8, 2011
http://isis-online.org/uploads/isis-reports/documents/IAEA_Iran_8Nov2011.pdf

Figure III.65: IAEA Report of November 8, 2011 – Hydrodynamic Experiments

One necessary step in a nuclear weapon development programme is determining whether a theoretical design of an implosion device, the behaviour of which can be studied through computer simulations, will work in practice. To that end, high explosive tests referred to as "hydrodynamic experiments" are conducted in which fissile and nuclear components may be replaced with surrogate materials.

Information which the Agency has been provided by Member States, some of which the Agency has been able to examine directly, indicates that Iran has manufactured simulated nuclear explosive components using high density materials such as tungsten. These components were said to have incorporated small central cavities suitable for the insertion of capsules such as those described in Section C.9 below. The end use of such components remains unclear, although they can be linked to other information received by the Agency concerning experiments **involving the use of high speed diagnostic equipment, including flash X ray, to monitor the symmetry of the compressive shock of the simulated core of a nuclear device.**

Other information which the Agency has been provided by Member States indicates that Iran constructed a large explosives containment vessel in which to conduct hydrodynamic experiments. The explosives vessel, or chamber, is said to have been put in place at Parchin in 2000. A building was constructed at that time around a large cylindrical object at a location at the Parchin military complex. A large earth berm was subsequently constructed between the building containing the cylinder and a neighbouring building, indicating the probable use of high explosives in the chamber. The Agency has obtained commercial satellite images that are consistent with this information. From independent evidence, including a publication by the foreign expert referred to in paragraph 44 above, the Agency has been able to confirm the date of construction of the cylinder and some of its design features (such as its dimensions), and that it was designed to contain the detonation of up to 70 kilograms of high explosives, which would be suitable for carrying out the type of experiments described in paragraph 43 above.

As a result of information the Agency obtained from a Member State in the early 2000s alleging that Iran was conducting high explosive testing, possibly in association with nuclear materials, at the Parchin military complex, the Agency was permitted by Iran to visit the site twice in 2005. From satellite imagery available at that time, the Agency identified a number of areas of interest, none of which, however, included the location now believed to contain the building which houses the explosives chamber mentioned above; consequently, the Agency's visits did not uncover anything of relevance.

Hydrodynamic experiments such as those described above, which involve high explosives in conjunction with nuclear material or nuclear material surrogates, are strong indicators of possible weapon development. In addition, the use of surrogate material, and/or confinement provided by a chamber of the type indicated above, could be used to prevent contamination of the site with nuclear material. It remains for Iran to explain the rationale behind these activities.

Source: IAEA, *Implementation of the NPT Safeguards Agreement and relevant provisions of Security Council resolutions in the Islamic Republic of Iran*, November 8, 2011
http://isis-online.org/uploads/isis-reports/documents/IAEA_Iran_8Nov2011.pdf

Figure III.66: IAEA Report of November 8, 2011 – Modeling and Calculations

Information provided to the Agency by two Member States relating to modelling studies alleged to have been conducted in 2008 and 2009 by Iran is of particular concern to the Agency. According to that information, the studies involved the modelling of spherical geometries, consisting of components of the core of an HEU nuclear device subjected to shock compression, for their neutronic behaviour at high density, and a determination of the subsequent nuclear explosive yield. The information also identifies models said to have been used in those studies and the results of these calculations, which the Agency has seen. The application of such studies to anything other than a nuclear explosive is unclear to the Agency. It is therefore essential that Iran engage with the Agency and provide an explanation.

The Agency obtained information in 2005 from a Member State indicating that, in 1997, representatives from Iran had met with officials from an institute in a nuclear-weapon State to request training courses in the fields of neutron cross section calculations using computer codes employing Monte Carlo methodology, and shock wave interactions with metals. In a letter dated 14 May 2008, Iran advised the Agency that there was nothing to support this information. The Agency has also been provided with information by a Member State indicating that, in 2005, arrangements were made in Iran for setting up projects within SADAT centres (see Section C.1 and Attachment 1), inter alia, to establish a databank for "equation of state" information and a hydrodynamics calculation centre. The Agency has also been provided with information from a different Member State that, in 2005, a senior official in SADAT solicited assistance from Shahid Behesti University in connection with complex calculations relating to the state of criticality of a solid sphere of uranium being compressed by high explosives.

Research by the Agency into scientific literature published over the past decade has revealed that Iranian workers, in particular groups of researchers at Shahid Behesti University and Amir Kabir University, have published papers relating to the generation, measurement and modelling of neutron transport.43 The Agency has also found, through open source research, other Iranian publications which relate to the application of detonation shock dynamics to the modelling of detonation in high explosives, and the use of hydrodynamic codes in the modelling of jet formation with shaped (hollow) charges. Such studies are commonly used in reactor physics or conventional ordnance research, but also have applications in the development of nuclear explosives.

Source: IAEA, *Implementation of the NPT Safeguards Agreement and relevant provisions of Security Council resolutions in the Islamic Republic of Iran*, November 8, 2011
http://isis-online.org/uploads/isis-reports/documents/IAEA_Iran_8Nov2011.pdf

Figure III.67: IAEA Report of November 8, 2011 – Neutron Initiator

The Agency has information from a Member State that Iran has undertaken work to manufacture small capsules suitable for use as containers of a component containing nuclear material. The Agency was also informed by a different Member State that Iran may also have experimented with such components in order to assess their performance in generating neutrons. Such components, if placed in the centre of a nuclear core of an implosion type nuclear device and compressed, could produce a burst of neutrons suitable for initiating a fission chain reaction. The location where the experiments were conducted was said to have been cleaned of contamination after the experiments had taken place. The design of the capsule, and the material associated with it, are consistent with the device design information which the clandestine nuclear supply network allegedly provided to Iran.

The Agency also has information from a Member State that work in this technical area may have continued in Iran after 2004, and that Iran embarked on a four year programme, from around 2006 onwards, on the further validation of the design of this neutron source, including through the use of a non-nuclear material to avoid contamination.

Given the importance of neutron generation and transport, and their effect on geometries containing fissile materials in the context of an implosion device, Iran needs to explain to the Agency its objectives and capabilities in this field.

Source: IAEA*, Implementation of the NPT Safeguards Agreement and relevant provisions of Security Council resolutions in the Islamic Republic of Iran*, November 8, 2011
http://isis-online.org/uploads/isis-reports/documents/IAEA_Iran_8Nov2011.pdf

Figure III.68: IAEA Report of November 8, 2011 – Conducting a Nuclear Test

The Agency has information provided by a Member State that Iran may have planned and undertaken preparatory experimentation which would be useful were Iran to carry out a test of a nuclear explosive device. In particular, the Agency has information that Iran has conducted a number of practical tests to see whether its EBW firing equipment would function satisfactorily over long distances between a firing point and a test device located down a deep shaft. Additionally, among the alleged studies documentation provided by that Member State, is a document, in Farsi, which relates directly to the logistics and safety arrangements that would be necessary for conducting a nuclear test. The Agency has been informed by a different Member State that these arrangements directly reflect those which have been used in nuclear tests conducted by nuclear-weapon States.

Source: IAEA*, Implementation of the NPT Safeguards Agreement and relevant provisions of Security Council resolutions in the Islamic Republic of Iran*, November 8, 2011
http://isis-online.org/uploads/isis-reports/documents/IAEA_Iran_8Nov2011.pdf

Figure III.69: IAEA Report of November 8, 2011 – Integration into a Missile Delivery Vehicle

The alleged studies documentation contains extensive information regarding work which is alleged to have been conducted by Iran during the period 2002 to 2003 under what was known as Project 111. From that information, **the project appears to have consisted of a structured and comprehensive programme of engineering studies to examine how to integrate a new spherical payload into the existing payload chamber which would be mounted in the re-entry vehicle of the Shahab 3 missile.**

According to that documentation, using a number of commercially available computer codes, Iran conducted computer modelling studies of at least 14 **progressive design iterations of the payload chamber** and its contents to examine how they would stand up to the various stresses that would be encountered on being launched and travelling on a ballistic trajectory to a target. It should be noted that the masses and dimensions of components identified in information provided to the Agency by Member States that Iran is alleged to have been developing (see paragraphs 43 and 48 above) correspond to those assessed to have been used in Project 111 engineering studies on the new payload chamber.

During these studies, prototype components were allegedly manufactured at workshops known to exist in Iran but which Iran refused the Agency permission to visit. The six engineering groups said to have worked under Project 111 produced many technical reports, which comprise a substantial part of the alleged studies documentation. The Agency has studied these reports extensively and finds that they are both internally consistent and consistent with other supporting information related to Project 111.

The alleged studies documentation also shows that, as part of the activities undertaken within Project 111, consideration was being given to subjecting the prototype payload and its chamber to engineering stress tests to see how well they would stand up in practice to simulated launch and flight stresses (so-called "environmental testing"). This work would have complemented the engineering modelling simulation studies referred to in paragraph 60 above. According to the information reflected in the alleged studies documentation, within Project 111, some, albeit limited, preparations were also being undertaken to enable the assembly of manufactured components.

Iran has denied conducting the engineering studies, claiming that the documentation which the Agency has is in electronic format and so could have been manipulated, and that it would have been easy to fabricate. However, the quantity of the documentation, and the scope and contents of the work covered in the documentation, are sufficiently comprehensive and complex that, in the Agency's view, it is not likely to have been the result of forgery or fabrication. While the activities described as those of Project 111 may be relevant to the development of a non-nuclear payload, they are highly relevant to a nuclear weapon programme.

Source: IAEA, *Implementation of the NPT Safeguards Agreement and relevant provisions of Security Council resolutions in the Islamic Republic of Iran*, November 8, 2011
http://isis-online.org/uploads/isis-reports/documents/IAEA_Iran_8Nov2011.pdf

Figure III.70: IAEA Report of November 8, 2011 – Fusing, Arming, and Firing System

The alleged studies documentation indicates that, as part of the studies carried out by the engineering groups under Project 111 to integrate the new payload into the re-entry vehicle of the Shahab 3 missile, additional work was conducted on the development of a prototype firing system that would enable the payload to explode both in the air above a target, or upon impact of the re-entry vehicle with the ground. Iran was shown this information, which, in its 117 page submission (referred to above in paragraph 8), it dismissed as being "an animation game".

The Agency, in conjunction with experts from Member States other than those which had provided the information in question, carried out an assessment of the possible nature of the new payload. As a result of that assessment, it was concluded that any payload option other than nuclear which could also be expected to have an airburst option (such as chemical weapons) could be ruled out. Iran was asked to comment on this assessment and agreed in the course of a meeting with the Agency which took place in Tehran in May 2008 that, if the information upon which it was based were true, it would constitute a programme for the development of a nuclear weapon. Attachment 2 to this Annex reproduces the results of the Agency's assessment as it was presented by the Secretariat to the Member States in the technical briefing which took place in February 2008.

Source: IAEA*, Implementation of the NPT Safeguards Agreement and relevant provisions of Security Council resolutions in the Islamic Republic of Iran*, November 8, 2011
http://isis-online.org/uploads/isis-reports/documents/IAEA_Iran_8Nov2011.pdf

Figure III.71: IAEA Report of November 8, 2011 – Departments, Projects, and Centers Relating to Iran's Nuclear Program

