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Options in Dealing with Iran's Nuclear Program

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	Page
Summary & Conclusions	4
Overview of Iran's Energy Requirements	22
Iran's Nuclear Facilities	39
Estimated Timeline for Iran producing Nuclear Weapons	50
Iranian Threat Perception & Response U.S. Response to Iranian Threat Perceptions West Perceptions of Iranian Threat & Options in dealing with Iran	57
The Military Balance: Israel GCC Iran	62
Options: Diplomacy & Sanctions	92
Options: Active Defense and Deterrence	102
Option: Preemptive Military Strike	115
Israeli Strike Scenario I: Conventional Air Strike	127

	Page
Israeli Strike Scenario II: Low Yield Earth Penetrating Nuclear Weapons: Ballistic Missiles Sea Launched Cruise Missiles	139
GCC Strike	146
U.S. Strike	150
Iranian Response	156
Ballistic Missile Attack on Israeli Nuclear and Missile Facilities	162
Oil Facilities & Oil Transit Chokepoints	165
Terrorism & Weapons of Mass Destruction	174
Chemical Terrorism	179
Biological Terrorism	183
Radiological (“Dirty Bomb”) Terrorism	188
Appendix: Target Analysis of Iranian Nuclear Facilities and Mission Force Payload	198

Summary & Conclusion

- Iran is a member of the Organization of the Petroleum Exporting Countries (OPEC), and ranks among the world's top three holders of both proven oil and natural gas reserves. Iran is OPEC's second-largest producer and exporter after Saudi Arabia, and is the fourth-largest exporter of crude oil globally after Saudi Arabia, Russia, and Norway.
- As of January 2009, Iran has an estimated 136.2 billion barrels of proven oil reserves, or roughly 10 percent of the world's total proven petroleum.

Crude Oil Production:

- Iran is OPEC's second-largest producer after Saudi Arabia. For most of 2008, it is estimated that Iran's OPEC production was approximately 3.8 million bbl/d; OPEC-wide cuts in late 2008 have lowered its production quota to roughly 3.6 million bbl/d. Iran's current crude oil production capacity is estimated to be 3.9 million bbl/d.
- Iran's fields have a natural annual decline rate estimated at 8 percent onshore and 11 percent offshore, while current Iranian recovery rates are 20-25 percent. It is estimated that 400,000-700,000 bbl/d of crude production is lost annually due to declines in the mature oil fields.
- A 2007 National Academy of Sciences study reports that if decline rates are allowed to continue, Iran's exports, which in 2007 averaged 2.4 million bbl/d could decrease to zero by 2015. To offset natural decline rates, Iran's oil fields require structural upgrades including enhanced oil recovery (EOR) efforts such as natural gas injection.

Consumption

- Iran's oil consumption was approximately 1.7 million bbl/d in 2007. Iran has limited refinery capacity for the production of light fuels, and consequently imports much of its gasoline supply. Iranian domestic oil demand is mainly for gasoline and diesel. Tehran imports about 40 percent of its gasoline.

(Source: EIA Iran Country Analysis Brief)

Export Terminals

- Kharg Island, the site of the vast majority of Iran's exports, has a crude storage capacity of 20.2 million barrels of oil and a loading capacity of 5 million bbl/d, followed by Lavan Island with capacity to store 5 million barrels and loading capacity of 200,000 bbl/d. Other important terminals include Kish Island, Abadan, Bandar Mahshar, and Neka, which helps facilitate imports from the Caspian region.

Natural Gas

- In 2008, Iran's estimated proven natural gas reserves stand at 948 trillion cubic feet (Tcf), second only to Russia. Roughly two-thirds of Iranian natural gas reserves are located in non-associated fields, and have not been developed. Major natural gas fields include: South and North Pars, Tabnak, and Kangan-Nar. In 2007, Iran produced and consumed an estimated 3.9 Tcf of natural gas. Natural gas consumption is expected to grow around 7 percent annually for the next decade.

Electric Power

- The government also aims to increase power reserves to 26 percent, signifying that the number of new projects awarded is likely to increase in the coming years. Iran continues to develop its nuclear program to generate electricity.
- Its first nuclear power plant of 1,000 MW is to be built at Bushehr with Russian assistance and operations are planned to begin in 2010. Russia is also providing fuel under an agreement signed in early 2005. Iran plans to develop 7,000 MW of nuclear-generated electricity by 2020.

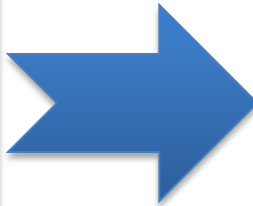
- The United States recognizes Iran as having sovereign right to peaceful civilian nuclear power, but does not have the right to Nuclear Weapons as stipulated in the Nuclear Non-Proliferation Treaty (NPT). To the United States, Iran is in violation of the IAEA safeguards, and the United Nations Security Council Resolutions. These are also becoming the findings of the International Community and Institutions, and not those of the United States alone.
- In a recent report, 18 February, 2010, the IAEA wrote “While the Agency continues to verify the non-diversion of declared nuclear material in Iran, Iran has not provided the necessary cooperation to permit the Agency to confirm that all nuclear material in Iran is in peaceful activities”. This statement has raised a lot of concern in the international community.
- After the declaration by Iran that a Facility near Qum was being built for the purpose of Uranium Enrichment, analysts concluded that if by the end of 2009 there existed another covert facility, such as the Fordow Facility, with 3,000 centrifuges (re-configured to produce HEU) each operating at 1.3 – 1.5 SWU/year, the time that Iran could have 3 fully operational nuclear weapons, that can even be carried on Ballistic Missiles, would be by 2014. The first could be sometime in 2010 or early 2011.
- Given the information available on nuclear weapons, and the enrichment process it is generally assumed that a simple implosion type nuclear weapon doesn’t need testing. The design is straightforward and has been tried by a number of countries to the extent that scientists and engineers can be confident that the weapon will work without undergoing multiple testing.
- The question is how many nuclear bombs would Iran require to establish itself as a nuclear state. It is generally assumed that three bombs would be required. The first would be for testing purposes, the second in case Iran enters into a nuclear war, would be for a “First Strike”, and the third would be for a “Second-Strike” or “Deterrent”.
- Because the activity to produce the required HEU material and the weaponization process can occur in parallel rather than in a sequence, then for 3 nuclear bombs it would take around three to four years for Iran to be considered a full Nuclear State, assuming further that it does not encounter any technical problems.

- With the public information and any Intelligence available it is very difficult to estimate the date when the political decision by the Iranian leadership was made, if one was made at all, to start a Nuclear Weapons program. We show that it will take 3 to 4 years for Iran to be a Nuclear State with three nuclear weapons. However, one nuclear weapon could also be considered as enough to be considered a “Nuclear Threshold State”.
- There does not exist any publicly available information if Iran has made an irreversible and definitive decision to acquire Nuclear Weapons no matter what the cost, or if it is still in the “option” stage. Nor do we know if Iran has become self-sufficient and is in the process of completing a network of clandestine facilities, to either move the enriched uranium around from one to the other until it can produce a nuclear weapon, or one facility that can undertake the total conversion to HEU independently.
- A possibility that has been talked about by Western analysts would be that Iran could produce 3.5% U-235 or 20% U-235, in these clandestine facilities, at the same time continue with a diplomatic engagement with the P5+1 until it feels the political conditions are just right giving it the option to “breakout” of the NPT, and move towards the production of nuclear weapons in a short period of time.
- Israel believes that the latest Iran will have a nuclear weapon capability is by 2013. That Iran should not be allowed to obtain any nuclear capabilities that could eventually allow it to produce nuclear weapons. In addition Israel views Iran as an existential threat and must be dealt with in the immediate future.
- U.S. believes this will be beyond 2013, and its approach is to leave all options on the table, mainly further sanctions in the form of Financial and Economic that will be crippling for Iran if it chooses to continue its pursuit of Nuclear Weapons.

Iranian Threat Perceptions

Iranian threat perceptions:

- Views itself as a Gulf power, its aim to keep the waters free from any foreign military presence.
- Prevent outside countries from shaping the political & security future of the Gulf.
- The occupation of Iraq by U.S. and presence of U.S. 5th fleet in the waters of the Gulf.
- Iran maintains that the U.S. is building bases in the Gulf as launching pads for a strike against it.
- Israel views Iran as an Existential Threat and must be dealt with in the immediate future.
- U.S. and Israel working to destabilize Iran and deny it a Nuclear Energy Program.
- Views itself as a regional power in the Muslim Middle East therefore has a say in any M.E. Peace Process.



Iranian actions dealing with its threat perceptions:

- Diplomatically active to convince GCC States that their security better ensured by signing mutual agreements with it, not US.
- Iran has been stressing that for longer term regional security & stability Iran and GCC states should replace the reliance on foreign military presence and intervention.
- The need to acquire nuclear weapons and long-range ballistic missiles as a deterrent, power projection and status.
- Accelerating a program to build a network of Uranium enrichment facilities in case any one of them is destroyed by a U.S. military strike.
- Develop short, medium and long range ballistic missiles to compensate for deficiencies in air power and as a deterrent.
- Building an Asymmetric Warfare capability. Political and Military support to Hezbollah and Hamas.

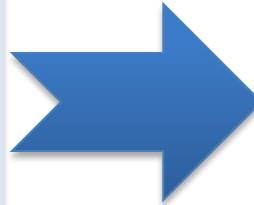
U.S. Response:

- As a response, the U.S. policy objective has been not to allow the Arabian Gulf region to be dominated by a hegemonic Iran. The United States believes that Iran cannot try to dominate the Gulf region as long as a U.S. military power is present
- By pursuing Nuclear Weapons the U.S. position is that this will:
 - not advance Iran's security;
 - not achieve its goal of enhance its power both regionally and globally;
 - spark an arms race in the region;
 - cause Iran to become more insecure;
 - Iran possessing nuclear weapons would be unacceptable to the U.S.;
 - Washington would arm allies in the region, and extend a "defense umbrella".
 - By extending assistance and a defense umbrella, Iran will not be able to intimidate and dominate its neighboring countries in particular the GCC, as Iran believes it can, once it possesses nuclear weapons.
- President Obama views Russia as an influential partner willing to help fight the proliferation of nuclear weapons mainly in Iran and North Korea. It has become clear that more collaboration between the US and Russia on nuclear non-proliferation could increase pressure on Iran, which has always taken advantage and benefitted from any disagreements between the two countries.
- It is believed that Russia and China could be key players in preventing Iran from having a nuclear weapons program. However, Russia seems to have a different perception of the threat and has not shown any interest so far in applying pressure on Iran.

West Perceptions of the Iranian Threat

Perceptions of Iranian threat:

- With occupation of Iraq, Iran now seeks to reemerge as the key power in Arabian Gulf and Muslim M.E. region.
- Nuclear Weapons program that poses as a serious threat to GCC and ME region in addition to the Short, Medium & Long Range Ballistic Missiles program capable of carrying WMD.
- Iran looks upon Nuclear Weapons and Ballistic Missiles as attractive alternatives to expensive modern conventional weapons for Power Projection and Deterrence purposes and as a means to increase status and prestige.
- Opposition to M.E. Process and its rising political influence there.
- Support for Int'l Terrorism; Hezbollah and Hamas as well as Train and Control Insurgency Groups.
- Threat to Stability of the Gulf States, has annexed the three Islands that dominate entrance to Straits of Hormuz. Considers itself Central to any Gulf Security Arrangements.
- Building Asymmetric Warfare capability.