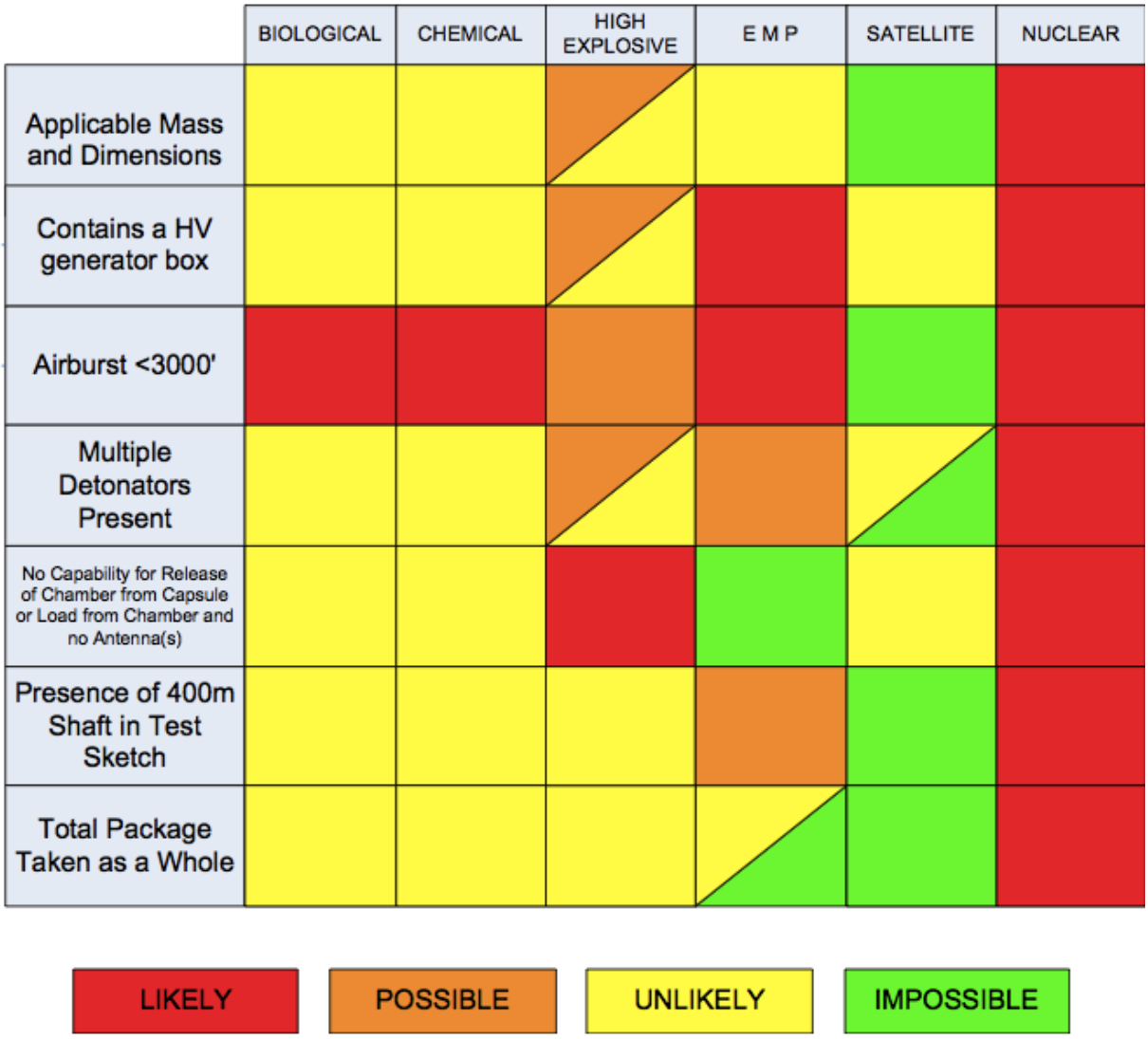
PHRC Departments	AMAD Plan Projects	SADAT Centers
Department 01: Nuclear Physics	Project 110: Payload Design	Center for Readiness & New Defense Technologies
Department 02: Centrifuge Enrichment	Project 111: Payload Integration	Center for R&D (1) of Explosion and Shock Technology
Department 03: Laser Enrichment	Project 3: Manufacture of Components 3.12: Explosives and EBW Detonator 3.14: Uranium Metallurgy	Center for Industrial Research & Construction
Department 04: Uranium Conversion	Project 4: Uranium Enrichment	Center for R&T (2) of Advanced Materials – Chemistry
Department 05: Geology	Project 5: Uranium Mining, Concentration, and Conversion 5.13: Green Salt Project 5.15: Gchine Mine Project	Center for R&T of New Aerospace Technology
Department 06: Health Physics	Projects 8, 9, and 10	Center for Laser and Phototonics Applications
Department 07: Workshop	Project Health and Safety	
Department 08: Heavy Water	Project 19: Involvement of IAP	
Department 09: Analytical Laboratory	Project/Group 117: Procurement and Supply	
Department 10: Computing		
Department 20: Analysis		

(1) R&D = Research & Development

(2) R&T = Research and Technology

Source: IAEA, *Implementation of the NPT Safeguards Agreement and relevant provisions of Security Council resolutions in the Islamic Republic of Iran*, November 8, 2011 http://isis-online.org/uploads/isis-reports/documents/IAEA_Iran_8Nov2011.pdf

Figure III.72: IAEA Report of November 8, 2011 – Analysis of Payload



Source: IAEA, *Implementation of the NPT Safeguards Agreement and relevant provisions of Security Council resolutions in the Islamic Republic of Iran*, November 8, 2011 http://isis-online.org/uploads/isis-reports/documents/IAEA_Iran_8Nov2011.pdf

The Potential Impact of Iranian Nuclear Weapons on US and Iranian Capabilities

The net effect of nuclear weapons on US and Iranian capabilities remains uncertain. Iran does not yet possess a nuclear weapon, has never conducted a nuclear test, and has never announced plans for developing given types and yields of weapons, deploying them on delivery systems, and using them to gain influence, deter, or warfighting. Hence, any assessment of the net effects of an Iranian nuclear weapon must be theoretical and somewhat problematic. Nevertheless, the maturity and likely weaponization of Iran's nuclear program necessitate an evaluation of the potential net effects such a scenario would engender.

Given the fact that Iran's strike aircraft and bombers have aged considerably and are nearly obsolescent in comparison with their US, Israeli, and Gulf equivalents, Iran would likely select another means for delivering a nuclear weapon, including nuclear-tipped ballistic or cruise missiles. Such assets (ballistic missiles in particular), however, would be detectable by US radar and satellite systems, and could provoke a retaliatory strike. As such, it is not unreasonable that Iran would consider delivering a nuclear weapon covertly, using any one of its regional proxies or its Al Qods Force. Using a covert means of nuclear delivery, Iran would possess a degree of deniability, and minimize the chances of US nuclear retaliation.

Assuming a dispersed, mature Iranian nuclear force, Iran would most likely leverage these forces against the US' conventional superiority. In addition to US forces and installations in the Gulf, Iran could potentially threaten the US allies in the region, Europe, Israel, and oil export capabilities. Any Iranian nuclear strike would, however, be limited in nature so as not to garner massive nuclear retaliation.

Regardless of its means of delivery, the mere existence of an Iranian nuclear arsenal would provide Iran with a massive deterrent, and neutralize the US' conventional superiority in the region to a degree. Iran would consequently be enabled to pursue a more aggressive foreign policy than it would otherwise, and use its nuclear capability to leverage other regional actors and competitors.

US Responses to Iran's Nuclear and Missile Efforts

As is described in the next chapter, the US continues to use sanctions and diplomacy as its primary *current* means of limiting Iran's nuclear efforts, and other diplomatic and negotiating initiatives. US officials have consistently stated that military options are still under consideration, but the US has joined its 5+1 allies at the negotiating table with Iran and did so again in January 2011.

The need to keep many key aspects of US threat perceptions classified means that there is no clear way to determine how top level US decision makers view the broader trade-offs between negotiation, preventive and preemptive military options, and deterrence/containment. US policy and actions in these areas are, however, is a key aspect of US and Iranian military competition, and one where current US perceptions will almost certainly change if Iran clearly moves to the point of a nuclear break out capability, tests a device, and begins to deploy some mix of nuclear armed forces.

Given the timing of Iran's actions, these are also areas where a different set of key actors are almost certain to be in office by the time Iran has significant nuclear capabilities, and possibly a

different Administration. Iran may define its goals in ways that raise or lower US perceptions of threat, and the 5+1, Gulf, and other regional states may change their perceptions as well.

US officials have never described US options for preventive and preemptive strikes, but the US can draw upon a number of assets that Iran would find difficult to counter and which are listed in **Figure III.73.**

US Strike Options Against Iran

A power as large as the US would have far more capability than Israel. It could strike at possible targets as well as confirm targets. The problem with a shell gamer is that it virtually provokes strikes at all the shells.

The US also could strike at a wide range of critical Iranian military facilities, including its missile production facilities. Most are soft targets, and would be extremely costly to Iran. Even if many of Iran's nuclear facilities did survive US strikes, Iran would be faced with either complying with the EU3 and UN terms or taking much broader military losses – losses its aging and limited forces can ill afford.

Military operations against Iran's nuclear, missile, and other WMD facilities and forces would be challenging for the US. 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 4,500-pound enhanced BLU-28 satellite-guided bunker-busting bombs – potentially enough to take out one hardened Iranian site per sortie. Such bombers could operate flying from Al Udeid air base in Qatar, Diego Garcia in the Indian Ocean, RAF Fairford in Gloucestershire, United Kingdom, and Whiteman US Air Force (USAF) Base in Missouri.

The US 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 four to six feet of reinforced concrete. An aircraft must overfly the target and launch the weapon with great precision to achieve serious penetration capability. It can be fitted with precision guidance and converted to a guided glide bomb.

The Joint Direct Attack Munition (JDAM) GBU-31 version has a nominal range of 15 kilometers with a CEP of 13 meters in the GPS-aided Inertial Navigation System (INS) modes of operation and 30 meters in the INS-only modes of operation.

More advanced systems that have been publicly discussed in the unclassified literature include the BLU-116 Advanced Unitary Penetrator (AUP), the GBU-24 C/B (USAF), or the GBU-24 D/B (US Navy), which has about three times the penetration capability of the BLU-109. The US is investing in other weapons that are supposed to destroy targets that are buried under more than 20 meters of dirt and concrete.

It is not clear whether the United States 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 carry two such missiles, one on each

inboard store station. It is a retargetable, precision-guided standoff weapon using inertial navigation aided by GPS satellites and has a 15-40-NM range.

The US does, however, have a number of other new systems that are known to be in the developmental stage and can probably deploy systems capable of roughly twice the depth of penetration with twice the effectiveness of the systems known from its attacks on Iraq in 1991. The nature and characteristics of such systems, however, are classified. The newest, most advanced weapons in US service are the 5,000-pound BLU-122 and the 30,000-pound Massive Ordnance Penetrator (MOP). The MOP weighs almost 30,000 pounds and able to carry 5,300 pounds of explosives. According to some estimates optimum penetrating distance for the MOP is up to 200 feet. Possible alternatives to these weapons are directed-energy and high-power microwave (HPM) weapons, none of which are currently beyond testing phase.

It is not clear whether such weapons could destroy all of Iran's most hardened underground sites, although it seems likely that they 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 under way in Natanz and Isfahan. The facilities are said to make extensive use of blast-proof doors, extensive divider walls, hardened ceilings, 20-centimeter-thick concrete walls, and double concrete ceilings with earth filled between layers to defeat earth penetrates. 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-2 could be used to deliver large numbers of precision-guided 250 and 500-pound bombs, or two MOPs against dispersed surface targets. Likewise, they could carry 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 standoff 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.

One analyst projects that strikes against some 400 targets would be necessary to dismantle the program. According to other reports, the US Department of Defense is considering both conventional and nuclear weapons to use against reinforced underground targets, and would strike at Iran’s other WMD facilities, missiles and missile production facilities, and create an entry corridor by destroying part of Iran’s air defense system. This could easily require 800-1,200 sorties and cruise missile strikes.

More generally, the US could cripple Iran's economy by striking at major domestic gas production and distribution facilities, refineries, and electric power generations. There are no rules that would preclude the US from immediate restrikes or restrikes over time. If the US chose to strike at the necessary level of intensity, it could use conventional weapons to cripple Iran's ability to function as a nation in a matter of days with attacks limited to several hundred aim points.

At present, a US attack might include B-2A bombers out of Diego Garcia, each carrying 2 GBU-57 MOP bombs, escorted by F-18s from the 5th fleet stationed in the Gulf area, or F-15E's, F-16C's, or F-22's from forward operating bases.

- In July 2009, verification of equipment required to integrate the MOP on the B-2 was complete - the hardware that holds the MOP inside the weapons bay.
- The MOP is a GPS-guided weapon containing more than 5,300 pounds of conventional explosives inside a 20.5 ft long bomb body of hardened steel. It is designed to penetrate dirt, rock and reinforced concrete to reach enemy bunker or tunnel installations. The B-2 will be capable of carrying two MOPs, one in each weapons bay.
- The B-2 currently carries up to 40,000 pounds of conventional ordnance. For example, it can deliver 80 independently targeted 500-lb class bombs from its smart bomb rack assembly; or up to 16 2,000-lb class weapons from its rotary launcher.
- Integration of the MOP on the B-2 is the latest in a series of modernization programs that Northrop Grumman and its subcontractors have undertaken with the Air Force to ensure that the aircraft remains fully capable against evolving threats.

While the success rate of any attack on Iran's nuclear facilities would depend on its duration and the number of strikes carried out, a high success rate would be possible if the attack were sustained for a couple of days.

The US has also offered its allies the option "extended regional deterrence," although it has left the character of such a capability ambiguous and indicated it might use conventional weapons, rather than the theater nuclear forces the US once used to provide extended deterrence for its NATO European allies.

Secretary of State Hillary Clinton put the US view forward as follows in June 2009, "We want Iran to calculate what I think is a fair assessment that if the United States extends a defense umbrella over the region, if we do even more to support the military capacity of those in the Gulf, it's unlikely that Iran will be any stronger or safer because they won't be able to intimidate and dominate as they apparently believe they can once they have a nuclear weapon."[73]

The US went further in its April 2010 Nuclear Posture Review.[74] The review discussed arms control options, and efforts to eventually end US reliance on nuclear weapons, but it also stated that,

> Security architectures in key regions will retain a nuclear dimension as long as nuclear threats to US allies and partners remain. US nuclear weapons have played an essential role in extending deterrence to US allies and partners against nuclear attacks or nuclear-backed coercion by states in their region that possess or are seeking nuclear weapons. A credible US "nuclear umbrella" has been provided by a combination of means – the strategic forces of the US Triad, non-strategic nuclear weapons deployed forward in key regions, and US-based nuclear weapons that could be deployed forward quickly to meet regional contingencies.
>
> In Asia and the Middle East – where there are no multilateral alliance structures analogous to NATO – the United States has mainly extended deterrence through bilateral alliances and security relationships and through its forward military presence and security guarantees. When the Cold War ended, the United States

[73] Mike Schuster, "Iran Prompts Debate Over Mideast Defense Umbrella," *NPR,* August 26, 2009. Available at http://www.npr.org/templates/story/story.php?storyId=112222260

[74] "Nuclear Posture Review Report," *Department of Defense,* April 2010. Available at http://www.defense.gov/npr/docs/2010%20Nuclear%20Posture%20Review%20Report.pdf

> withdrew its forward-deployed nuclear weapons from the Pacific region, including removing nuclear weapons from naval surface vessels and general-purpose submarines. Since then, it has relied on its central strategic forces and the capacity to re-deploy non-strategic nuclear systems in East Asia, if needed, in times of crisis.
>
> The Administration is pursuing strategic dialogues with its allies and partners in East Asia and the Middle East to determine how best to cooperatively strengthen regional security architectures to enhance peace and security, and reassure them that US extended deterrence is credible and effective.

Finally, all of the pervious uncertainties about nuclear and missile programs must be considered in the context that Iran, might – in one worst-case scenario – smuggle in a nuclear device into a Gulf state or Israel or detonate it in the water near a critical facility like Ras Tanura or a city like Tel Aviv.

Moreover, a focus on nuclear weapons ignores the fact that Iran is a declared chemical weapons state, and Israel has been caught importing the precursors for chemical weapons, that Iran is suspected to have advanced biological weapons programs, and there is the possibility that Iran will become able to use conventionally armed precision-guided weapons to attack key power, water, refinery, and other critical targets – turning such weapons into "weapons of mass effectiveness."

US and allied decision makers, military planners, and intelligence experts cannot ignore these possibilities and options is deciding how to compete with Iran. Senior US intelligence officers have repeatedly warned in public that Iran has chemical and suspected biological weapon programs. Accordingly, options like missile defense, preemptive strikes, and extended regional deterrence must look beyond competition on a nuclear level.

It is clear that the US has strike assets that are far larger and more capable than those of Israel. At the same time, there is no practical way to determine how US senior policymakers and military leaders perceive US ability to identify target, and destroy Iran's current nuclear and other strike capabilities, or assess the degree to which this would provide security over time vs. provoking Iran into some massive new effort to acquire nuclear weapons.

It is also clear that the US developed serious military contingency plans, and has improved its intelligence and targeting coverage. It is also clear from media sources that the US has focused on developing better ordnance to kill underground and hard targets, has developed regional missile defense options, is seeking to improve regional air defenses, and retains stealth and cruise missiles.

If the US ever did exercise such options, it would face far less serious threats of Iranian retaliation than Israel in the form of non-state actors with ties to Iran like Hezbollah. The US could also take the time to assess battle damage, and carry out restrikes – while Israel might only be able to carry out one major strike before it faced political constraints it cannot ignore. The US might also be able to get regional support for a US presence and overwatch that would continue to strike Iran – if Iran attempts to reconstitute its nuclear and missile programs.

At the same time, the US would have to deal with the negative political consequences of the military aftermath of any strike, and the cost it will have to pay in terms of reactions from and other states. Moreover, it must consider the impact strikes will have on the US conflicts in Iraq, Afghanistan, and the war on terror; whether US actions will provoke Iran into a massive new

covert effort; and how Iran might react in attacking energy exports in the Gulf, Israel, and other US interests in the region.

Much would depend on the extent to which the leaders of friendly Gulf states were actually willing to back the US in such a campaign, but any judgment about Gulf perceptions has to be speculative. Neither the public statements of Gulf leaders, nor the kind of material available from sources like WikiLeaks, provides a clear indication of the links between US and Gulf perceptions of the Iranian threat at the official level, or their willingness to act. Moreover, current Gulf perceptions are certain to change over time just as Israeli and US perceptions will evolve as the Iranian threat alters and becomes more tangible. It is far from clear that today's threat perceptions provide a clear picture for the future.

The US has also signaled that it might well rely on a combination missile defense and deterrence even if Iran does deploy nuclear armed aircraft and missiles. Key missile defense assets in the region include US Navy Aegis anti-ballistic missile cruisers stationed in the Gulf, and the MIM-104 Patriot surface-to-air missile system that Bahrain, Egypt, Israel, Jordan, Kuwait, and Saudi Arabia have acquired the from the US. Lastly, in September, 2011 the US and Turkey reached an agreement whereby a missile defense radar site will be constructed only 435 miles from the Turkey-Iran border.[75] While Iran's missiles have not been stated as the exclusive target of the system, it will greatly enable the US' ability to detect and intercept an Iranian missile launch.

As **Figure III.75** shows, the US has continued to push for missile defense forces in the Gulf, to support Israel's missile defense programs, and lay the ground for missile defense in Europe.

[75] Shanker, Thom. "U.S. Hails Deal With Turkey on Missile Shield." New York Times. September 15, 2011, http://www.nytimes.com/2011/09/16/world/europe/turkey-accepts-missile-radar-for-nato-defense-against-iran.html

Figure III.73: Key assets for a US strike on Iran

- **B-2A Spirit Bomber**

Primary Function	Multi role heavy bomber
Engines:	Four GE F-118-GE-100 engines, each with a thrust of 17,300 pounds (7,847kg)
Speed, Cruise:	High Subsonic
Ceiling:	50,000 ft (15,000 meters)
Weight Takeoff, (typical):	335,500 – 350,000 pounds (152,600 – 159,000kg)
Weight, Empty (typical):	125,000 – 160,000 pounds
Range:	6,000 nmi (9,600 km), unrefueled range for a Hi-Lo mission with nuclear free-fall bombs. 10,000 nmi with one aerial refueling.
Payload:	40,000 pounds (18,000kg)
Crew:	2 pilots
Current Armament:	**Nuclear:** 16 B61, 16 B83 **Conventional:** 80 MK82 (500lb), 16 MK84 (2000lb), 34-36 CBU-87, 34-36 CBU-89, 34-36 CBU-97 **Precision:** 216 GBU-39 SDB (250lb), 80 GBU-30 JDAM (500lb), 16 GBU-32 JDAM (2000lb), GBU-27, GBU-28, GBU-36, GBU-37, AGM-154 HSOW, 8-16 AGM-137 TSSAM, 2 MOP/DSHTW/Big BLU

- **GBU-57 Massive Ordnance Penetrator (MOP)**

GBU-57A/B Massive Ordnance Penetrator (MOP)	**Specifications**
Weight, total:	13,600kg (slightly less than 30,000 pounds)
Weight, explosive:	2,700kg (6,000lb)
Length:	6m/20.5 feet
Diameter:	31.5 in
Penetration:	60 meters (200ft) through 5,000 psi reinforced concrete. 40 meters (125ft) through moderately hard rock.

	8 meters (25ft) through 10,000 psi reinforced concrete.
Control:	Short-span wings and trellis-type tail
Contractors:	Boeing, Northrop Grumman
Platforms:	B-52, B2
Guidance	GPS aided Inertial Navigation System

Figure III.74: Potential US Strike on Iran's Nuclear Facilities

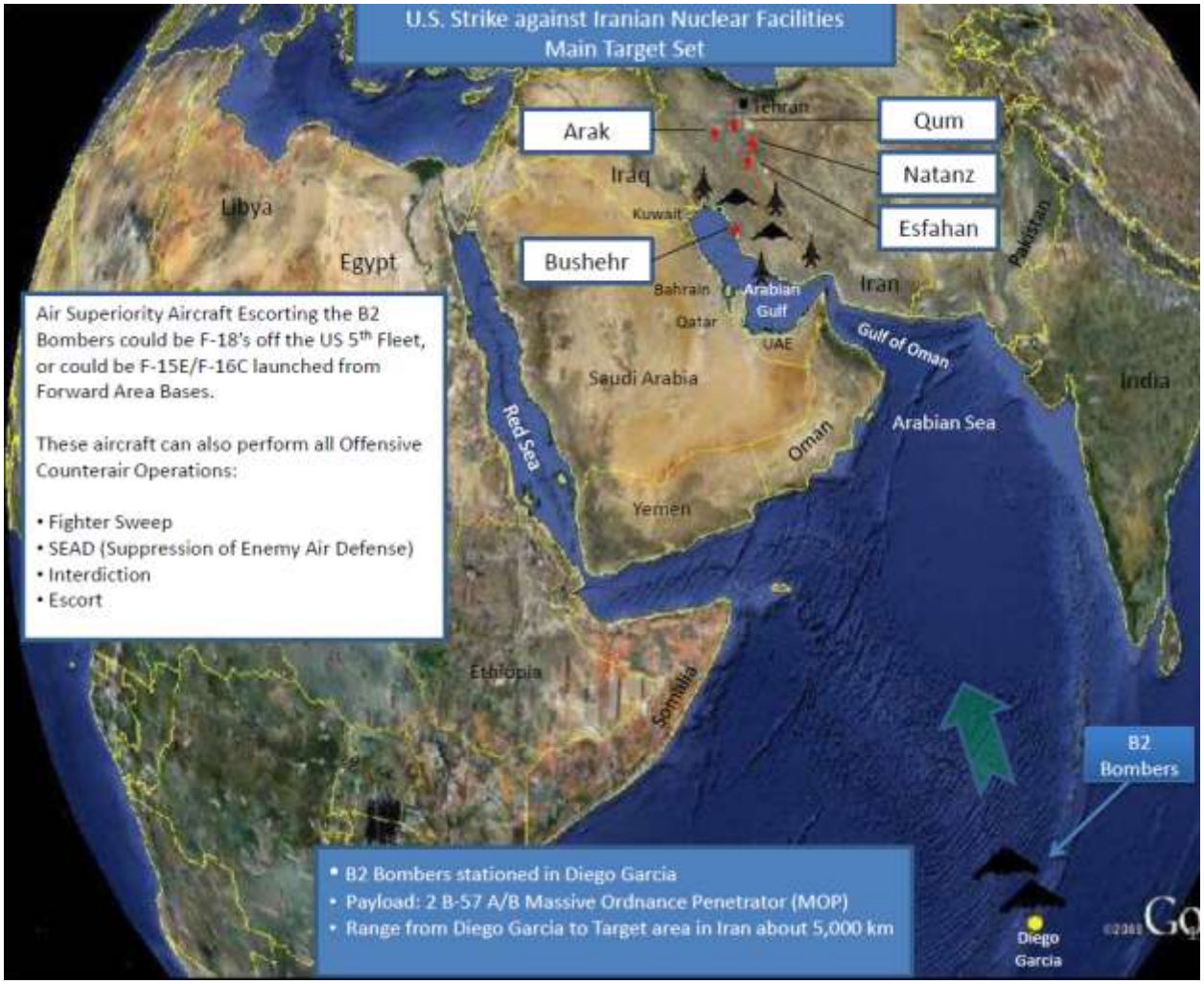
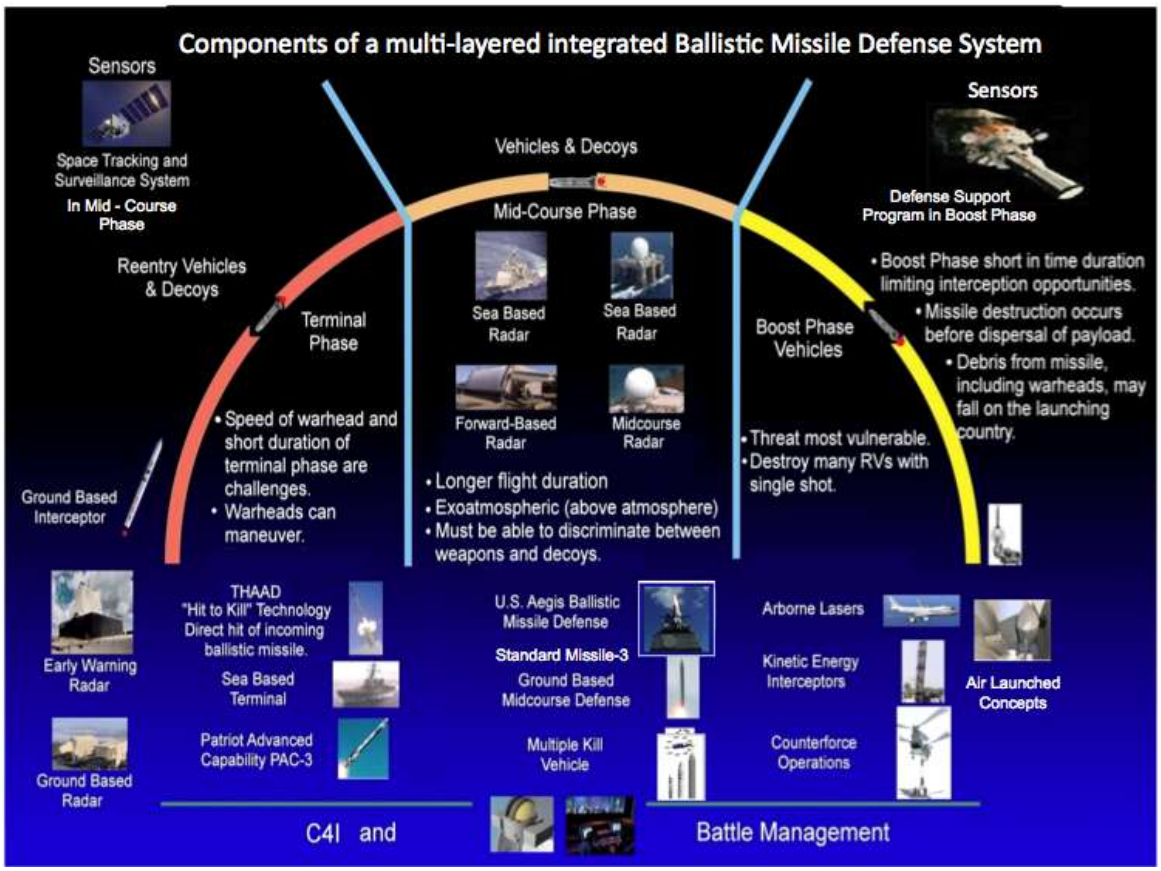