Options to deal with Iran:

- Diplomacy & Dialog
- Incentives
- Containment
- Sanctions
- Regime Change
- Defense
- Deterrence
- Military Strike against Nuclear Facilities

Diplomacy & Sanctions

- Early in his administration, Obama had said he would give the Iranians until the end of 2009 to change their policy on nuclear weapons development. But the end of 2009 came, and the Iranians continued their policy. All along, Obama has focused on diplomacy on the Iran question.
- Some recommend that the U.S. should remain open to dialog and negotiations with Iran. However, It should be made clear to Iran, as the U.S. Secretary of State Hilary Clinton said, that the U.S. administration will work to impose a “crippling” sanctions on Iran “in the event that the offers presented are either rejected or the process is inconclusive or unsuccessful”.
- On 21 September 2009, Iran informed the IAEA that it had decided “to construct a new pilot fuel enrichment plant”, the Fordow Fuel Enrichment Plant (FFEP), located near the city of Qom. The Agency verified that FFEP is being built to contain sixteen cascades, with a total of approximately 3000 centrifuges.
- On Sept. 25, 2009, President Obama and leaders of Britain and France accused Iran of building a secret underground plant, known as “Fudrow” to manufacture nuclear fuel, saying the country has hidden the covert operation from international weapons inspectors for years.
- In talks with the United States and other major powers on Oct.1, the first such discussions in which the United States has participated fully, Iran agreed to open the newly revealed plant to international inspection within two weeks. Iran initially agreed in negotiations with the P5+1 (five permanent members of the UNSC plus Germany) to ship 70% (1,200 kg) declared Low Enriched Uranium (LEU) to Russia for further 20% enrichment and then to France for processing into fuel rods that can be used in the Medical Research Reactor facility in Tehran. In this way the deal reduces the LEU in Iran below the quantity needed which when enriched further could become weapons grade Highly Enriched Uranium (HEU).
- A month later, Iran stated that it would want the nuclear fuel to be delivered to Iran and its handing over of the LEU Stockpile to take place simultaneously in Iran. The P5+1 have been insisting that Iran transfer all of its LEU before any reactor fuel is shipped to Iran.

- Iran notified the UN nuclear watchdog of plans to produce 20% enriched uranium, saying it could not wait any longer to reach an agreement, based on its proposals, on exchanging its LEU uranium for 20% enriched uranium that will be used for its medical research reactor in Tehran.
- Iran's move to begin enriching uranium to 20% drew strong criticism from U.S. President Barack Obama, who reacted by stating that Washington and its allies would begin developing "significant" new sanctions against Iran. The move by Iran to enrich uranium up to 20% could very likely spur the UN Security Council to agree on tougher economic sanctions.
- Speaking in Italy, US Defense Secretary Robert Gates said:
"If the international community will stand together and bring pressure to bear on the Iranian government, I believe there is still time for sanctions and pressure to work," Mr. Gates said following meetings with his Italian counterpart. "But we must all work together."
- Speaking at a joint Riyadh news conference with Mrs. Clinton, Saudi Arabia's Foreign Minister Prince Saud said: "Sanctions are a long term solution. They may work, we can't judge. "But we see the issue in the shorter term maybe because we are closer to the threat... So we need an immediate resolution rather than a gradual resolution."
- According to a report by Spiegel Online, the European Union is preparing to impose stiff sanctions against Iran in the energy and financial sectors, where the regime is particularly vulnerable, and will have a serious impact on the Iranian economy. The most crippling sanction would be stopping Iran's gasoline imports, as Tehran imports about 40 percent of its gasoline. These go beyond the typical sanctions such as: trade embargo on military equipment and dual use technologies, nuclear products, travel bans on Iranian officials involved in the Nuclear program.

Military Strikes

Israeli Strike

- It is possible that Israel will carry out a strike against Iranian Nuclear Facilities, if the U.S. does not, with the objective of either destroying the program or delaying it for some years. The success of the Strike Mission will be measured by how much of the Enrichment program has it destroyed, or the number of years it has delayed Iranian acquisition of enough Uranium or Plutonium from the Arak reactor to build a nuclear bomb.
- We conclude that a military strike by Israel against Iranian Nuclear Facilities is possible and the optimum route would be along the Syrian-Turkish border then over a small portion of Iraq then into Iran, and back the same route. However, the number of aircraft required, refueling along the way and getting to the targets without being detected or intercepted would be complex and high risk and would lack any assurances that the overall mission will have a high success rate.
- The U.S. would certainly be perceived as being a part of the conspiracy and having assisted and given Israel the green light, whether it did or had no part in it whatsoever. This would undermine the U.S. objectives in increasing stability in the region and bringing about a peaceful solution to the Arab-Israeli conflict. It will also harm for a very long period of time relations between the U.S. and its close regional allies.
- Another scenario is in using Low Yield Earth Penetrating Nuclear Weapons as a substitute for conventional weapons to attack deeply buried nuclear facilities in Iran. Some believe that these are the only weapons that can destroy targets deep underground or in tunnels.
- The Israeli Sea Launched Cruise Missile (SLCM), Popeye Turbo, with a range of 1,500km launched from the German built Dolphin-class submarine, is capable of carrying these nuclear warheads. Israel is reported to possess a 200kg nuclear warhead containing 6 kg of weapons grade Plutonium that could be mounted on the Sea Launched Cruise Missiles and producing a Yield of 20KT.
- Very unlikely that any U.S. President would authorize the use of such nuclear weapons, or even allow any other country, even a strong ally such as Israel, to use them, unless another country had used nuclear weapons against the U.S. and its allies.

- It is doubtful that an Israeli strike on Iranian Nuclear Facilities would bring Syria into a direct conflict with Israel. Syria knows very well that alone its military forces are no match to Israel. However, proxy actors such as Hezbollah would engage Israel in anti-symmetric attacks, with Syrian and Iranian assistance.
- A strike by Israel on Iran will give rise to regional instability and conflict as well as terrorism. The regional security consequences will be catastrophic.

GCC Strike:

- GCC aircraft allocated for the strike mission would be: F-15S, F-16C and Mirage 2000, equipped with GBU-27A and GBU-28A bombs.
- Mission, can be operationally achieved with a much higher success rate than an Israeli strike, given the same aircraft and weapons. Shorter distances to cover giving the capability to keep up a sustained GCC attack over a couple of days.

However,

- GCC countries will not launch a strike on Iran, nor will they allow their territories to be used as a launching stage in any pre-emptive strikes against Iran. The GCC States military posture has always been a Defensive Posture.
- GCC has been calling for a peaceful resolution of the Nuclear weapons issue between the West and Iran in the form of Dialog and Negotiations. GCC states might approve of sanctions however, not to the “crippling” level that is being presently advocated and definitely not in a way that would affect the Iranian people, such as Financial, Gasoline and Economic.
- Even with a U.N. resolution to attack and destroy the Iranian facilities, the GCC countries will most probably not participate, but could give low profile support.

US Strike

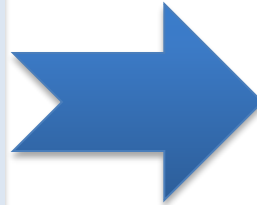
- B-2 bombers out of Diego Garcia, each carrying 2 GBU-57 MOP bombs.
- Mission can be achieved with a high success rate also maintaining a sustained strike over a couple of days.
- B-2 bombers escorted by F-18s from the 5th fleet stationed in the Gulf waters, or F-15Es and F-16Cs from forward area bases.
- United States and Western allies considered to be the only countries involved, no GCC or any Arab country involvement and especially no-Israeli direct involvement.
- Still though, Iran most probably will accuse Israel to be part of the Strike and will try to retaliate, either by launching a Ballistic Missile on Israel carrying conventional or WMD (chemical, biological, radiological) and activating Hezbollah to launch cross border attacks against Israel.
- Iran would also try to attack any U.S. military airbases that are active in the Gulf even if they are stationed in GCC countries.
- If Iran attacks any of the GCC countries, then they will have the right to self-defense. In addition the whole Arab Middle East will not accept an Iranian attack on any of the GCC countries.

	Deterrence	Active Defense	Pre-emptive Strike	Strategic Depth
GCC	Conventional against Iran or any other adversary.	TBM Defense Systems with the U.S. Has zero tolerance of Ballistic Missile leakage even if conventional.	Has capability but will NOT launch. Not part of military doctrine. Military Posture purely Defensive.	None. Only Saudi Arabia has the Strategic Depth. Other GCC states are frontline states. A very short time window in the defense against Ballistic Missiles
Israel	Nuclear & Conventional. Any adversary it considers as an existential threat,	TBM Defense Systems, Israeli Arrow system as well as U.S. systems.	Has the capability and YES will launch given the support and green light by the U.S. Pre-emptive strike part of Military Doctrine. Past experience, the Iraqi Osirak Nuclear Power Plant.	Yes, U.S. installed strategic long range X-band radar system, can detect incoming missiles from hundreds of miles away, thereby intercepting them as far as possible from Israeli borders.
US	Nuclear & Conventional	Yes and prepositioning some in the Middle East region.	Has the capability but must weigh the regional political and military consequences.	Yes. Has forward bases in the region as well a Naval Fleet from which it can launch.

Military Confrontation with Iran

What could accelerate a military confrontation with Iran:

- Discovery of further Iranian covert activities in establishing Uranium enrichment facilities for the purpose of building Nuclear Weapons.
- Iran to possess enough weapons grade HEU for a nuclear weapon that can serve as a deterrent against U.S. and Israeli strike.
- Having in its possession highly accurate short, medium and long range ballistic missiles, capable of carrying WMD weapons.
- A modern SAM air defense system, such as Russian S-300PMU2 "Favorit", giving Iran an advanced BMD capability as well.
- A Maritime capability that can start threatening commercial shipping and Naval Forces in the Gulf, and possibility of interrupting flow of oil through Straits of Hormuz.
- Train and control a number of Insurgency groups and terrorists, increasing threat of asymmetric attacks against US allies in the region.



Iran military response:

- Immediate retaliation using its Shehab III BMs on Israeli military, civilian and nuclear sites including the use of CBR warheads.
- Give rise to regional instability through conflict as well as terrorism.
- Destabilizing Iraq through the Shia against U.S. presence, and further arming insurgency groups when possible.
- Support and upgrade Taliban capabilities in Afghanistan.
- Increase threat of asymmetric attacks against American interests and allies in the region. Attack U.S. military bases that are active and stationed in the Gulf States
- Use proxy groups such as Hezbollah or Hamas to attack Israel proper with suicide bombings and rocket attacks.
- Target U.S. and Western shipping in the Gulf, and attempt to disrupt the flow of oil through Straits of Hormuz.
- Withdraw from NPT Treaty and start accelerated nuclear weapons program.

Conclusions:

- The study concludes that the U.S. is central to any Diplomatic solution in dealing with the Iranian Nuclear Program, and the only country that can launch a successful Military Solution, if all peaceful options have been exhausted and Iran has left no other means to convince it to stop or change its course in pursuing Nuclear Weapons, The U.S. should alone determine what the timeline could be if Iran does pursue the path to develop nuclear weapons.
- Any realistic resolution to the Iranian nuclear program will require an approach that encompasses Military, Economic, Political interests and differences of the West vs Iran. There will be no lasting resolution to the Iranian nuclear program until the broader interests of Iran, the US, the region and the world are addressed. Iran should be engaged directly by the U.S. with an agenda open to all areas of military and non-military issues that both are in agreement or disagreement.
- The U.S. should continue trying to make diplomacy and engagement the priority in dealing with the Iranian Nuclear Program, and will have to try to make Comprehensive Verification of Iran's Nuclear Development Program as one of the priorities in any diplomatic dialogue, while trying at the same time to persuade Iran to stop its enrichment program. However, in this area the U.S. will have to walk and negotiate along a very fine line between Israel's WMD and Ballistic Missiles capabilities and the Iranian Nuclear development program. The U.S. must recognize that both are very closely inter-related and are fueling each other. So the U.S. should be prepared to address both issues simultaneously while trying not to be perceived as though it has double standards when it comes to Israel.
- The Arab States, have become extremely frustrated with the U.S. and the West double standard when addressing the Proliferation of Weapons of Mass Destruction in the Middle East. Most probably they will not condone any attack on Iran under the pretext that Iran poses an existential threat to Israel and a security threat to the whole region, whilst Israel has some 200 to 300 nuclear weapons, and the delivery means using the Jericho missiles, in addition to Israel still occupying the West Bank and the Syrian Golan Heights.
- The Arab States position is that controlling Iran's Nuclear Program using all options available are necessary but not sufficient conditions to establish peace and security in the Middle East region. In fact, a solution to the Palestinian-Israeli conflict through a two state solution, and for a regional peace based on the Arab Peace Initiative are central and fundamental to establishing peace and security in the Middle East region.

U.S. Negotiations:

- In general to influence Iranian policy and promote a more positive nature of the regime. Move from a Confrontational to a Cooperative foreign policy.
- Military Posture to be more Defensive rather than Offensive.
- Open all facilities for IAEA inspection in particular the Uranium Enrichment Facilities.
- Stop arming Hezbollah and Hamas., and actually play a role in disarming Hezbollah.
- Destroy all Long Range Ballistic Missiles that are a threat to the Arab GCC countries and the region.
- Start Confidence & Security Building Measures with the Arabian Gulf States.
- Iran to find a peaceful solution in withdrawing from the three UAE islands in the Gulf waters that it occupied.
- Start a dialog with the M.E. region including Israel on the establishment of a WMDFZ and other forms of Arms Control.
- Support the Israeli-Syrian Peace Negotiations based on UNSCR 242 & 338.
- Join the Arab countries in supporting a peaceful solution to the Palestinian-Israeli negotiations and the two state solution.
- Support the US in Iraq, especially the Shia Groups and for them not to attack U.S personnel.
- Support the U.S. in Afghanistan by not supporting the Taliban or other Insurgency groups.
- Support the U.S. in the war against Terrorism and in particular Al-Qaida.