Figure III.75: Gulf Integrated Missile Defenses



Possible US War Plans: Attacking, Delaying, Waiting Out

If the US does choose to respond militarily, it has several major types of military and strategic options which are reflected in **Figure III.76** through **Figure III.81**. Each of these options might have many of the following broad characteristics, although it should be stressed that these are only rough outlines of US options and are purely speculative and illustrative points. They are more warnings than recommendations, and they are not based on any inside knowledge of actual US war plans, and calculations. Those who argue strongly for and against such options should note, however, that there are many different ways in which the US could act. There are no rules or certainties that either say such attacks could not succeed or that they would.

- **Figure III.76** reflects a potential scenario in which the US used limited "demonstrative" or "deterrent" strikes to coerce Iran into abandoning its efforts to acquire nuclear weapons without launching a full strike on Iran's nuclear facilities. It is unclear how Iran would respond to such action.
- **Figure III.77** reflects a potential scenario in which the US used limited strikes to damage or destroy Iran's largest and most important nuclear sites.
- **Figure III.78** reflects a potential scenario in which the US engaged in major strikes on Iran's CBRN and major missile targets.
- **Figure III.79** reflects a potential scenario in which the US engaged in major attacks on Iran's nuclear facilities, major missile assets, as well as "dual use" assets that contribute to Iran's "technology base" such as universities.
- **Figure III.80** reflects a potential scenario in which the US waited for Iran to provide proof of or a "smoking gun" that indicated nuclear proliferation to strike at the country's facilities.
- **Figure III.81** reflects a potential scenario in which the US would not attack Iran's nuclear sites, but indicated nuclear targeting of Iran's military and CBRN facilities and its cities. Other potential action could include deploying anti-ballistic missile and cruise missile defense and tacitly signaling a "green light" for Israeli nuclear retaliation or preemption, among others.

Figure III.76: US Demonstrative, Coercive, or Deterrent Strikes

- Conduct a few cruise missile or stealth strikes simply as a demonstration or warning of the seriousness of US intentions if Iran does not comply with the terms of the EU3 or UN.
- Hit at least one high value target recognized by IAEA and EU3 to show credibility to Iran, minimize international criticism.
- Might strike at new sites and activities to show Iran cannot secretly proceed with, or expand its efforts, by ignoring the UN or EU3.
- Could be carrier-based; would not need territory of Gulf ally.
- International reaction would be a problem regardless of the level of US action.
- Might trigger Iranian counteraction in Iraq, Afghanistan, and dealing with Hezbollah.

Figure III.77: Limited US Attacks

- Limited strike would probably take 16-20 cruise missile and strike sorties. (Total sorties in Gulf and area would probably have to total 100 or more including escorts, enablers, and refuelers).
- Might be able to combine B-2s and carrier-based aircraft and sea-launched cruise missiles. Might well need land base(s) in Gulf for staging, refueling, and recovery.
- Goal would be at least 2-3 of most costly and major facilities critically damaged or destroyed.
- Hit at high value targets recognized by IAEA and EU3 to show credibility to Iran, minimize international criticism.
- Might strike at new sites and activities to show Iran cannot secretly proceed with, or expand its efforts, by ignoring the UN or EU3.
- Might slow down Iran if used stealth aircraft to strike at hard and underground targets, - but impact over time would probably still be more demonstrative than crippling.
- Hitting hard and underground targets could easily require multiple strikes during mission, and follow-on restrikes to be effective.
- Battle damage would be a significant problem, particularly for large buildings and underground facilities.
- Size and effectiveness would depend very heavily on the quality of US intelligence, and suitability of given ordnance, as well as the time the US sought to inflict a given effect.
- Iran's technology base would survive; the same would be true of much of equipment even in facilities hit with strikes. Little impact, if any, on pool of scientists and experts.
- Iranian response in terms of proliferation could vary sharply and unpredictably: Deter and delay vs. mobilize and provoke.
- Likely to produce cosmetic Iranian change in behavior at best. Would probably make Iran disperse program even more, and drive it to deep underground facilities. Might provoke to implement (more) active biological warfare program.
- Any oil embargo likely to be demonstrative.
- Would probably trigger Iranian counteraction in Iraq, Afghanistan, and dealing with Hezbollah.
- International reaction could be a serious problem; US might well face same level of political problems as if it had launched a comprehensive strike on Iranian facilities.

Figure III.78: Major US Attacks on Iranian CBRN and Major Missile Targets

- 200-600 cruise missiles and strike sorties; would have to be at least a matching number of escorts, enablers, and refuelers. Period of attacks could extend from 3 to 10 days.
- Hit all suspect facilities for nuclear, missile, BW, and related C4IBM.
- Knock out key surface-to-air missile sites and radars for future freedom of action.
- Would need to combine B-2s, carrier-based aircraft and sea-launched cruise missiles, and used of land base(s) in Gulf for staging, refueling, and recovery.
- Threaten to strike extensively at Iranian capabilities for asymmetric warfare and to threaten tanker traffic, facilities in the Gulf, and neighboring states.
- At least 7-10 days to fully execute and validate.
- Goal would be at least 70-80% of most costly and major facilities critically damaged or destroyed.
- Hit at all high value targets recognized by IAEA and EU3 to show credibility to Iran, minimize international criticism, but also possible sites as well.
- Strike at all known new sites and activities to show Iran cannot secretly proceed with, or expand its efforts, unless hold back some targets as hostages to the future.
- Impact over time would probably be crippling, but Iran might still covertly assemble some nuclear device and could not halt Iranian biological weapons effort.
- Hitting hard and underground targets could easily require multiple strikes during mission, and follow-on restrikes to be effective.
- Battle damage would be a significant problem, particularly for large buildings and underground facilities.
- Size and effectiveness would depend very heavily on the quality of US intelligence and suitability of given ordnance, as well as the time the US sought to inflict a given effect.
- Much of Iran's technology base would still survive; the same would be true of many equipment items, even in facilities hit with strikes. Some impact, if any, on pool of scientists and experts.
- Iranian response in terms of proliferation could vary sharply and unpredictably: Deter and delay vs. mobilize and provoke.
- A truly serious strike may be enough of a deterrent to change Iranian behavior, particularly if coupled to the threat of follow on strikes in the future. It still, however, could as easily produce only a cosmetic Iranian change in behavior at best. Iran might still disperse its program even more, and shift to multiple, small, deep underground facilities.
- Might well provoke Iran to implement (more) active biological warfare program.
- An oil embargo might be serious.
- Iranian government could probably not prevent some elements in Iranian forces and intelligence from seeking to use Iraq, Afghanistan, support of terrorism, and Hezbollah to hit back at the US and its allies if it tried; it probably would not try.

- International reaction would be a serious problem, but the US might well face same level of political problems as if it had launched a small strike on Iranian facilities.

Figure III.79: Major US Attacks on Military and Civilian Targets

- 1000-2,500 cruise missiles and strike sorties.
- Hit all suspect facilities for nuclear, missile, BW, and C4IBM, and potentially "technology base" targets including universities, dual use facilities.
- Either strike extensively at Iranian capabilities for asymmetric warfare and to threaten tanker traffic, facilities in the Gulf, and neighboring states or threaten to do so if Iran should deploy for such action.
- Would require a major portion of total US global assets. Need to combine B-2s, other bombers, and carrier-based aircraft and sea-launched cruise missiles. Would need land base(s) in Gulf for staging, refueling, and recovery. Staging out of Diego Garcia would be highly desirable.
- Would probably take several weeks to two months to fully execute and validate.
- Goal would be 70-80%-plus of most costly and major CBRN, missile and other delivery systems, key conventional air and naval strike assets, and major military production facilities critically damaged or destroyed.
- Hit at all high value targets recognized by IAEA and EU3 to show credibility to Iran, minimize international criticism, but also possible sites as well.
- Strike at all known new sites and activities to show Iran cannot secretly proceed with, or expand its efforts, unless hold back some targets as hostages to the future.
- Hitting hard and underground targets could easily require multiple strikes during mission, and follow-on restrikes to be effective.
- Impact over time would probably be crippling, but Iran might still covertly assemble some nuclear device and could not halt Iranian biological weapons effort.
- Battle damage would be a significant problem, particularly for large buildings and underground facilities.
- Size and effectiveness would depend very heavily on the quality of US intelligence and suitability of given ordnance, as well as the time the US sought to inflict a given effect.
- Much of Iran's technology base would still survive; the same would be true of many equipment items, even in facilities hit with strikes. Some impact, if any, on pool of scientists and experts.
- Iranian response in terms of proliferation could vary sharply and unpredictably: Deter and delay vs. mobilize and provoke.
- Such a series of strikes might be enough of a deterrent to change Iranian behavior, particularly if coupled to the threat of follow on strikes in the future. It still, however, could as easily produce only a cosmetic Iranian change in behavior at best. Iran might still disperse its program even more, and shift to multiple, small, deep underground facilities.
- Might well provoke Iran to implement (more) active biological warfare program.
- An oil embargo might be serious.

- Iranian government could probably not prevent some elements in Iranian forces and intelligence from seeking to use Iraq, Afghanistan, support of terrorism, and Hezbollah to hit back at the US and its allies if it tried; it probably would not try.
- International reaction would be a serious problem, and far greater than strikes that could be clearly associated with Iran's efforts to proliferate.

Figure III.80: Delay and Then Strike

- The US could execute any of the above options, and wait until after Iran provided proof was proliferating. Such a "smoking gun" would create a much higher chance of allied support, and international tolerance or consensus.
- Iran will have committed major resources, and created much higher value targets.
- The counter-risk is an unanticipated Iranian break out; some form of Iranian launch on warning (LOW), launch under attack (LUA), or survivable "ride out" capability.
- Iranian dispersal and sheltering may be much better.
- Iran might have biological weapons as a counter.
- Allied and regional reactions would be uncertain. Time tends to breed tolerance of proliferation.

Figure III.81: Ride Out Iranian Proliferation

- Announce or quietly demonstrate US nuclear targeting of Iran's military and CBRN facilities and cities.
- Tacitly signal US "green light" for Israeli nuclear retaliation or preemption.
- Deploy anti-ballistic and cruise missile defenses, and sell to Gulf and neighboring states.
- Signal US conventional option to cripple Iran by destroying its power generation, gas, and refinery facilities.
- Provide US guarantees of extended deterrence to Gulf states.
- Tacitly accept Saudi acquisition of nuclear weapons.
- Maintain preventive/preemptive option at constant combat readiness. Act without warning.
- Encourage Israel to openly declare its strike options as a deterrent.
- Announce doctrine that any Iranian use of biological weapons will lead to nuclear retaliation against Iran.

The Impact of Israeli-Iranian Nuclear Arms Race

While Iran does not yet possess a nuclear weapon, it already possess aircraft and missiles with the range to target Israel, and Israel has nuclear armed missiles that can reach any target in Iran. This creates a de facto nuclear arms race in the Middle East, and creates an even stronger incentive for Israel to try to suppress Iran's nuclear program and missile capabilities than exists for the US and Arab Gulf states.

Despite Israel's advantage in weapons technology, one nuclear detonation on Israeli territory could prove to be an "existential" threat to Israel given its size, dependence on Tel Aviv and Haifa, and the impact of such a strike on Israel's political cohesion and Israeli emigration after such a strike

It must be noted, however, that Iran will be limited to relatively low yield, non-boosted fission weapons for some years into the future while Israel already has high yield boosted and thermonuclear weapons. The greater metropolitan area of Tehran is home to some 15 million people, which constitute 20% of Iran's population. Furthermore, 45% of large Iranian industrial firms are located in Tehran, as is 50% of all Iranian industry. As such, an Israeli nuclear strike on Tehran would have disastrous consequences for the Iranian state and Israel could target every major Iranian city.

In actual practice, Israel can already deliver an "existential" strike on Iran, and will have far more capability to damage Iran than Iran is likely to have against Israel for the next decade. Moreover, Israel has steadily improving missile defenses, and the US has offered "extended deterrence" to Israel and the Arab states. This potentially could mean US retaliation for any Iranian nuclear attack on Israel or an Arab ally of the US.

Potential Israeli Options for Striking Against Iran's Nuclear Program

Israeli officials have never publically discussed options for striking against Iran. It does, however, have both the air and missile capability to execute a significant strike.

Illustrative Israeli options for such a strike include the following courses of action described in **Figure III.82** through **Figure III.84.**

- **Figure III.82** and **Figure III.83** present a picture of what an Israeli conventional strike using air power would like. Israeli aircraft could take any one of three routes (northern, central, or southern), all of which would involve traversing unfriendly air space to reach targets in Iran. The central route would involve flying through 1,500-1,700 kilometers through Jordan and Iraq, the southern route would involve flying 1,900-2,100 kilometers through Saudi Arabia, and the northern route would involve flying 2,600-2,800 kilometers in a loop through Turkey.

- **Figure III.84** shows what a low yield Israeli nuclear strike on Iran's nuclear facilities would look like. Israel would use either ballistic missiles or nuclear-armed strike aircraft to carry out such a mission.

An Israeli conventional strike on Iran's nuclear facilities would have an uncertain probability of lasting success for several reasons. Given the unfriendly airspace Israeli strike aircraft would have to traverse to reach Iran's facilities as well as Israel's geographic distance from Iran, the likelihood of Israel being able to carry out repeated strikes is low. Israeli strike aircraft would only have one opportunity to strike at Iran's nuclear facilities. Moreover, Iran's nuclear facilities

are dispersed and fortified, and a single Israeli strike would probably only temporarily impede Iran's nuclear progress.

If Israel used conventional air and missile power to strike at Iran's nuclear program, Iran would also be able to respond in the following ways:

- Withdraw from the NPT and increase its long-term resolve to develop a nuclear deterrent program.
- Immediate retaliation using its ballistic missiles on Israel. Multiple launches of Shahab-3 including the possibility of CBR warheads against Tel Aviv, Israeli military and civilian centers, and Israeli suspected nuclear weapons sites.
- Use proxy groups such as Hezbollah or Hamas to attack Israel proper with suicide bombings, covert CBR attacks, and rocket attacks from southern Lebanon.
- Launch asymmetric attacks against American interests and allies in the Arabian Gulf.
- Target US and Western shipping in the Gulf, and possibly attempt to interrupt the flow of oil through the Strait of Hormuz.

Even if Israel had the attack capabilities needed for the destruction of the all elements of the Iranian nuclear program, it is doubtful whether Israel has the kind of intelligence needed to be certain that all the necessary elements of the program were traced and destroyed fully. Israel has good photographic coverage of Iran with the Ofeq series of reconnaissance satellites, but being so distant from Iran, one can assume that other kinds of intelligence coverage are rather partial and weak.

In a conventional strike, Israel could launch and refuel two-three full squadrons of 36 to 54 combat aircraft for a single set of strikes with refueling. It could use either its best F-15s (28 F-15C/D, 25 F- 15I Ra'am or part of its 126 F-16 CDs and 23 F-16I Sufas. It has at least three specially configured squadrons with conformal fuel tanks specially designed for extended range use. It could add fighter escorts, but refueling and increased warning and detection would be major problems.

For the purposes of guessing at how Israeli might attack, its primary aircraft would probably be the F-15I, although again this is guesswork. Global Security has excellent reporting on the F15I.

> The key aspects are that Boeing's (formerly McDonnell Douglas) F-15E Strike Eagle entered service with the IDF/Heyl Ha'Avir (Israeli Air Force) in January of 1998 and was designated the F-15I Ra'am (Thunder). The F-15E Strike Eagle is the ground attack variant of the F-15 air superiority fighter, capable of attacking targets day or night, and in all weather conditions.
>
> The two-seat F-15I, known as the Thunder in Israel, incorporates new and unique weapons, avionics, electronic warfare, and communications capabilities that make it one of the most advanced F-15s. Israel finalized its decision to purchase 25 F-15Is in November 1995. The F-15I, like the US Air Force's F-15E Strike Eagle, is a dual-role fighter that combines long-range interdiction with the Eagle's air superiority capabilities. All aircraft are to be configured with either the F100-PW-229 or F110-GE-129 engines

> by direct commercial sale; Night Vision Goggle compatible cockpits; an Elbit display and sight helmet (DASH) system; conformal fuel tanks; and the capability to employ the AIM-120, AIM-7, AIM-9, and a wide variety of air-to-surface munitions.
>
> Though externally the Ra'am looks similar to its USAF counterpart, there are some differences, mainly in the electronic countermeasures gear and the exhaust nozzles. The Ra'am has a counterbalance on the port vertical stabilizer instead of the AN/ALQ-128 EWWS (Electronic Warfare Warning System) antenna found on USAF Strike Eagles. The Ra'am uses two AN/ALQ- 135B band 3 antennas, one mounted vertically (starboard side) and one horizontally (port side). These are located on the end of the tail booms. They are distinguished by their chiseled ends, unlike the original AN/ALQ-135 antenna, which is round and located on the port tail boom of USAF Eagles.
>
> The Ra'am utilizes extra chaff/flare dispensers mounted in the bottom side of the tail booms. Unlike USAF Eagles, the Ra'am still use engine actuator covers (turkey feathers) on their afterburner cans. The US Air Force removed them because of cost and nozzle maintenance, though curiously, USAF F-16s still have their actuator covers installed. Israeli Strike Eagles and some USAF Eagles based in Europe use CFT air scoops. These scoops provide extra cooling to the engines.
>
> The 25 F-15Is operational since 1999 [and the 100 F-16Is] were procured first and foremost to deal with the Iranian threat. In August 2003 the Israeli Air Force demonstrated the strategic capability to strike far-off targets such as Iran [which is 1,300 kilometers away], by flying three F- 15 jets to Poland 1,600 nautical miles away. After they celebrated that country's air force's 85th birthday, on their return trip, the IAF warplanes staged a fly-past over the Auschwitz death camp.

Israeli aircraft would probably need to carry close to their maximum payloads to achieve the necessary level of damage against most targets suspected of WMD activity, although any given structure could be destroyed with 1-3 weapons. (This would include the main Bushehr reactor enclosure, but is real-world potential value to an Iranian nuclear program is limited compared to more dispersed and/or hardened targets). At least limited refueling would be required, and back-up refueling and recovery would be an issue.

They key weapon to be used against hard targets and underground sites like Natanz might be the GBU-28, although the US may have quietly given Israel much more sophisticated systems or Israel may have developed its own, including a nuclear armed variant.

The GBU-28 is carried by the F-15I. It is a "5,000 pound" laser guided bomb with a 4,400-pound earth-penetrating warhead that can be upgraded by the IAF to use electro- optical or GPS targeting. It is a vintage weapon dating back to the early 1990s, and the IAF is reported to have bought at least 100. It has been steadily upgraded since 1991 and the USAF ordered an improved version in 1996.

It looks like a long steel tube with rear fins and a forward guidance module. It can glide some 3-7 miles depending on the height of delivery. It is 153" long X 14.5" in diameter.

Multiple strikes on the dispersed buildings and entries in a number of facilities would be necessary to ensure adequate damage without restrikes – which may not be feasible for Israel given the limits to its sortie generation capability over even Iranian soft targets. As for hardened and underground targets, the IAF's mix of standoff precision-guided missiles – such as Harpoon or Popeye – would not have the required lethality with conventional warheads and Israel's use of even small nuclear warheads would cause obvious problems.

Israel may have specially designed or adapted weapons for such strikes, and bought 500 bunker-busters from the US in February 2005. Experts speculated whether the purchase was a power projection move or whether Israel was in fact planning to use these conventional bombs against Iranian nuclear sites. These speculations were further exacerbated when the Israeli Chief of Staff, Lt. General Dan Halutz, was asked how far Israel would go to stop Iran's nuclear program, he said "2,000 kilometers."

The hard target bombs it has acquired from the US are bunker-busters, however, are not systems designed to kill underground facilities. They could damage entrances but not the facilities. What is not known is whether Israel has its own ordnance or has secretly acquired more sophisticated systems.

Its main problem would be refueling – its 5 KC-130H and 5 B-707 tankers are slow and vulnerable and would need escorts – and its ordinary B-707 AE&W, ELINT and electronic warfare aircraft are also slow fliers, although the new G-550 Shaved ELINT aircraft is a fast flier and the IAF has some long-range UAV that could support its aircraft, before, during, and after such missions.

The big manned "slow fliers" would have serious problems penetrating and surviving in Iranian air space. Israel has, however, specially configured some of its F-15s and F-16s with targeting, EW, SAM-suppression aids, and ELINT for this kind of mission. The full details of such capabilities are unknown.

Repeated strikes would be a problem because Israel could probably get away with going through Jordan and then through Saudi Arabia/Gulf or Iraq once, but any repeated effort would be too politically dangerous for Arab governments to easily tolerate. Israel has also had problems with its intelligence satellites and its battle damage assessment and time-urgent retargeting capabilities for precision strikes with a target mix as complex as Iran's could be a major problem.

Much would depend on just how advanced Israel's long-range UAV capabilities really are and whether Israel could get access to US intelligence and IS&R capabilities for both its initial targeting and restrikes, but confirming the actual nature of damage, carrying out restrikes, and sending a clear signal that Israel can repeat its strikes if Iran rebuilds or creates new facilities would be a problem.

The radars in the countries involved would probably detect all IAF and US missions relatively quickly, and very low-altitude penetration profiles would lead to serious range-payload problems. The countries overflown would be confronted with the need to either react or have limited credibility in claiming surprise. An over flight of Iraq would be seen in the region as having to have had a US "green light."

Iran would almost certainly see Jordanian, Turkish, and/or Saudi tolerance of such an IAF strike as a hostile act. It might well claim a US "green light" in any case in an effort to mobilize hostile Arab and Muslim (and possibly world) reactions.

Israel's second option, a low yield nuclear strike on Iran's nuclear facilities, would have a greater probability for success, but also generate severe diplomatic and military consequences for Israel. Hence, it seems unlikely that Israel would launch a preemptive or preventative nuclear strike on Iran's nuclear facilities until it is far clearer that Iran actually developed and began to deploy nuclear weapons. Israel's assessment of risks involved would then depend heavily on Iran's target base, its knowledge of Iran's nuclear and missile targets, and its assessment of Iran's willingness to use such weapons and Israel's deterrent and defensive capabilities.

Israel may be preparing for a strike on Iran's nuclear facilities. In early November of 2011, Israeli aircraft participated in a large exercise with Italy over Sardinia, over 2,300 km from Israel.[76] The exercises involved fighters jets, aerial refueling and airborne warning and control aircraft. Furthermore, Israeli pilots were able to fly against adversaries flying unfamiliar aircraft such as the Eurofighter.

While a simulation of an attack on Iran was not the stated purpose of the exercises, an IAF Lieutenant Colonel identified only as "Yiftah" stated that such exercises are important because flying over unfamiliar territory "prepares people for battle over unfamiliar ground."[77] Moreover, he stated that "we train for long-range flights and prepare ourselves for every type of terrain."[78]

A pilot of the Knights of the North squadron, identified only as "Major B.," stated that "we're practicing in a unknown place. The size of our flight field is larger than the entire State of Israel, allowing us to practice things we can't back home."[79] While somewhat vague and unspecific, such statements are indicative of the emphasis the training placed on mounting a long distance operation over large, unfamiliar terrain and airspace.