Iranian Negotiations:

- Guarantee and Security Assurances that Israel does not strike Iran.
- Put a stop to the Israeli threats to the survival of the Iranian regime.
- Disarming Israel from its Nuclear Weapons capability and its long range Ballistic Missiles.
- The Muslim Arab world to recognize the importance of Iran as a regional power and the key role it plays in the security and stability of the region, and to be treated as such.
- US and Europe to support the construction of Oil and Gas pipeline from the Caspian region through Iran into Afghanistan, Pakistan and India.
- The U.S. to arrange for a defense dialog with Pakistan and India (the two nuclear states neighboring Iran).
- Iran to play a role in the security and stability of Afghanistan. To ensure no emergence of opposition groups in Afghanistan.
- To have access to all developments of Science and Technology in the West.
- To rebuild its conventional armed forces.
- For the U.S. to help in structurally upgrading its oil fields, and guarantee a Nuclear Power program.

Overview of Iran's Energy Requirements

- Iran is a member of the Organization of the Petroleum Exporting Countries (OPEC), and ranks among the world's top three holders of both proven oil and natural gas reserves. Iran is OPEC's second-largest producer and exporter after Saudi Arabia, and is the fourth-largest exporter of crude oil globally after Saudi Arabia, Russia, and Norway.
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Crude Oil Production:

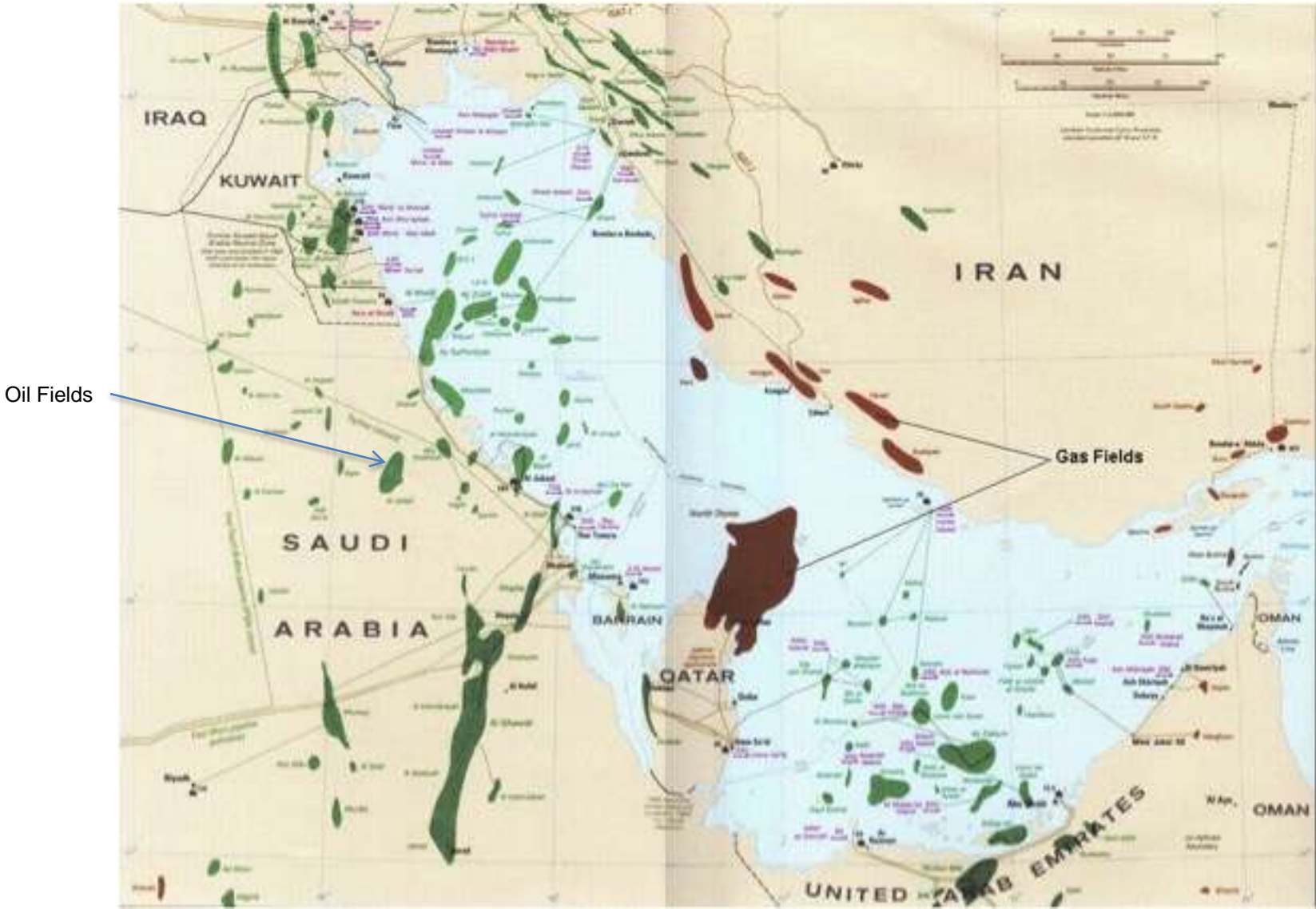
- Iran is OPEC's second-largest producer after Saudi Arabia. In 2007, Iran produced approximately 4.1 million barrels per day (bbl/d) of total liquids, of which roughly 3.8 million bbl/d was crude oil, equal to about 4.5 percent of global production.
- For most of 2008, it is estimated that Iran's OPEC production was approximately 3.8 million bbl/d; OPEC-wide cuts in late 2008 have lowered its production quota to roughly 3.6 million bbl/d. Iran's current crude oil production capacity is estimated to be 3.9 million bbl/d.
- Iran produced 6 million bbl/d of crude oil in 1974, but has been unable to produce at that level since the 1979 revolution due to a combination of war, limited investment, sanctions, and a high rate of natural decline in Iran's mature oil fields.
- Iran's fields have a natural annual decline rate estimated at 8 percent onshore and 11 percent offshore, while current Iranian recovery rates are 20-25 percent. It is estimated that 400,000-700,000 bbl/d of crude production is lost annually due to declines in the mature oil fields.
- A 2007 National Academy of Sciences study reports that if decline rates are allowed to continue, Iran's exports, which in 2007 averaged 2.4 million bbl/d could decrease to zero by 2015. To offset natural decline rates, Iran's oil fields require structural upgrades including enhanced oil recovery (EOR) efforts such as natural gas injection.

Consumption

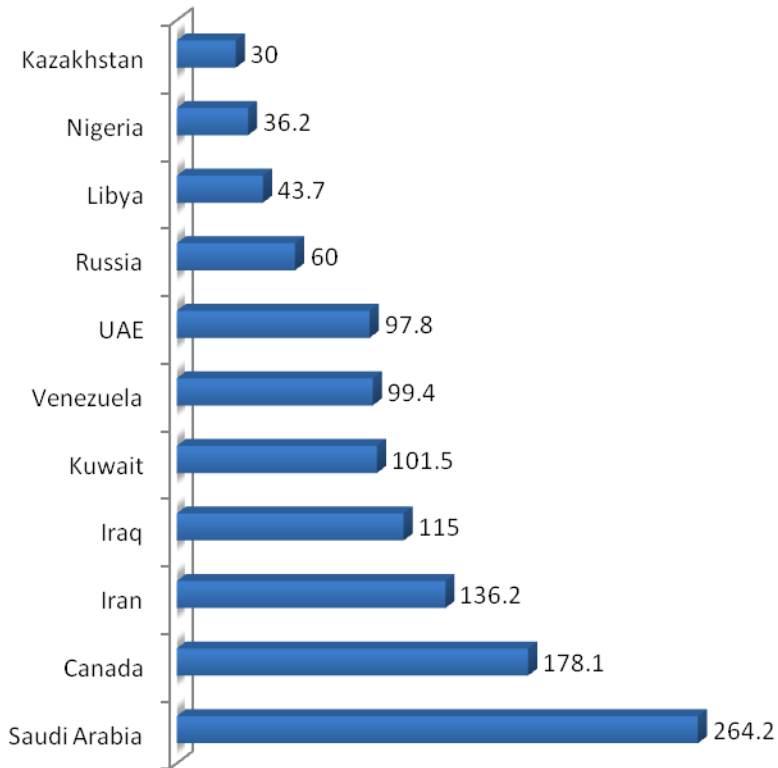
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(Source: EIA Iran Country Analysis Brief)

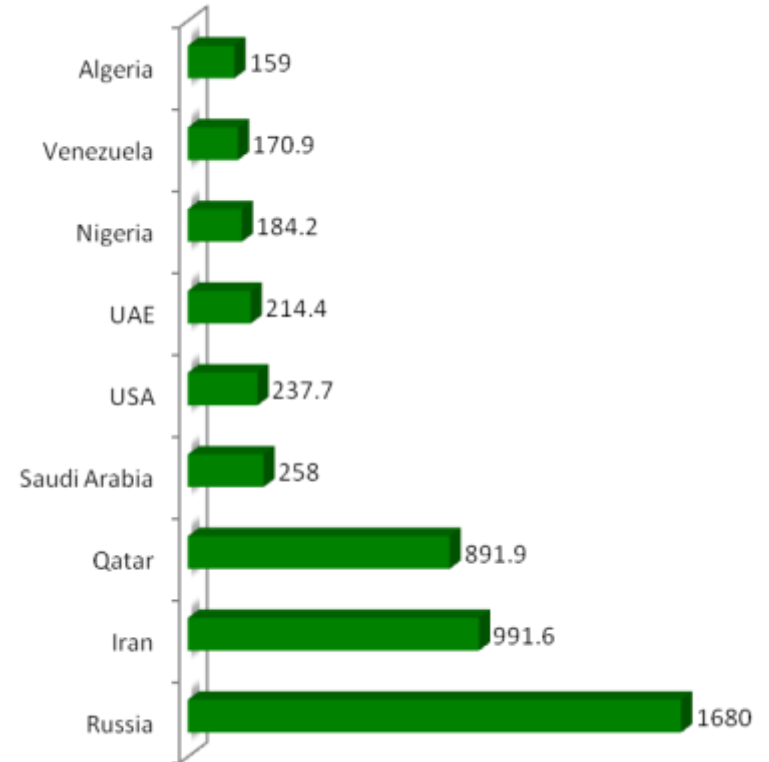
Oil and Gas Fields in the Gulf Region



Top Proven World Oil Reserves
January 1, 2009 (Billion Barrels)



World Natural Gas Reserves by Country
January 1, 2009 (Trillion Cubic Feet)



(Source: EIA Iran Country Analysis Brief)

Oil Production, Reserve and Flow (2008)

Suez Canal/Sumed Pipeline
Oil flow: 4.5 million bbl/d

Egypt
Oil Supply: 0.664mn bbl/d
Oil Reserve: 3.7 bn bbl

Israel
West Bank
Jordan
Oil Supply: 0.45mn bbl/d
Oil Reserve: 2.5 bn bbl

Syria
Iraq
Oil Supply: 2.37mn bbl/d
Oil Reserve: 115 bn bbl

Saudi Arabia
Oil Supply: 10.782mn bbl/d
Oil Reserve: 266.7 bn bbl

Iran
Oil Supply: 4.14mn bbl/d
Oil Reserve: 136.1 bn bbl

Kuwait
Oil Supply: 2.74mn bbl/d
Oil Reserve: 104 bn bbl

Bahrain
Oil Supply: 0.048mn bbl/d
Oil Reserve: 0.12 bn bbl

Qatar
Oil Supply: 1.21mn bbl/d
Oil Reserve: 15.2 bn bbl

UAE
Oil Supply: 3.04mn bbl/d
Oil Reserve: 97.8 bn bbl

Yemen
Oil Supply: 0.3mn bbl/d
Oil Reserve: 3.0 bn bbl

Oman
Oil Supply: 0.76mn bbl/d
Oil Reserve: 5.5 bn bbl

Strait of Hormuz
Oil flow: 16.5 million bbl/day which is roughly 40 percent of all seaborne traded oil (or 20 percent of oil traded worldwide)