Although preparation for a strike on Iran was not the stated objective of the exercise, it could be considered as a test-run for the kind of operation Israel would mount to strike at Iran. Given the similar distances of both objectives and the dispersed nature of Iran's nuclear program, Israel would have to engage in the same kind of operational planning to carry out such a strike as it did in its exercises with the Italian Air Force.

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[76] Pfeffer, Anshel. "IDF Insists Preparedness Drills and Military Exercises are Not Tied to Iran Chatter." Haaretz. November 3, 2011. http://www.haaretz.com/print-edition/news/idf-insists-preparedness-drills-and-military-exercises-are-not-tied-to-iran-chatter-1.393384

[77] Pfeffer, Anshel. "IDF Insists Preparedness Drills and Military Exercises are Not Tied to Iran Chatter." Haaretz. November 3, 2011. http://www.haaretz.com/print-edition/news/idf-insists-preparedness-drills-and-military-exercises-are-not-tied-to-iran-chatter-1.393384

[78] Pfeffer, Anshel. "IDF Insists Preparedness Drills and Military Exercises are Not Tied to Iran Chatter." Haaretz. November 3, 2011. http://www.haaretz.com/print-edition/news/idf-insists-preparedness-drills-and-military-exercises-are-not-tied-to-iran-chatter-1.393384

[79] idfspokesperson.com. "The Israeli and Italian Airforces Train Together in Joint Exercise in Sardinia." November 3, 2011. http://idfspokesperson.com/2011/11/03/the-israeli-and-italian-airforces-train-together-in-joint-exercise-in-sardinia/

The Ongoing Policy Debate Within Israel Regarding a Preemptive Strike on Iran

There have been many reports that Israel is planning a preventive or preemptive strike on Iran. These reports resurfaced in November 2011 in the form of media reports of a policy debate within Israel's leadership and intelligence community regarding a possible strike on Iran's nuclear program. While Israeli officials have generally been cautious in doing more than stating that a military option exists, public and leaked statements emanating from key individuals within the Israeli government indicated that Israel was now actively taking such a strike into consideration.

- *"It's clear to all that a nuclear Iran is a grave danger and the whole world, led by the United States, must make constant efforts to stop Iran from obtaining nuclear weapons. The Iranians already have more than four tons of 3-4 percent enriched uranium and 70 kgs. of 20 percent enriched uranium. It's clear to us they are continuing to make missiles. Iran's nuclearization is not only a threat to Israel but to several other Western states, and the international interest must unite here."* – Israeli Minister of Intelligence and Atomic Energy, Dan Meridor

- *"This is a complicated time and it's better not to talk about how complicated it is. This possible action is keeping me awake at night. Imagine we're [attacked] from the north, south and center. They have short-range and long-range missiles - we believe they have about 100,000 rockets and missiles."* – Israeli Interior Minister, Eli Yishai

- *"One of those regional powers is Iran, which is continuing its efforts to obtain nuclear weapons. A nuclear Iran would constitute a grave threat to the Middle East and the entire world, and of course it is a direct and grave threat on us."* – Israeli Prime Minister, Benjamin Netanyahu

- *"I don't think that that is a subject for public discussion. But I can tell you that the IAEA report is, has a sobering impact on many in the world leaders, as well as the publics, and people understand that the time has come. Amano told straightly what he found, unlike Baradei, and it became a major issue that I think duly so, becomes a major issue for sanctions, for intensive diplomacy, with urgency. People understand now that Iran is determined to reach nuclear weapons. No other possible or conceivable explanation for what they have been actually doing. And that should be stopped."* – Israeli Minister of Defense, Ehud Barak

- *"As long as no such sanctions have been imposed and proven effective, we continue to recommend to our friends in the world and to ourselves, not to take any option off the table.*

  This outlandish depiction (by the media) of two people, the prime minister and the defense minister, sitting in a closed room and leading the entire country into an adventurist operation is baseless and divorced from reality.

  We haven't decided yet to embark on any operation… We don't want war.

  I tell you there won't be 100,000 casualties, and not 10,000 casualties and not 1,000 casualties… And Israel won't be destroyed." – Israeli Minister of Defense, Ehud Barak

- *"The possibility of a military strike on Iran is more likely to be realized than the diplomatic option.*

I do not think there has already been a decision on the matter, but it appears that Iran is getting closer to obtaining nuclear weapons." – Israeli President, Shimon Peres

- *"I think that one has to use diplomatic pressure and sanctions on Iran.*

  I refuse to be intimidated, as if Iran could destroy Israel.

  Israel is the most powerful country, from Tripoli to Tehran. There is no reason to be afraid of anything." – Israeli Minister of Defense, Ehud Barak

- *"A situation could be created in the Middle East in which Israel must defend its vital interests in an independent fashion, without necessarily having to reply on other forces, regional or otherwise."* – Israeli Minister of Defense, Ehud Barak

- *"The more Iran believes that all options are on the table, the less the chance of confrontation."* – Israeli Prime Minister, Benjamin Netanyahu

- *"The war won't be against Iran, but will be a regional war. I recommend that the prime minister not decide to attack... I will express my opinion anyway. I am not prepared for it to be on my conscience that there will be a repeat of what happened in 1973."* – Former Head of the Mossad, Meir Dagan

As such statements reflect, there is no unified message emanating from the Israeli leadership regarding an Israeli preemptive attack, and it is clear that those involved in the debate are divided regarding the effectiveness and potential ramifications of such a strike. It is clear, however, that Israeli officials take Iran's nuclear program seriously, and that an Israeli attempt to strike at Iran's program has been seriously contemplated.

Individuals such as Israel's Prime Minister, Benjamin Netanyahu, Minister of Defense, Ehud Barak, and President, Shimon Peres, have alluded to the possibility or likelihood of a preemptive attack on Iran's nuclear facilities.

On October 31, 2011, Ehud Barak alluded to what seems to be a potential unilateral Israeli attack, stating,

> "A situation could be created in the Middle East in which Israel must defend its vital interests in an independent fashion, without necessarily having to reply on other forces, regional or otherwise."[80]

In a November 8, 2011 interview, Barak also stated that,

> "I tell you there won't be 100,000 casualties, and not 10,000 casualties and not 1,000 casualties, and Israel won't be destroyed."[81]

Lastly, on November 2, 2011, Benjamin Netanyahu elucidated his perception of the Iranian nuclear threat, stating,

> "One of those regional powers is Iran, which is continuing its efforts to obtain nuclear weapons. A nuclear Iran would constitute a grave threat to the Middle East and the entire world, and of course it is a direct and grave threat on us."[82]

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[80] "Benjamin Netanyahu Pushes For Pre-Emptive Strike On Iran, According To Reports." Huffington Post. November2, 2011. http://www.huffingtonpost.com/mobileweb/2011/11/02/benjamin-netanyahu-iran-strike_n_1072136.html

[81] Teibel, Amy. "Israeli Minister Warns Iran Strike is Possible." Associated Press. November 8, 2011. http://articles.boston.com/2011-11-08/news/30373971_1_nuclear-program-israeli-military-strike-iranian-program

These statements, while not indicative of any specific Israeli course of action, reflect that the Israeli leadership has contemplated military action against Iran.

It is unclear, however, how sincere such hawkish statements are. In late May of 2011, Netanyahu stated that "the more Iran believes that all options are on the table, the less the chance of confrontation" in a speech to the US Congress. Once again, while vague and unspecific, such statements raise the likely possibility that at least some of Israel's sabre rattling regarding Iran's nuclear program is intended to serve as a deterrent rather than a harbinger of an Israeli strike.[83]

There are voices within Iran's security and policy establishments that, by contrast, do not view a preemptive Israeli attack on Iran's nuclear program favorably. In a speech in late May of 2011 at Tel Aviv University, Meir Dagan, the former head of the Mossad, made the following statement regarding a potential attack on Iran's nuclear facilities,

> "The war won't be against Iran, but will be a regional war. I recommend that the prime minister not decide to attack."[84]

Further referring to the possibility of such an attack, Dagan stated,

> "I will express my opinion anyway. I am not prepared for it to be on my conscience that there will be a repeat of what happened in 1973."[85]

Lastly, according to Israeli media reports, Dagan reportedly stated that such a strike was "the stupidest thing I have ever heard" in a public conference.[86] Such statements made by the former director of the Mossad cannot be taken lightly.

Meir Dagan is not the only individual who has expressed doubts about an Israeli strike on Iran's facilities. In early November of 2011, former Israeli Minister of Defense, Benjamin Ben-Eliezer, said he feared a "horror scenario" in which Netanyahu and Barak decide to attack Iran. He warned of a "rash act" and said he hoped "common sense will prevail."[87] Once again, statements made by Benjamin Ben-Eliezer, who, like Meir Dagan, held a top post in the Israeli defense

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[82] Ravid, Barak; Harel, Amos; Zrahiya, Zvi; Lis, Jonathan. "Netanyahu Trying to Persuade Cabinet to Support Attack on Iran." Ha'aretz. November 2, 2011. http://www.haaretz.com/print-edition/news/netanyahu-trying-to-persuade-cabinet-to-support-attack-on-iran-1.393214

[83] Ravid, Barak; Harel, Amos; Zrahiya, Zvi; Lis, Jonathan. "Netanyahu Trying to Persuade Cabinet to Support Attack on Iran." Ha'aretz. November 2, 2011. http://www.haaretz.com/print-edition/news/netanyahu-trying-to-persuade-cabinet-to-support-attack-on-iran-1.393214

[84] Ravid, Barak; Harel, Amos; Zrahiya, Zvi; Lis, Jonathan. "Netanyahu Trying to Persuade Cabinet to Support Attack on Iran." Ha'aretz. November 2, 2011. http://www.haaretz.com/print-edition/news/netanyahu-trying-to-persuade-cabinet-to-support-attack-on-iran-1.393214

[85] Ravid, Barak; Harel, Amos; Zrahiya, Zvi; Lis, Jonathan. "Netanyahu Trying to Persuade Cabinet to Support Attack on Iran." Ha'aretz. November 2, 2011. http://www.haaretz.com/print-edition/news/netanyahu-trying-to-persuade-cabinet-to-support-attack-on-iran-1.393214

[86] Buck, Tobias. "Ex-spymasters Oppose Iran Attack." Financial Times. November 11, 2011. http://www.ft.com/cms/s/0/fbbe0342-0c57-11e1-88c6-00144feabdc0.html#axzz1exldRNQb

[87] Buck, Tobias. "Ex-spymasters Oppose Iran Attack." Financial Times. November 11, 2011. http://www.ft.com/cms/s/0/fbbe0342-0c57-11e1-88c6-00144feabdc0.html#axzz1exldRNQb

community, must be taken seriously. While nebulous and ill-defined, they show that there is an unmistakable opposition to an Israeli strike on Iran within the Israeli defense community.

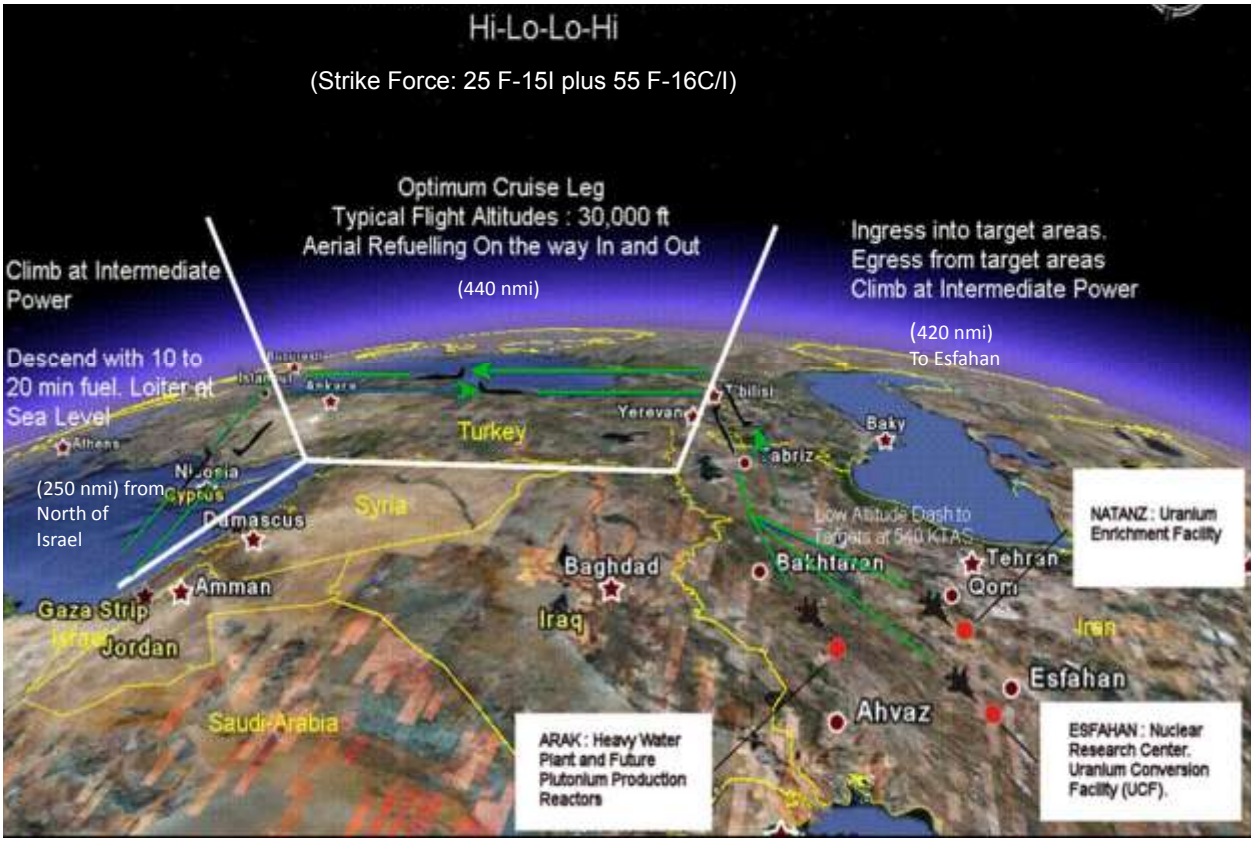
Speaking to the potential repercussions of such an attack, Israel's Interior Minister, Eli Yishai, stated the following in an October 31, 2011 speech to Shas activists in northern Israel,