Bab el-Mandab
Oil flow: 3.3 million bbl/d

(Source: www.eia.gov)

© 2010 Cnes/Spot Image
© 2010 Tele Atlas
© 2010 Europa Technologies
US Dept of State Geographer

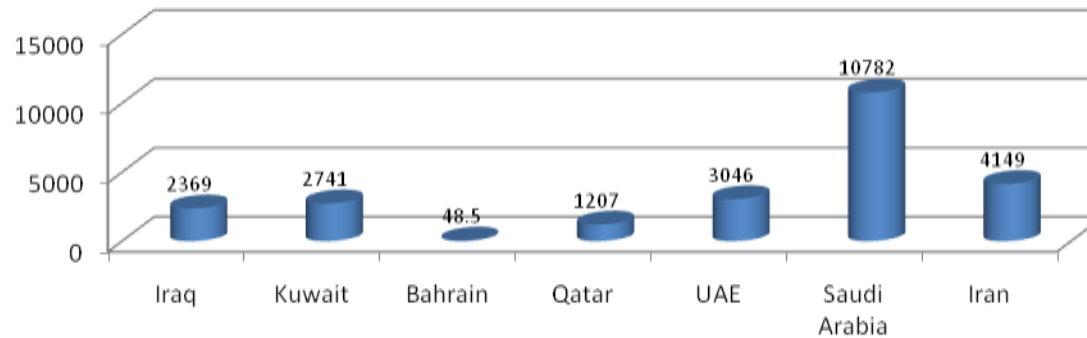
25°45'55.97" N 48°08'39.27" E elev 1262 ft

©2008 Google 26

Eye alt 1774.47 mi

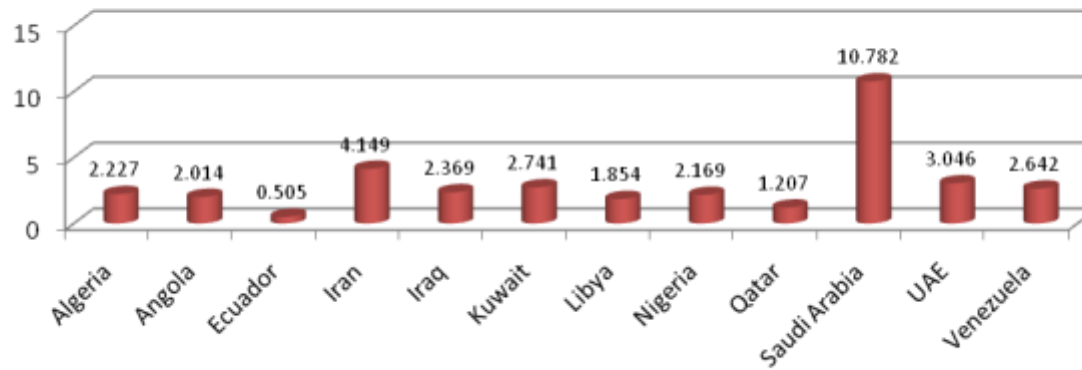
Gulf States

Total Oil Supply 2008
(Thousand Barrels Per Day)

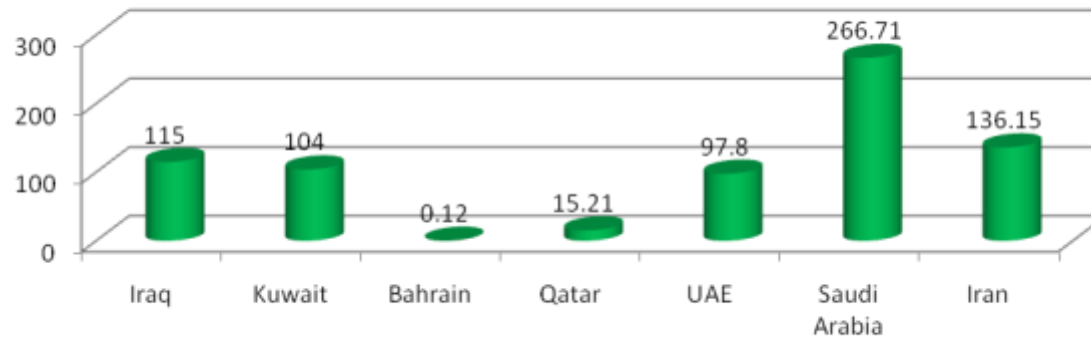


OPEC

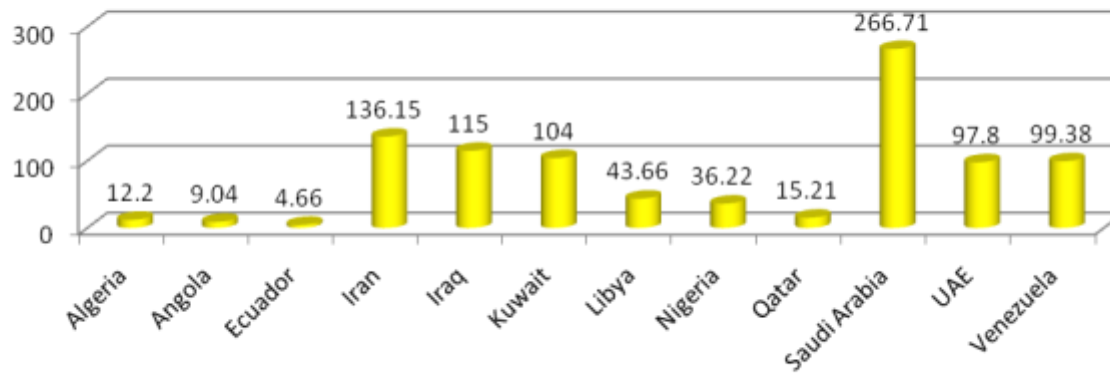
Total Oil Supply 2008
(Million Barrels Per Day)



Gulf States
Crude Oil Proved Reserves 2009
(Billion Barrels)

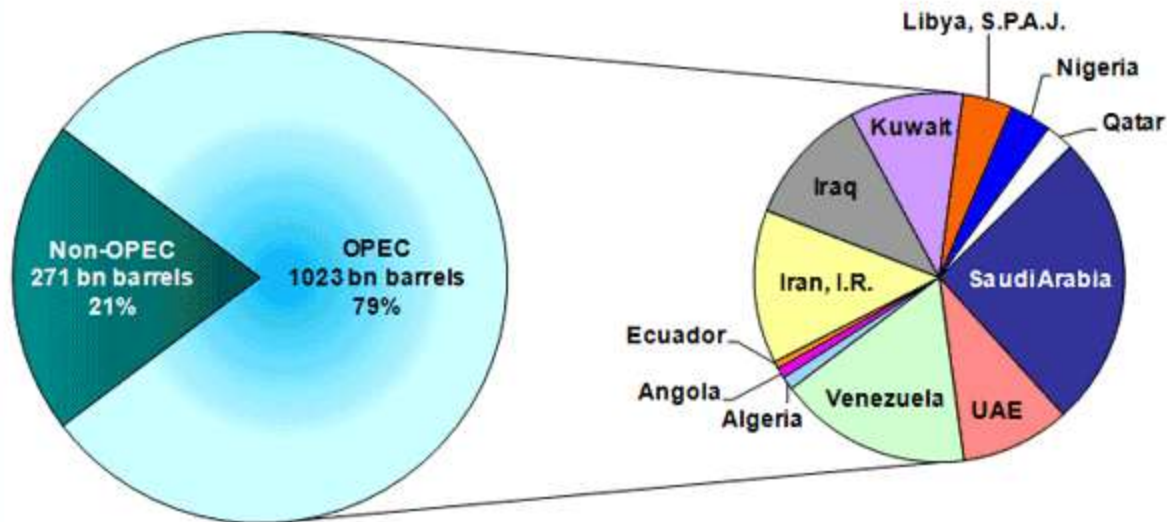


OPEC
Crude Oil Proved Reserves 2009
(Billion Barrels)



(Source: www.eia.doe.gov)

OPEC Share of World Crude Oil Reserves 2008

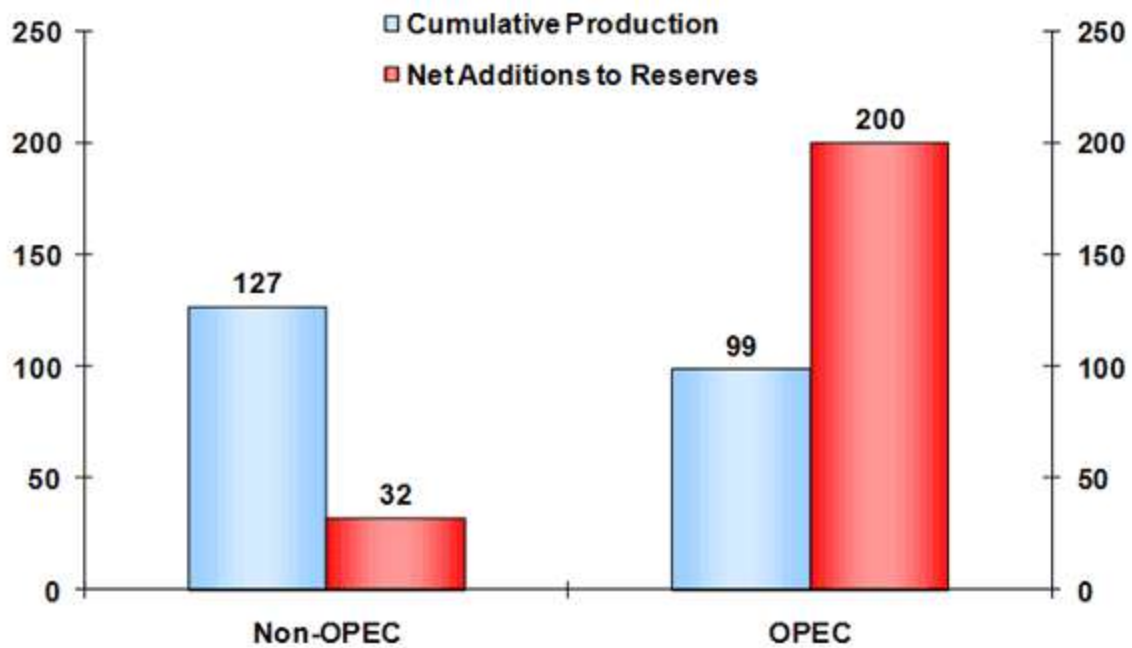


OPEC proven crude oil reserves , end 2008
(billion barrels)

Saudi Arabia	264	25.8%	Iraq	115	11.2%	Libya, S.P.A.J.	44	4.3%	Algeria	12	1.2%
Venezuela	172	16.8%	Kuwait	102	9.9%	Nigeria	37	3.6%	Angola	10	0.9%
Iran, I.R.	138	13.4%	UAE	98	9.6%	Qatar	25	2.5%	Ecuador	7	0.6%

Source: OPEC Annual Statistical Bulletin 2008

World crude oil reserves: Cumulative production versus net additions (2000-2008) (billion barrels)



Source: OPEC Annual Statistical Bulletin 2008

Gulf Oil and Gas as % of World

	World	Gulf	Gulf % of World	OPEC	OPEC % of World
Crude Oil Proved Oil Reserves (Billion Barrels)	1342	735	55%	940	70%
Total Oil Supply (Million Barrels per Day)	85.5	24.3	28%	35.7	42%
Proved Reserves of Natural Gas (Trillion Cubic Ft)	6,254	2,535	41%	3,110	50%

(Source: www.eia.doe.gov)

OPEC Flows of Crude and Refined Oil, 2007 (Thousands of Barrels per Day)

	Europe	North America	Asia and Pacific	Latin America	Africa	Middle East	Total World
Middle East							
<i>IR IRAN</i>	859	0	1,844	2	150	0	2,855
<i>IRAQ</i>	418	593	605	0	0	85	1,701
<i>KUWAIT</i>	346	134	1,828	0	44	0	2,351
<i>QATAR</i>	0	0	689	0	0	0	689
<i>SAUDI ARABIA</i>	938	1,597	4,682	87	321	477	8,101
<i>UNITED ARAB EMIRATES</i>	78	17	2,590	5	41	19	2,750
Africa							
<i>ALGERIA</i>	567	873	75	84	50	40	1,689
<i>ANGOLA</i>	334	743	81	0	27	0	1,185
<i>NIGERIA</i>	448	1,671	26	0	53	0	2,198
<i>SP LIBYAN AJ</i>	1,279	102	141	37	26	4	1,589
Asia/Far East							
<i>INDONESIA</i>	1	30	395	0	0	0	426
Latin America							
<i>ECUADOR</i>	1	214	13	154	0	0	382
<i>VENEZUELA</i>	271	1,378	199	871	18	0	2,738

(Source: <http://www.eia.doe.gov>)

Refining

- Iran's total refinery capacity in 2008 was about 1.5 million bbl/d, with its nine refineries operated by the National Iranian Oil Refining and Distribution Company (NIORDC), a NIOC subsidiary.
- Iranian refineries are unable to keep pace with domestic demand, but Iran plans to increase refining capacity to around 3 million bbl/d by 2012. This increase, through expansions at existing refineries as well as planned grass-root refinery construction, could eliminate the need for imports by 2012.

Gasoline

- In 2007, Iran consumed around 400,000 bbl/d of gasoline, roughly the same amount as 2006. Iran does not currently have sufficient refining capacity to meet its domestic gasoline and other light fuel needs. However, according to FACTS Global Energy, government targets for domestic gasoline refinery projects combined with the elimination of gasoline subsidies by the official goal of 2011 could make Iran a gasoline exporter by 2012. The International Energy Agency predicts 5.3 percent demand growth in 2009.

Gasoline Imports

- Iran spent approximately \$6 billion on gasoline imports in 2007. Under the rationing system, implemented in June 2007, Iran's gasoline imports declined from an estimated 204,000 bbl/d in May 2007, to an estimated average of 94,000 bbl/d for the remainder of 2007. Large, multinational wholesalers such as BP, Reliance, Total, Trafigura, and Vitol provided Iran with gasoline in 2007 and 2008.

Exports:

- Iran suffers from budget deficits due to a growing population and large government subsidies on gasoline and food products. For Iran's financial year 2007/2008, the International Monetary Fund (IMF) estimated that subsidies for crude oil and its derivatives cost Iran approximately 11 percent of its GDP.
- Iran has the largest oil tanker fleet in the Middle East. The National Iranian Tanker Company holds 29 ships, including Very Large Crude Carriers. There have been reports that Iran uses its oil tanker fleet to store oil when its export terminals are full.

Export Terminals

- Kharg Island, the site of the vast majority of Iran's exports, has a crude storage capacity of 20.2 million barrels of oil and a loading capacity of 5 million bbl/d, followed by Lavan Island with capacity to store 5 million barrels and loading capacity of 200,000 bbl/d.
- Other important terminals include Kish Island, Abadan, Bandar Mahshar, and Neka, which helps facilitate imports from the Caspian region. The Strait of Hormuz, on the southeastern coast of Iran, is an important route for oil exports from Iran and other Persian Gulf countries (see Persian Gulf Analysis Brief). At its narrowest point the Strait of Hormuz is 21 miles wide, yet an estimated 17 million barrels in the first half of 2008, or roughly 40% of all seaborne traded oil, flows through the Strait daily.

Pipelines

- Iran has an expansive domestic oil network including 5 pipelines, and multiple international pipeline projects under consideration. Iran has invested in its import capacity at the Caspian port to handle increased product shipments from Russia and Azerbaijan, and enable crude swaps with Turkmenistan and Kazakhstan. In the case of crude swaps, the oil from the Caspian is consumed domestically in Iran, and an equivalent amount of oil is produced for export through the Persian Gulf

Natural Gas

- In 2008, Iran's estimated proven natural gas reserves stand at 948 trillion cubic feet (Tcf), second only to Russia. Roughly two-thirds of Iranian natural gas reserves are located in non-associated fields, and have not been developed. Major natural gas fields include: South and North Pars, Tabnak, and Kangan-Nar. In 2007, Iran produced and consumed an estimated 3.9 Tcf of natural gas. Natural gas consumption is expected to grow around 7 percent annually for the next decade.
- Both production and consumption have grown rapidly over the past 20 years, and natural gas is often used for re-injection into mature oilfields in Iran. According to FACTS Global Energy, Iran's natural gas exports will be minimal due to rising domestic demand even with future expansion and production from the massive South Pars project. In 2007, roughly 70 percent of Iranian natural gas was marketed production, while approximately 30 percent was for enhanced oil recovery gas re-injection, and 285 million cubic feet was lost due to flaring. As with the oil industry, natural gas prices in Iran are heavily subsidized by the government.

Iran Oil & Gas Facilities

Iran Kharg Island
Storage Capacity : 20.2 mn bbl
Loading Capacity : 5 mn bbl/d

Iran Levant Island
Storage Capacity : 5 mn bbl
Loading Capacity : 200,000 bbl/d

Kish Island

Iran Crude Refining Capacity
January 1, 2010

Refinery	1000 bbl/day
Abadan	350
Isfahan	280
Bandar Abbas	230
Tehran	220
Arak	170
Tabriz	100
Shiraz	40
Kermanshah	30
Lavan Island	30
Total Existing	1,450



Strait of Hormuz
Oil flow: 16.5 million
bbl/day which is
roughly 40 percent of
all seaborne traded oil
(or 20 percent of oil
traded worldwide)

(Source: EIA Iran Country Analysis Brief)

- Natural gas accounts for half of Iran's total domestic energy consumption, while the remaining half is predominately oil consumption. The continued exploration and production of the offshore South Pars natural gas field in the Gulf is a key part of Iran's energy sector development plan.

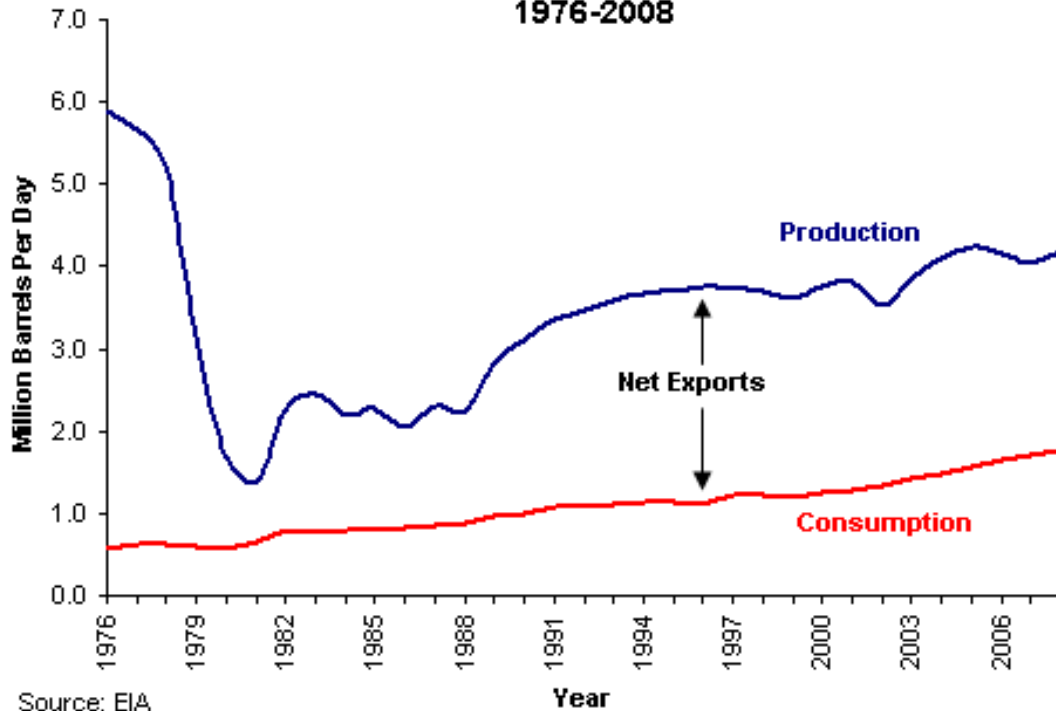
Energy:

- In 2006, Iran generated a projected 190 billion kilowatt-hours (Bkwh) and consumed 149 Bkwh. 172 Bkwh was generated by conventional thermal electric power, and about 18 Bkwh was generated by hydroelectric power, with a marginal amount of renewable (solar and wind) power provided. As of 2007, EIA shows no nuclear electric power generation. Iran seeks to increase its installed capacity by roughly 10 percent annually, keeping in line with its projected 7-9 percent annual demand growth.

- Iran has been focused on meeting higher demand mainly through expanding combined-cycle and hydroelectric power. However, a severe drought during late 2007 and early 2008 adversely affected Iran's hydroelectric production, leaving water reservoirs emptied during the summer peak demand season, resulting in a drop of nearly 70 percent in hydroelectricity power generation. This has brought into question Iran's ability to fulfill its domestic power obligations, let alone its export obligations. Consequently, as of late 2007 some 85 water dams were under construction.

- Further investment is required to meet Iran's future consumption needs. The Ministry of Energy estimates that to meet the growth in demand projected, capacity must reach 60,000 MW by 2015. A substantial element of this new capacity is due to be generated by independent power producers (IPPs), who are expected to have foreign equity stakes. Iran has a number of such projects in preparation, including plans to develop an IPP-based 1,000 MW open-cycle gas-fired power plant in Shiraz with the help of Quest Energy of Dubai. To date, most projects have been awarded through Iran's state-owned Tavanir but there is recognition that IPPs and private capital are necessary to meet even medium-term demand projections.

Iran's Petroleum Production and Consumption, 1976-2008



Source: EIA

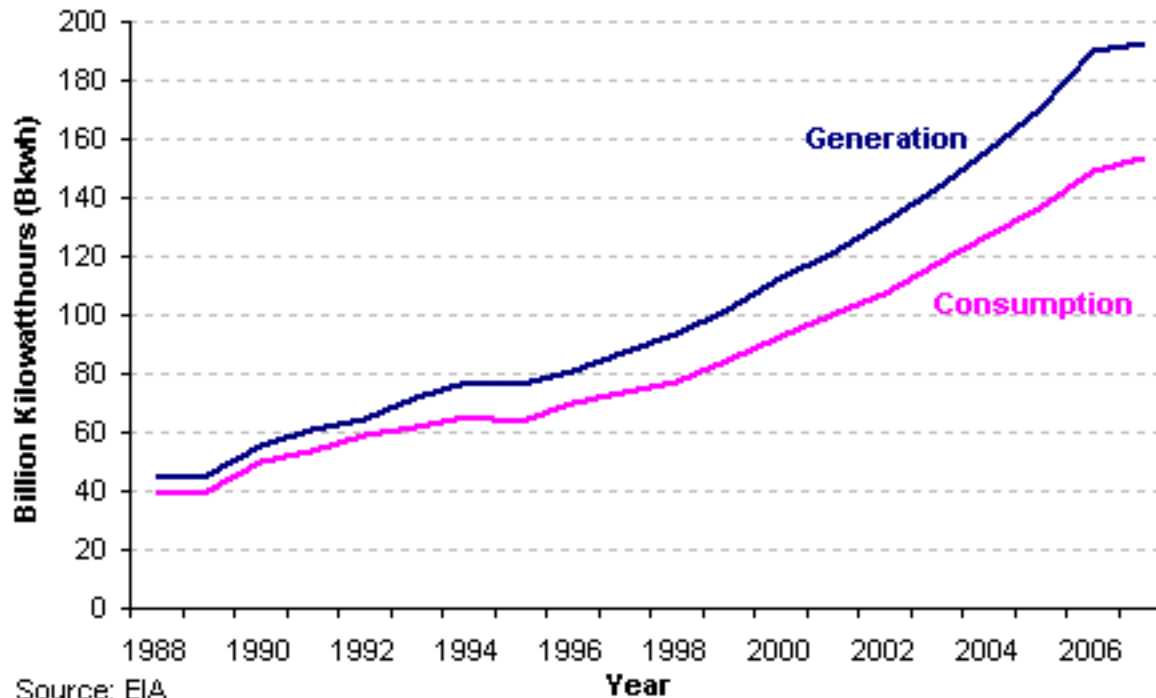
Top Iranian Crude Oil Export Destinations 2007

Country	1000 bbl/d
Japan	523
China	411
India	374
South Korea	258
Italy	197
France	131
South Africa	126
Greece	113
Netherlands	93
Spain	79
Other	151
Total Exports	2,458

(Source: EIA)

(Source: EIA Iran Country Analysis Brief)

Iran's Electricity Generation and Consumption, 1988-2007



- The government also aims to increase power reserves to 26 percent, signifying that the number of new projects awarded is likely to increase in the coming years. Iran continues to develop its nuclear program to generate electricity.