> "This is a complicated time and it's better not to talk about how complicated it is. This possible action is keeping me awake at night. Imagine we're [attacked] from the north, south and center. They have short-range and long-range missiles - we believe they have about 100,000 rockets and missiles."[88]

These statements and others like them made by former and current Israeli officials represent elements within Israel's leadership that do not consider a strike on Iran's nuclear program realistic or worthwhile, and have definite reservations about the possibility of such an attack.

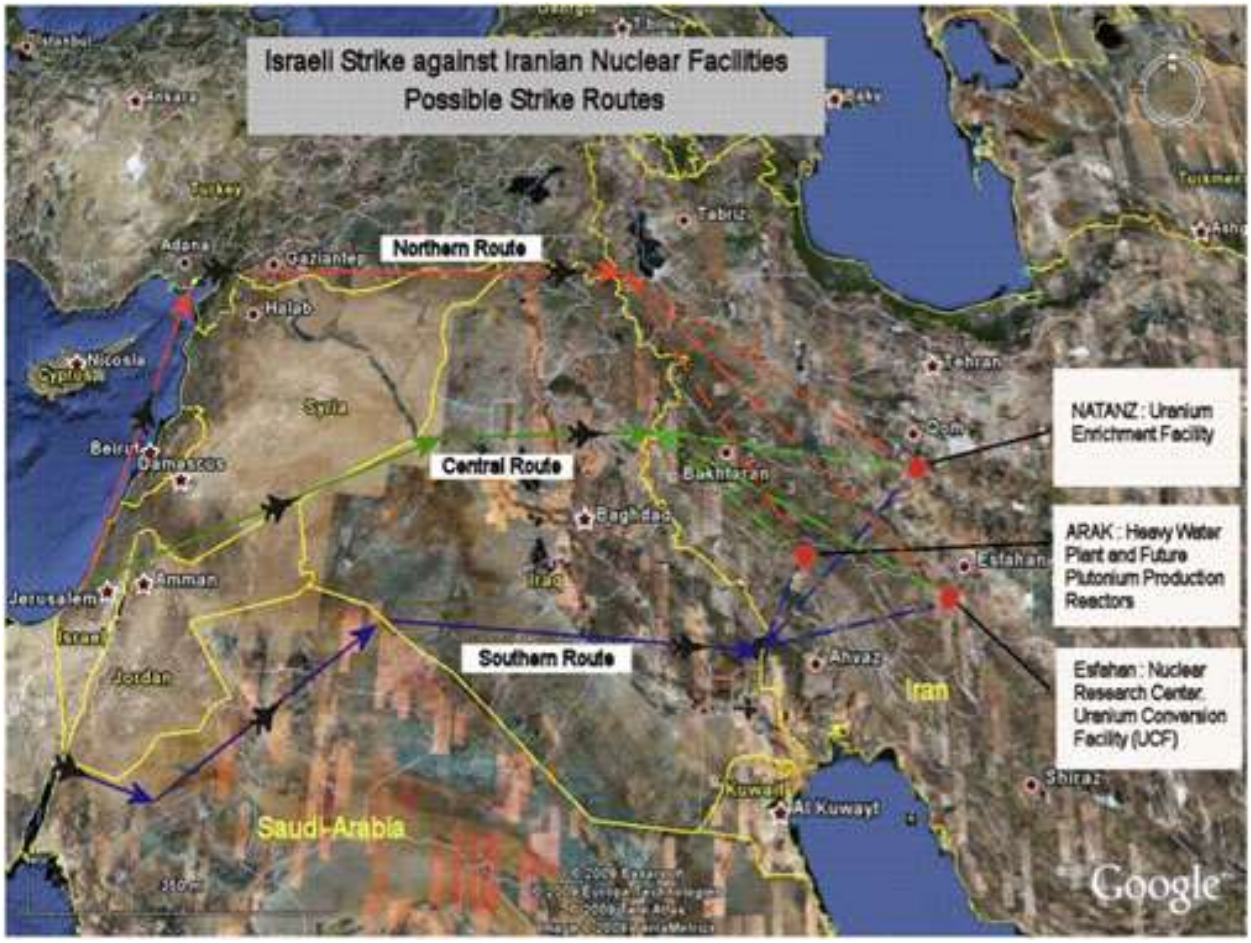
[88] Ravid, Barak; Harel, Amos; Zrahiya, Zvi; Lis, Jonathan. "Netanyahu Trying to Persuade Cabinet to Support Attack on Iran." Ha'aretz. November 2, 2011. http://www.haaretz.com/print-edition/news/netanyahu-trying-to-persuade-cabinet-to-support-attack-on-iran-1.393214

Figure III.82: Israeli Conventional Strike on Iran's Nuclear Facilities



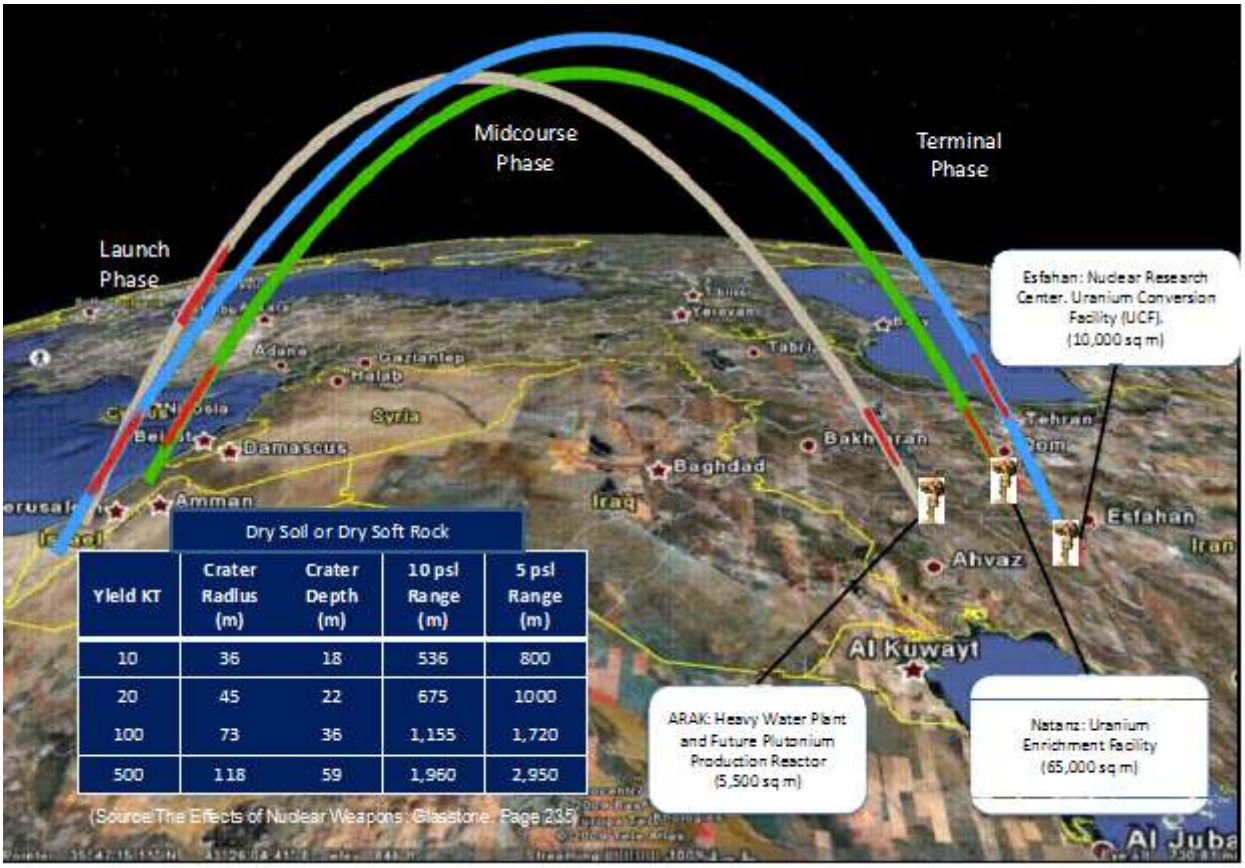
Source: Dr. Abdullah Toukan

Figure III.83: Probable Israeli Strike Route



Source: Dr. Abdullah Toukan

FigureIII.84: Low-Yield Israeli Nuclear Strike on Iran's Nuclear Facilities



Yield KT	Crater Radius (m)	Crater Depth (m)	10 psi Range (m)	5 psi Range (m)
10	36	18	536	800
20	45	22	675	1000
100	73	36	1,155	1,720
500	118	59	1,960	2,950

Source: Dr. Abdullah Toukan

The Critical Role of Energy in US-Iranian Military Competition

The chapters that follow put all various aspects of US and Iranian military competition into a broader political and economic context by country and sub-region. What is critical from the viewpoint of US strategic interest, however, is that all of these areas of competition impact on Iran's ability to use threats or attacks to limit or block the flow of energy exports and food and other critical imports into the Gulf also perceive this aspect of the Iranian threat largely in terms of their mutual dependence on the security and stability of Gulf petroleum, gas, and product exports.

This is sometimes disguised in the case of the US by politics and polices that search for ways to eliminate US dependence on energy imports. In practice, however, is a search that has gone on – without any meaningful strategic impact – since the Nixon Administration. The more recent efforts of the Bush and Obama Administrations have little near and mid-term prospect of having any more impact, and of reducing US strategic commitments to deterring and containing Iran and other threats to the Gulf region.

As **Figure III.85**, shows, estimates by the US Energy Information Agency indicate that the US will remain dependent on major energy imports through 2035 – the furthest period for which the EIA makes such estimates. Moreover, while US is not currently a major direct importer of Gulf oil, but it does have to pay world prices for oil and any reduction in global supply raises prices. Moreover, the US is deeply tied to a global economy dependent on the flow of Gulf energy exports to Europe and Asia and to manufactured imports that require such oil and gas exports.

Like wheat and other global commodities, the strategic importance of oil exports is not dependent on whether petroleum goes from one nation to another at any given time, but rather it is dependent on the global market and balance of supply and demand. While the volume of Gulf exports varies according to demand and the state of the global economy, the US Energy Information Agency estimated in January 2011 that the Strait of Hormuz, which is located between Oman and Iran, is the world's most important oil chokepoint. Some 15.5 to 17 million barrels a day have flowed through the Strait to world markets in recent years. This has been 33% to 40% of all seaborne traded oil, and some 17% of all oil traded worldwide, and these percentages ignore a substantial trade in liquid gas.

Saudi Arabia can export another 4.5 million barrels a day of crude and 2 million barrels a day of NGL and products through the Yanbu' terminal on the Red Sea. Iraq exports some 300,000 barrels per day through Turkey, and Iraq has one major crude oil export pipeline, the Kirkuk-Ceyhan (Iraq-Turkey) pipeline, which transports oil from the north of Iraq to the Turkish Mediterranean port of Ceyhan. This pipeline has been subject to repeated disruptions this decade, limiting exports from the northern fields. However, Iraq has signed an agreement with Turkey to extend the operation of the 1.6 million barrels per day pipeline, as well as to upgrade its capacity by 1 million barrels per day. This will add a total additional capacity of over 7 million barrels per day to the flow through the Strait of Hormuz.