- Its first nuclear power plant of 1,000 MW is to be built at Bushehr with Russian assistance and operations are planned to begin in 2010. Russia is also providing fuel under an agreement signed in early 2005. Iran plans to develop 7,000 MW of nuclear-generated electricity by 2020.

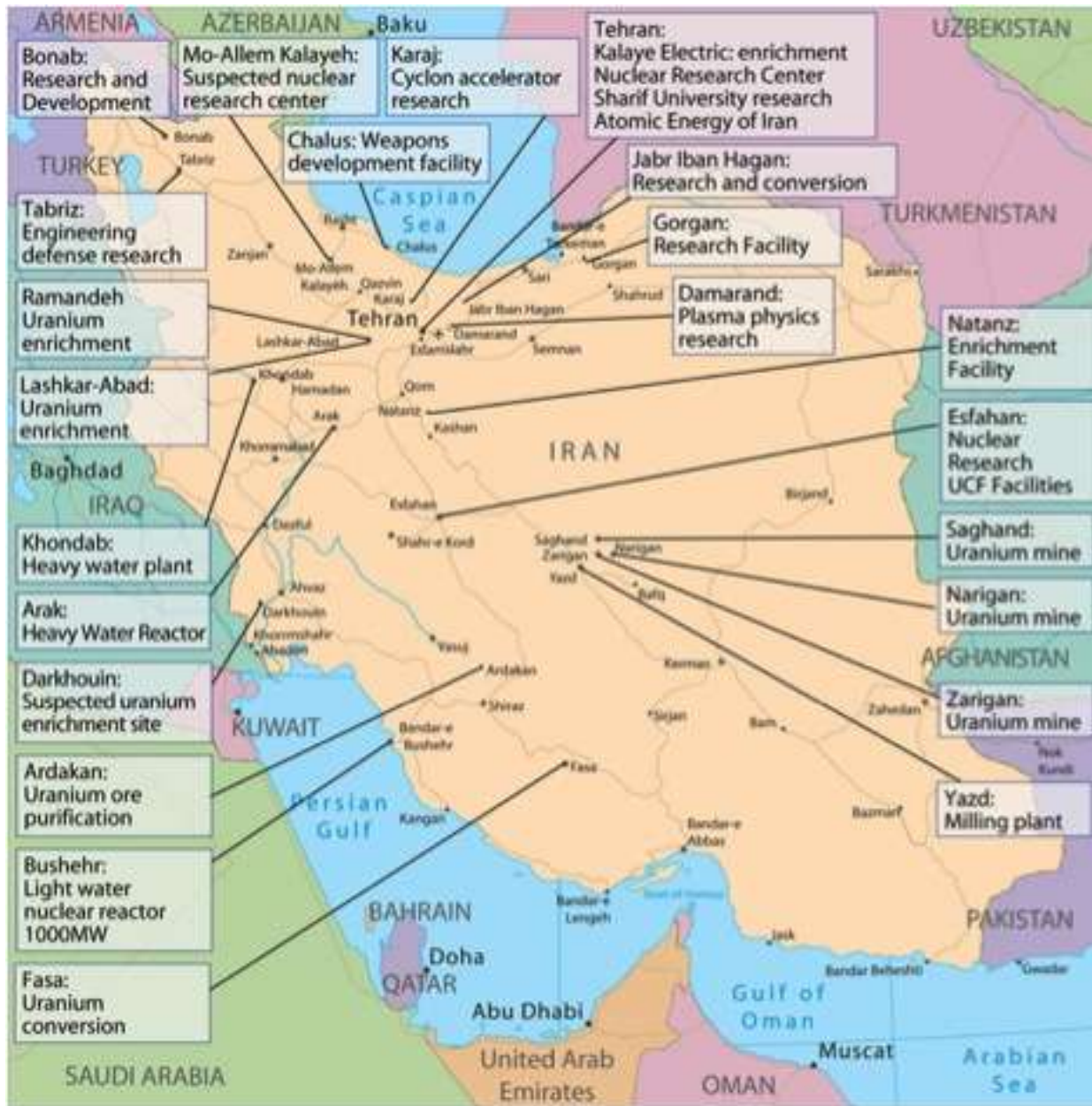
Iran Nuclear Facilities

The main facilities which are critical nodes in Iran's Nuclear infrastructure that can stop or at the least delay the program:

- Nuclear Fuel Cycle:
 - Esfahan : Nuclear Research Center. Uranium Conversion Facility (UCF).
 - Natanz : Uranium Enrichment Facility
 - Fordow: Uranium Enrichment Facility

- Plutonium Production Nuclear Reactor:
 - Arak : Heavy Water Plant and future Plutonium production center

Iran Nuclear Sites



(Source:NTI)

Iran: Nuclear Fuel Cycle

(3) Natanz:

- Uranium Enrichment. UF₆ produced at Esfahan is transported to this facility for enrichment via gas-centrifuge.
- The UF₆ is then sent back to a UCF for further processing to produce low-enriched uranium (3 to 5% U-235) used for fuel in light-water nuclear reactors.
- Side Products are: High-Enriched Uranium (90% U-235). Weapons-grade Uranium. At least 15kg needed for a bomb. Also Depleted Uranium, mainly U-238, can be produced as a high density metal used in weaponry.

Tehran Nuclear Research Center(TNRC):

- Small scale uranium laser enrichment pilot plant. Established in 2000 and apparently dismantled in 2003.

Arak:

- 40 MW(t) Heavy Water Nuclear Reactor. Programmed to be operational by 2011.
- Can produce about 8kg of Plutonium per year, enough for a 20KT nuclear bomb every year.

(1) Yazd, Saghand, Narigan, Zarigan:

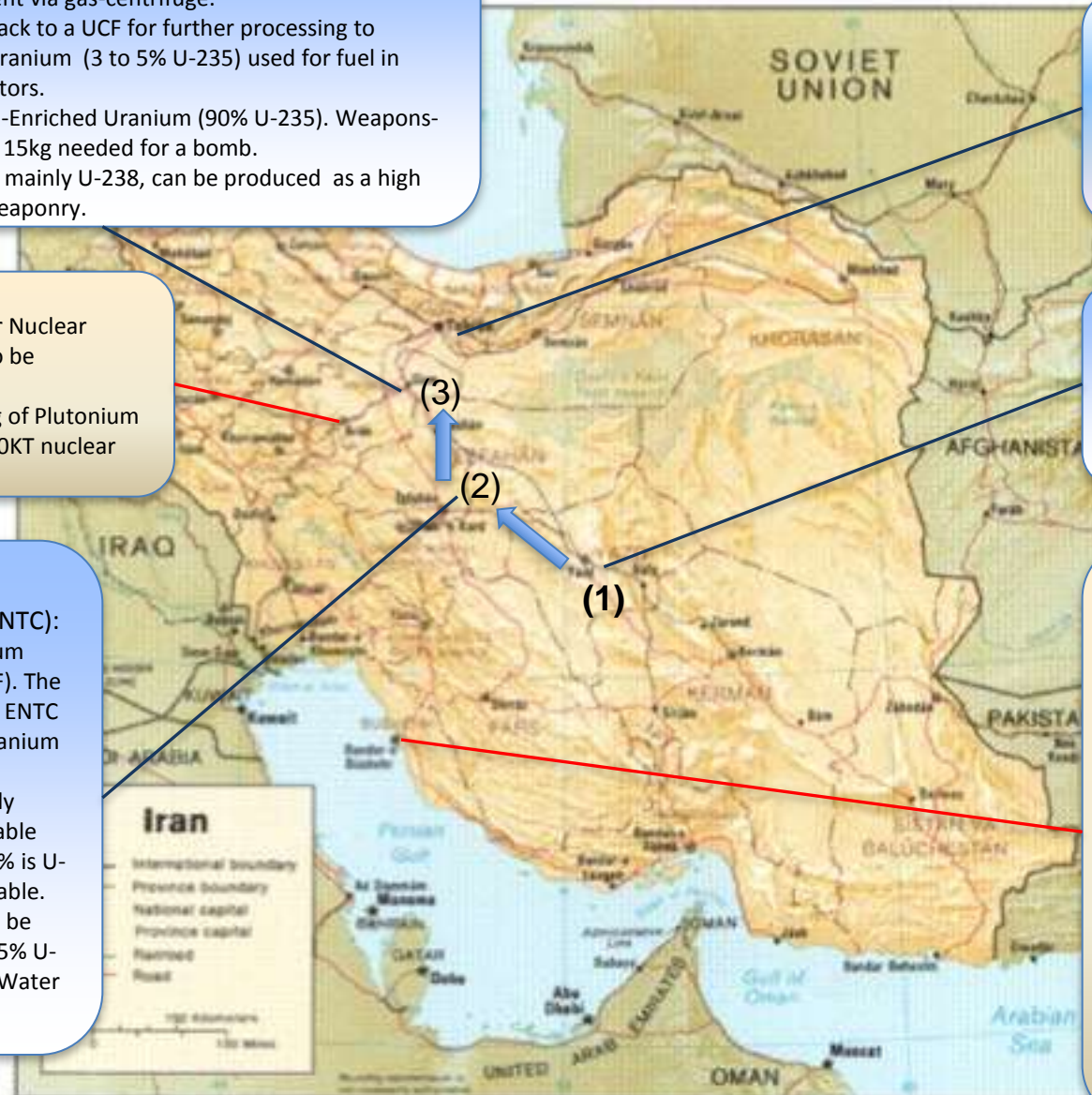
- Mining Uranium Ores
- Milling to produce U₃O₈ Uranium Oxide (Yellow Cake)

(2) Esfahan Nuclear Technology Center (ENTC):

- Industrial-Scale Uranium Conversion Facility (UCF). The U₃O₈ is transported to ENTC to convert it to UF₆ (Uranium Hexafluoride).
- Natural Uranium is only 0.7% U-235, the fissionable isotope. The other 99.3% is U-238 which is not fissionable.
- The Uranium needs to be enriched between 3 to 5% U-235 to be used in Light Water Reactors.

Bushehr:

- 1000 MW(t) Light Water Reactor for Electric Power production.
- Built by Russia and scheduled to be online in 2009.
- Russia will supply the fuel. Also spent fuel rods to be returned to Russia.
- 3 to 5% U-235 is needed for use as a fuel in light water reactors.
- The Uranium fuel for fission reactors will not make a bomb; it takes enrichment to over 90% necessary for weapons applications.



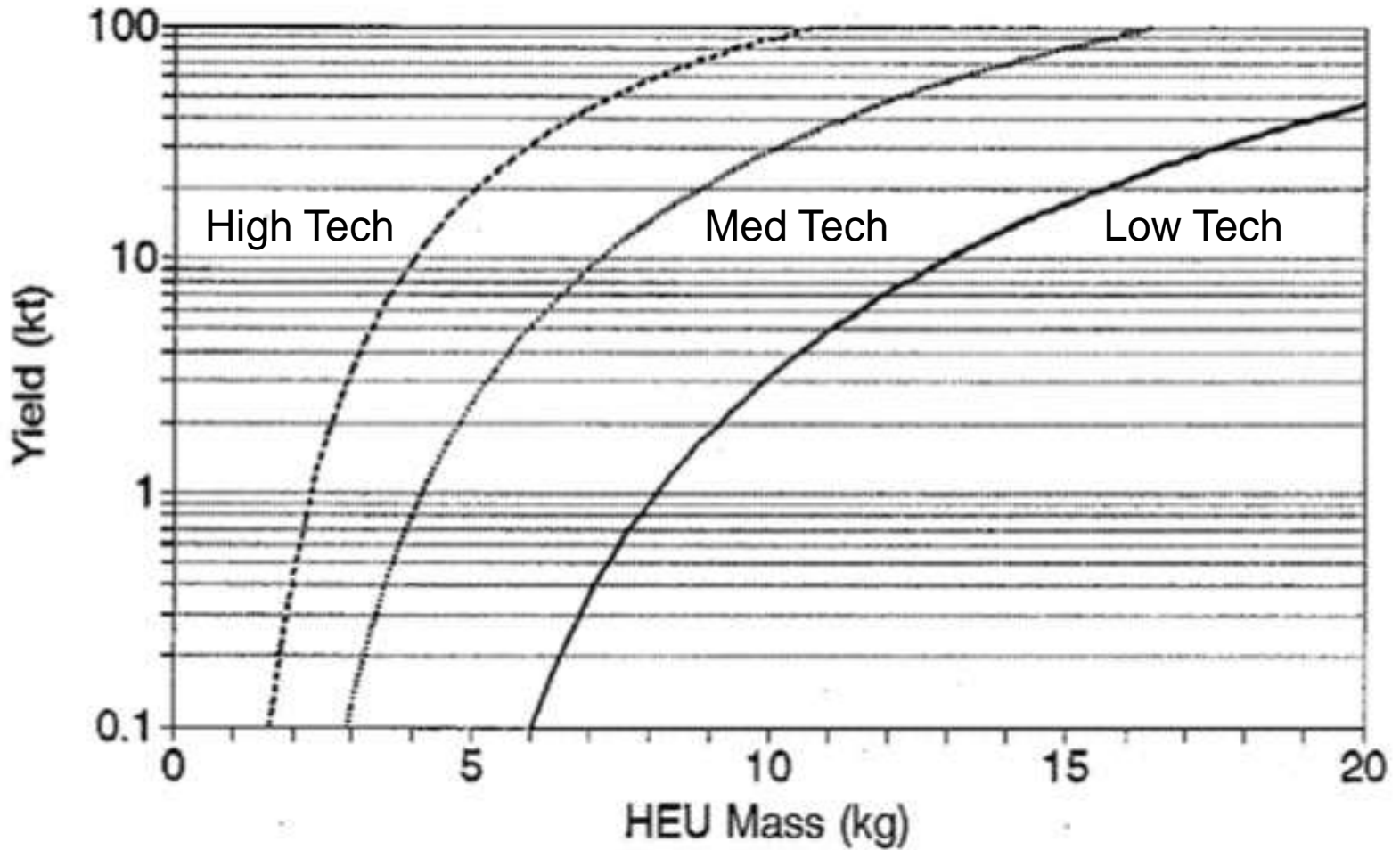
Amount of Fissile Material needed to build an Atomic Bomb

HEU Enriched to 90% U-235	Simple gun-type nuclear weapon	90 to 110 lbs (40 to 50 kg)
	Simple implosion weapon	33 lbs (15) kg
	Sophisticated implosion Weapon	20 to 26 lbs (9 to 12 kg)
Plutonium	Simple implosion weapon	14 lbs (6 kg)
	Sophisticated implosion weapon	4.5 to 9 lbs (2 to 4 kg)

- The amount of HEU needed to make a nuclear weapon varies with the degree of enrichment and sophistication of the weapon design.
- In general, the higher the enrichment level, the less HEU is needed to make a bomb.
- For a HEU-based nuclear weapon, there are two basic design options:
 - Gun-type weapon
 - Implosion weapon
 - Gun-type weapons are far simpler in design, whereas the implosion weapon is more difficult technically but requires less HEU
 - Plutonium based nuclear weapons only work as implosion weapons, with more sophisticated weapons using less plutonium.

(Source: Union of Concerned Scientists. Fact Sheet. April 2004)

Yield vs HEU Mass (As a Function of Technical Capability)



Source: The Amount of Plutonium and HEU Needed for Pure Fission Nuclear Weapons
Thomas B. Cochran and Christopher E. Paine. 13 April 1995
National Resources Defense Council, Inc. (NRDC)

Iran's Nuclear Chief Explains Nuclear Fuel Cycle, Comments on US Concerns

IAP20060414011060 Tehran Vision of the Islamic Republic of Iran

Network 2 in Persian 1920 GMT 12 Apr 06

[Interview with Gholamreza Aqazadeh, the head of Iran's Atomic Energy Organization -- live]

.....

[Presenter] Regarding the 3,000 figure which you say you want to achieve by the end of the year, do they produce a 3.5 percent enriched uranium?

[Aqazadeh] It is 3.5 percent. It does not go higher. It does not make any difference. It is only a matter of quantity. Let me explain something. In the 164 chain, the maximum amount of material that we can feed the system is 70 grams an hour, with a 10 percent product of 7 grams. The product is 7 grams. Some 63 grams remain. When a series is operating 24 hours you have to multiply 24 by 70 grams. This is the total product of one series.

- Based on the above interview when Aqazadeh gave some detail regarding the performance of the 164 IR-1 centrifuge cascade that was the basis of the Natanz Uranium Enrichment facility, Richard Garwin ("when could Iran deliver a nuclear weapon?" January 17, 2008, Bulletin of Atomic Scientists), outlines that the waste system has 0.4% U-235 content and how in the 18 x 164-centrifuge cascade= 2,952 centrifuges, each centrifuge contributes 1.362 SWU per year. Concluding that with natural uranium feed at 0.4% U-235 in the tail (waste) stream, each kg of 90% product requires 170.4 SWU. The 4,022 SWU per year resulting as an output from 2,952 centrifuges ($2,952 \times 1.362 = 4,022$ SWU/Year) gives as an output of 23.6 kg per year of 90% HEU ($4,022/170.4 = 23.6$ kg).
- This implies that if Iran could operate the 3,000 centrifuges installed at the rate claimed for the 164-centrifuge cascade in 2006, it could produce enough HEU each year for one implosion type nuclear weapon.
- One implosion type weapon with 25kg of 90% HEU would require 10.7 tons of Uranium Hexafluoride UF₆ containing 7.23 tons of natural uranium with 0.711% U-235 feed assay, 90% U-235 product and 0.4% U-235 tail assay.
- The above Aqazadeh interview further stated that as of April 2006, Iran had produced some 110 tons of Uranium Hexafluoride containing about 78 tons of natural uranium, the amount required to produce 10 nuclear bombs (total of 250 kg HEU). For a simple gun-type nuclear bomb with 40kg HEU, then production would be 6 nuclear bombs per year.

- The production rate of HEU can be increased from a 3,000 centrifuge arrangement when it is fed with 3.5% U-235 feed assay rather than the 0.711% U-235, with waste at 0.4% U-235. Taking the SWU/year for each centrifuge to be 1.3, then to produce 1 kg of 90% U-235 would require 65.3 SWU/kg/year instead of the 170.5/kg/year from a natural uranium feed. This would result in 3 implosion type bombs to be produced per year or 1 gun-type nuclear weapon.
- If all the 50,000 centrifuges planned for Natanz are installed, then the facility could produce some 400 kg of HEU per year enough for about 20 implosion type nuclear weapons per year.
- On the other hand looking at Natanz facility as providing nuclear fuel for the 1,000 Megawatt Bushehr nuclear reactor, as a rule of thumb, it takes about 100,000 SWU of 3.5 % Enriched Uranium to fuel a reactor of this type for one year. By taking that each centrifuge contributes 1.3 SWU/year, as in Natanz, then some 77,000 centrifuges ($100,000/1.3 = 77,000$) will be required, way beyond what the final capacity of Natanz is planned for.

The Fordow Facility

- Iran informed the IAEA that the Fordow facility was a pilot plant and that it was built as a contingency enrichment plant as a backup in case its main enrichment facility was destroyed by a military attack. Iran declared that site would enrich uranium to the low 5% purity required as fuel for a nuclear power plant.
- In a Sept. 25 press conference the leaders of the United States, France and the United Kingdom, publicly revealed the existence of the facility, stating that it was “inconsistent with a peaceful nuclear program.” A number of nuclear experts have also declared that Fordow was most probably planned to be built as a clandestine facility devoted to producing weapons grade HEU as part of its nuclear weapon “breakout” plan.
- David Albright stated that the Fordow facility is not ideal for the production of enriched uranium for commercial reactors, but its size and capacity could be part of a network of clandestine nuclear facilities. With 3,000 centrifuges, the Fordow plant can produce around 25kg of HEU enough for one implosion type nuclear weapon a year.

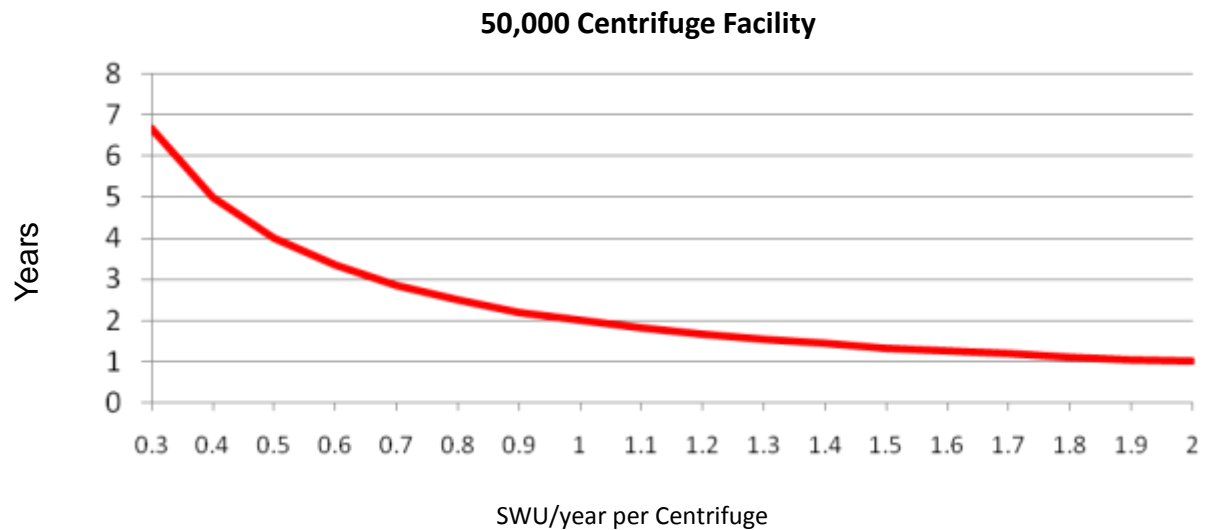
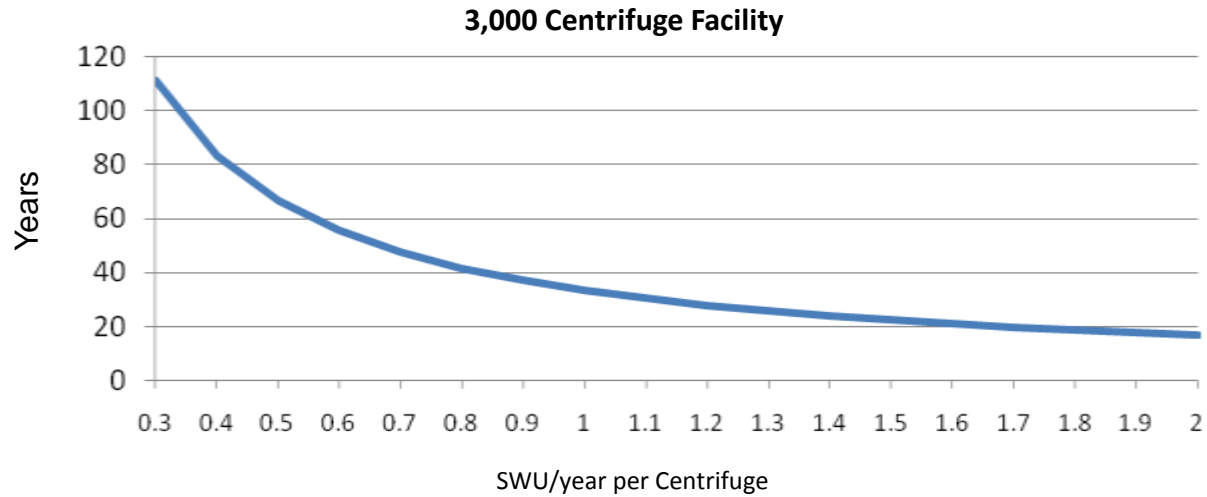
- If the Fordow facility were to use a feed of already enriched reactor grade uranium, 3 to 5%, this would require that this feed be smuggled out of the Natanz facility. Or some other facility that has not been revealed to the IAEA, as the IAEA report raises this possibility, but states that Iran has declared that it has no other undeclared nuclear facilities. Esfahan and Natanz are under IAEA safeguards.
- Ivan Oerlich and Ivanka Bazashka published in the Bulletin of Atomic Scientist an analysis on the Fordow facility, they state that their calculations, based on publicly available IAEA reports, shows that Iran is operating its IR-1 centrifuges at 20 – 25% of what we might expect. So instead of the 1.3 SWU/year per centrifuge we would expect between 0.3 – 0.4 SWU/year per centrifuge.
- This would also imply that instead of taking 1 year to produce the 25kg of weapons grade HEU for 1 nuclear bomb, it would take about 4 years to produce this amount of weapons grade HEU. The 3,000 centrifuges according to the BAS article would produce 1000 SWU/year hence for a 1 Megawatt Commercial Nuclear reactor that requires around 100,000 SWU/year it would take some 100 years ($100,000/1000 = 100$ years) to produce the fuel needed, which the article states.
- FAS Issue Brief, December 7, 2009:
 “In summary, we concluded that the timing of the construction and announcement of the facility did not *prove an Iranian intention to deceive* the agency, although it certainly poses many troubling questions. The facility is far too small for commercial-scale enrichment, raising concerns that it might have been intended to covertly produce highly enriched uranium (HEU) for weapons. But we also argued that the facility, by itself, is actually too small to be of great use to a weapons program. A quite plausible explanation is that FFEP was meant to be one of several covert enrichment plants and was simply the only one to be discovered. We believe, however, that it is significant that the Iranians assured the agency that they “did not have any other nuclear facilities that were currently under construction or in operation that had not yet been declared to the Agency”¹ because any additional enrichment plants uncovered in the future will be almost impossible to explain innocently. This statement, however, does not preclude Iran from making a decision to construct new enrichment facilities in the future.”
- We did not follow the analysis of the BAS article in coming to the conclusion that the IR-1 centrifuges are operating at 20 to 25%. Instead we have followed the approach of both Richard Garwin and David Albright, by basing our own analysis and calculations on the Aqazahed interview and other information that has come out of the IAEA. Hence, we have taken an average of 1.3 SWU/year for each centrifuge, giving us results close to the ISIS and Richard Garwin.