The end result is that the politics of calling for "energy independence" have little – if any – impact on either US threat perceptions or plans for the defense of the Gulf. In practice, US national security planners accept the fact that the Gulf is and will remain is the location of a strategically vital share of the world's petroleum resources.

Figure III.86 shows that the importance of this aspect of US and Iranian military competition will increase indefinitely into the future. Both the US Energy Information Agency and International Energy Agency estimate there will be a steady increase in Gulf production capacity through 2030 – rising from some 25 million barrels a day of capacity in 2008 to some 35 million in 2035. The EIA report on the *International Energy Outlook* for 2010 estimates that Gulf oil production capacity will rise from 28 of the world total today to 31% in 2035 and do so in spite of major increases in production in other areas and in liquids from alternative fuels.

This gives the US and southern Gulf states every reason to focus on a competition with Iran for influence in Iraq, the need to build-up the security forces of the southern Gulf states, and the need to maintain a major US conventional naval and air presence in the Gulf and the ability to rapidly stage US Army and Marine forces. It also means that US concerns over Turkey center more in terms of Turkey's economic ties to Iran and Turkey's role in Iraq than over the Palestinian issue.

It also helps explain recent and planned US focus on major new arms sales to key southern Gulf states like Saudi Arabia and the UAE. It explains why US efforts to force a strategic partnership with Iraq are so important, and it explains why the US must now work with Bahrain, Kuwait, Oman, and Qatar to both improve their deterrent, defense, and internal security capabilities and reshape the US role in the Gulf when it withdraws from Iraq at the end of 2011.

Figure III.85: Estimated US Dependence on Petroleum Imports: 1990-2035

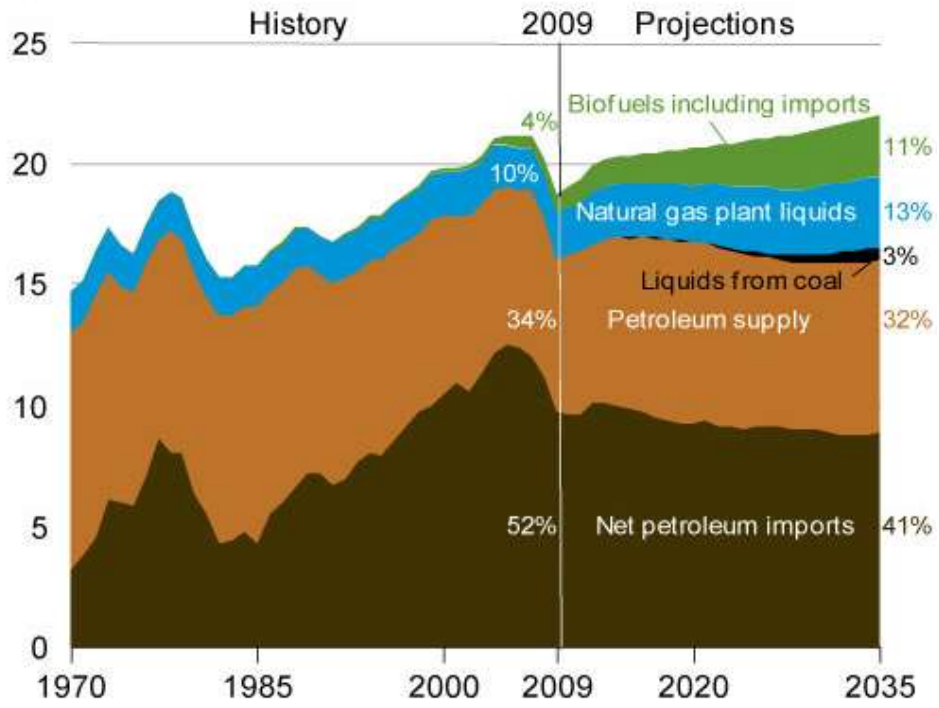
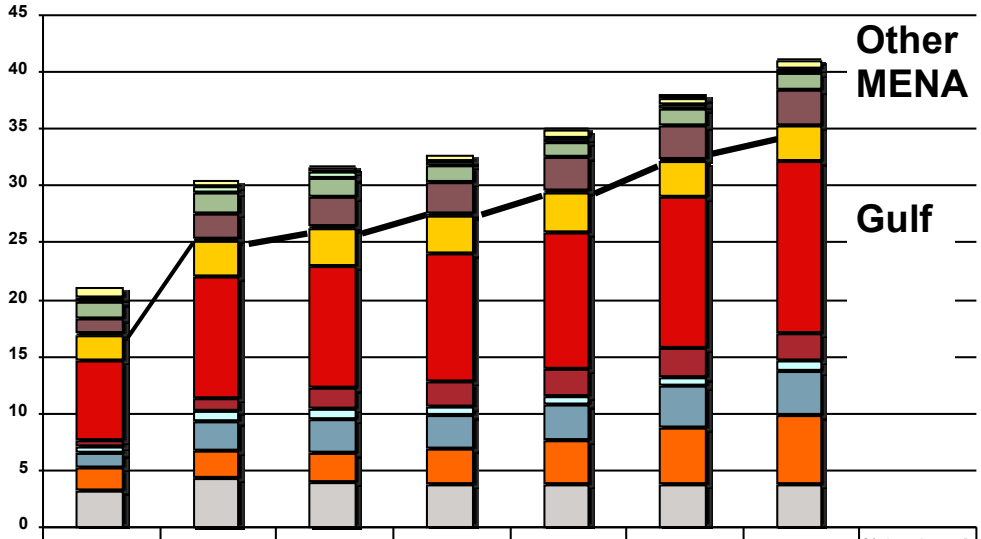


Figure III.86: Growing Strategic Importance of Gulf Petroleum production: 2008-2030



	1990	2008	2015	2020	2025	2030	2035	% Ave. Annual Change 07-35
Gulf Share of World	-	*28%	*28%	*29%	*29%	*30%	*31%*	-
Total World	-	*85.5	*88.7	*92.1	*97.6	*103.0	*110.5%	*1.0
Total MENA	-	*30.5	*31.6	*32.6	*35.0	*37.9	*41.0	
Other	-	0.1	0.1	0.1	0.2	0.2	0.2	*4.0
Egypt	0.9	0.6	0.5	0.6	0.7	0.7	0.7	*0.1
Syria	0.4	0.4	0.4	0.3	0.3	0.3	0.3	*-1.8
Libya	1.4	1.9	1.7	1.4	1.4	1.5	1.6	*-0.5
Algeria	1.3	2.2	2.6	2.8	2.9	3	3	*1.2
Yemen	0.2	0.3	0.2	0.2	0.2	0.1	0.1	*-2.9
Total Gulf	-	*25.0	*26.1	*27.2	*29.3	*32.1	*35.1	*1.4
UAE	2.3	3	3.4	3.4	3.4	3.2	3.1	*0.2
Saudi	7	10.7	10.7	11.2	12.1	13.3	15.1	*1.4
Qatar	0.4	1.2	1.8	2.1	2.3	2.5	2.5	*2.8
Oman	0.7	0.8	0.9	0.8	0.8	0.8	0.8	*0.2
Kuwait	1.2	2.7	2.9	3	3.2	3.6	3.9	*1.4
Iraq	2.1	2.4	2.6	3.1	3.9	5.1	6.1	*3.9
Iran	3.1	4.2	3.9	3.7	3.6	3.6	3.7	*1.4

Source: Adapted from EIA, *World Energy Outlook*, 2010, p. 225 and *World Energy Outlook*, 2010, p. 260

Implications for US Policy

Given the importance of the Gulf in global energy security, Iran's goals of becoming a regional power, and socio-political instability in the Middle East, military competition between the US and Iran will likely continue to intensify. Despite US conventional superiority, Iran's asymmetric strategy presents a unique challenge for US policy makers, as it hinges on bolstering and diversifying its unconventional, nuclear, and missile capabilities to undermine the US presence in the region. To compete with Iran most effectively, US decision-makers must carefully assess and address Iran's asymmetric strategy, as well as its perception of military competition.

While many of Iran's unconventional assets remain unproven in conflict, as is their capability against US forces, Iran has gone to great lengths to expand these capabilities to build up a deterrent as well as a means to expand its regional influence and reach. The US' conventional superiority currently gives it the upper hand in a protracted conflict. In a limited war of attrition, however, assets such as Iran's light fast attack craft, smart munitions, and submarines, among others, could inflict losses on US forces or those of US regional allies, damage critical infrastructure, and disrupt or halt Gulf commerce with little or no warning.

While these forces remain incapable of decisive victory, the deterrent they engender allows Iran to pursue a more aggressive regional foreign policy than it would otherwise. To successfully neutralize this threat, the US must continue to improve its mechanisms for detection and early warning, as well as maintain an effective doctrine to counter them. Moreover, the US must continue to equip, modernize, and train the forces of its regional allies to confront asymmetric threats.

Iran's array of regional proxies has proven to be an effective element of its asymmetric arsenal, although none are directly under Iran's command and control. These unconventional forces have enabled it to greatly influence the affairs of regional states with a degree of deniability. These assets have proven effective in undermining the internal stability and cohesion of US allies in the Middle East (most notably Lebanon and Iraq), and have, in the case of Hamas in the Gaza Strip, seized political power. Given the strategic importance of these states in the regional balance, the US can ill-afford to allow Iran to continue to cultivate and strengthen its proxies. As such, the US must continue to fund, support, and train its regional allies to counter Iran's proxies within their borders. Furthermore, the US must work to stem Iranian material and financial support to these groups.

While formidable, Iran's proxies and unconventional warfare assets do not present the same kind of challenge that Iran's nuclear and ballistic missile programs do. While Iran does not currently possess nuclear weapons, this reality may change in the near future, with massive ramifications for the US-Iranian military balance. Assuming a dispersed, mature Iranian nuclear force, Iran would likely leverage these forces against the US' conventional superiority, and pursue a more aggressive regional foreign policy. Consequently, Iran's nuclear program represents a key aspect of the country's asymmetric military strategy of confronting the US, and is of paramount importance when considering military competition between both states.

Although Iran's quest for a nuclear deterrent makes a preemptive attack on Iran's nuclear facilities attractive to some policy makers, such action would likely be a temporary solution at best. The maturity of Iran's program nearly guarantees that the country could rebuild its program. Moreover, a massive strike on Iran's nuclear infrastructure would likely provide the

Iranian regime with a justification to pursue nuclear weapons, and drive the program deeper underground. Hence, the only lasting solution to Iran's nuclear program would likely come in the form of a political solution, driven by compromise and a "carrot and stick" approach on behalf of the US and the international community. Such an approach would consist of offering Iran economic and other incentives to shelve its nuclear program, and penalizing it for continuing efforts at weaponization and refusing to comply with the IAEA.

The situation remains seemingly intractable, however, as negotiations between the US, Iran, and other states during the last decade have collapsed time and again due to the refusal of both sides to accept the basic demands of the other. Furthermore, the historical tension between both states, as well as Iran's foreign policy and military doctrine that are centered on neutralizing US conventional power in the region, make it unlikely that Iran would give up the deterrent that a nuclear force would engender. As such, the future of Iran's nuclear program remains murky, and it seems increasingly unlikely that it will comply with international demands.

As long as Iran's conventional forces remain weak in comparison to those of its neighbors, Iran will continue to develop its ballistic missile program as both a weapon of intimidation, and a means to deliver a nuclear warhead should Iran successfully miniaturize a nuclear device.

Given the current maximum range of Iran's ballistic missiles, US installations in the Gulf, US allies in the Middle East, and much of southeast Europe would be in range of an Iranian nuclear missile. Unlike Iran's other asymmetric assets, the US has the means to both reliably detect (using satellite surveillance and radar coverage) and destroy Iranian missiles in flight using the Aegis anti-ballistic missile cruisers and MIM-104 Patriot surface-to-air missile systems it has stationed in the region, and new systems like THAAD.

The missile defense radar system scheduled to be constructed in Turkey by the US will further add to its ability to detect and intercept Iranian missiles. The US is therefore in a better position to directly counter Iranian missile launches than Iran's aforementioned assets. As Iran's arsenal of missiles grows and becomes more dispersed, however, US countermeasures will be less equipped to effectively counter an Iranian missile barrage.

More broadly, Iran and the US will continue to compete militarily as long as the Strait of Hormuz remains strategically critical and Iran seeks to establish itself as a regional power. As Iran is constantly stepping up its efforts to challenge and undermine the US' presence in the Middle East asymmetrically, the US cannot afford to be lax or dismissive in confronting Iran's strategy. To effectively engage Iran, the US must put Iran's perceptions of military competition, as well as its aforementioned conventional and asymmetric capabilities in careful perspective, and continue to develop the means to counter Iran's evolving assets throughout the region.