Uranium Enrichment Using a 3,000 Centrifuge Assembly Facility

SWU/year From 1 Centrifuge	SWU/year From 3,000 Centrifuges	Feed Assay : 0.711% U-235 Product Assay: 90% U-235 Tail (Waste) Assay: 0.4% U-235		Feed Assay : 3.5% U-235 Product Assay: 90% U-235 Tail (Waste) Assay: 0.4% U-235	
		U-235 kg/year (SWU/kg/year=170.5)	No. of Simple 15 kg Implosion Nuclear Weapons	U-235 kg/year (SWU/kg/year=65.3)	No. of Simple 15 kg Implosion Nuclear Weapons
0.6	1,800	10.6	-	27.6	1
0.7	2,100	12.3	-	32.1	2
0.8	2,400	14.1	-	36.7	2
0.9	2,700	15.8	1	41.3	2
1	3,000	17.6	1	45.9	3
1.1	3,300	19.4	1	50.5	3
1.2	3,600	21.1	1	55.1	3
1.3	3,900	22.9	1	59.7	3
1.4	4,200	24.6	1	64.3	4
1.5	4,500	26.4	1	68.9	4

(Source: WISE Uranium Project. Uranium Enrichment Calculator. <http://www.wise-uranium.org/nfcue.html>)

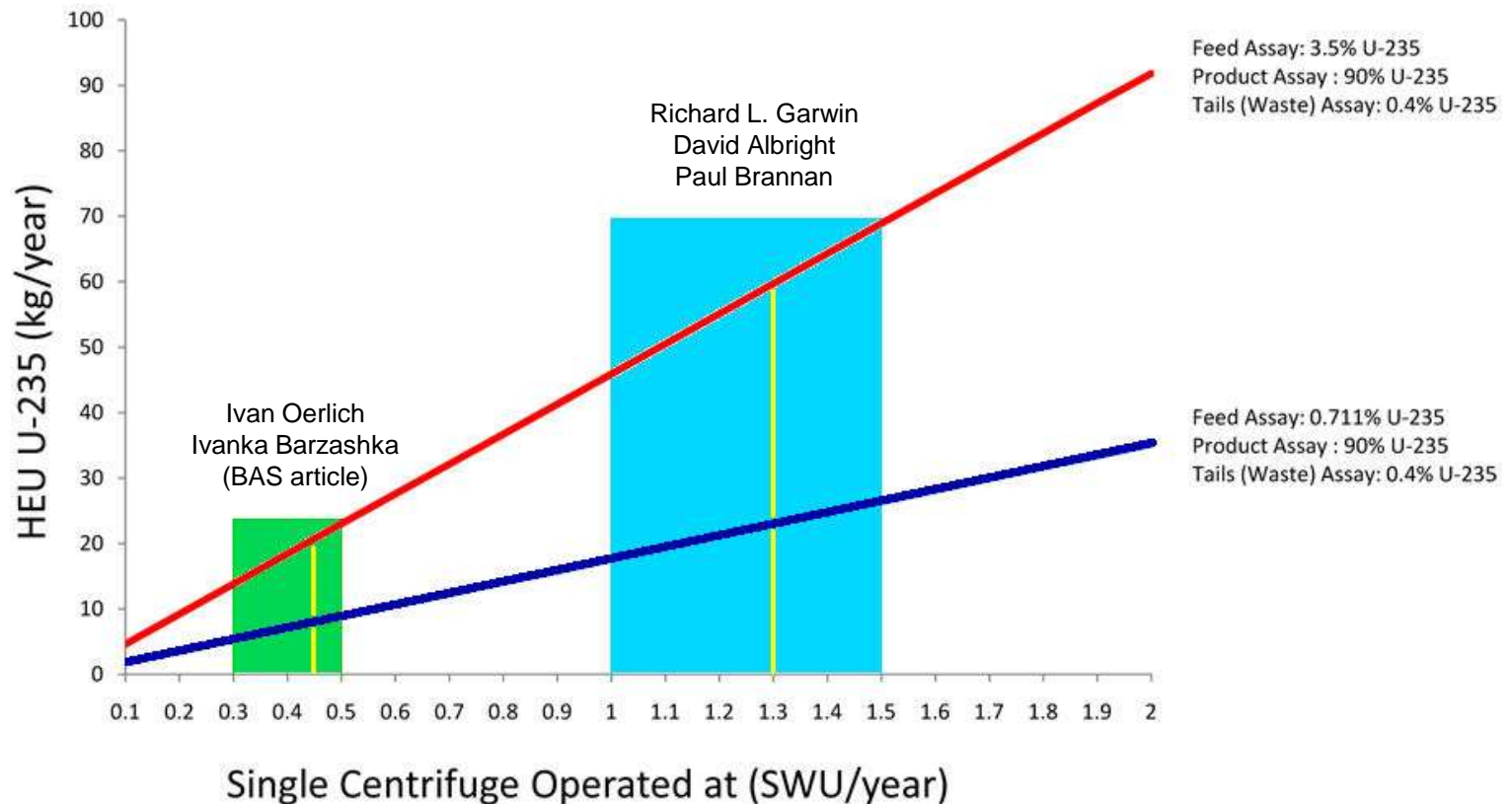
Time to supply 3 to 5% Enriched Uranium to fuel a typical 1,000 Megawatt Commercial Light Water Nuclear Reactor



It takes about 100,000 SWU of Enriched Uranium to fuel a typical 1,000 Megawatt Commercial Nuclear Reactor

HEU Produce with 3,000 Centrifuges (kg/year)

Ranges of Separative Work Unit (SWU)/year per Centrifuge



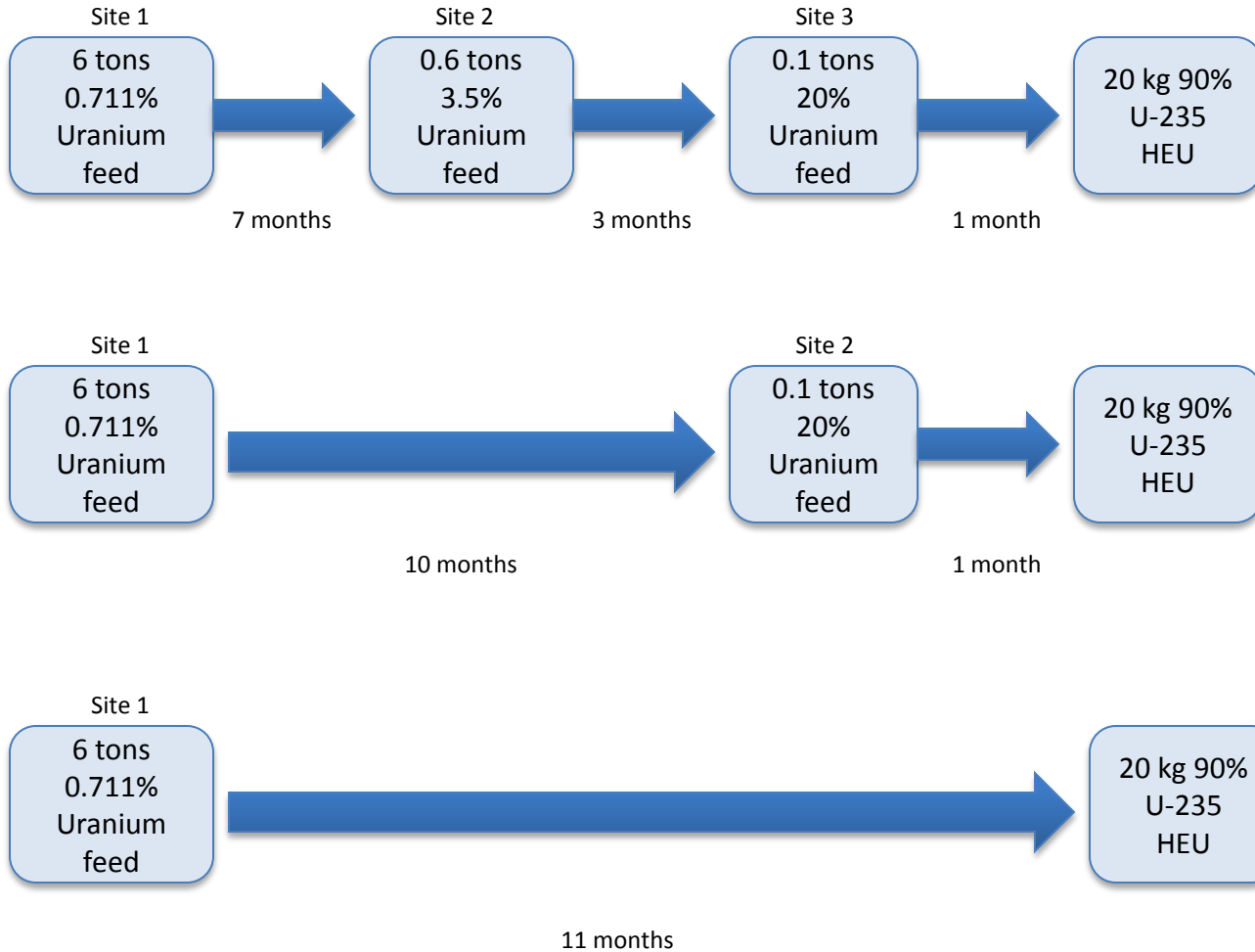
SWU/year in the range of 1 to 1.5:

- Richard L. Garwin: "When could Iran deliver a nuclear weapon?" Jan 17, 2008
- David Albright and Paul Brannan. ISIS Report. November 30, 2009. "Critique of Recent Bulletin of Atomic Scientist Article on the Fordow Enrichment Plant".
- David Albright and Paul Brannan. "Further Comments regarding the BAS Article on Fordow" Dec 4 2009.

Timelines
Iran Producing Nuclear Weapons

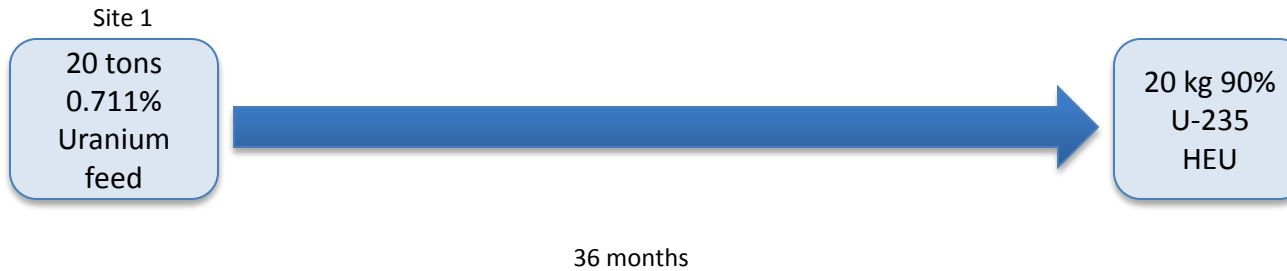
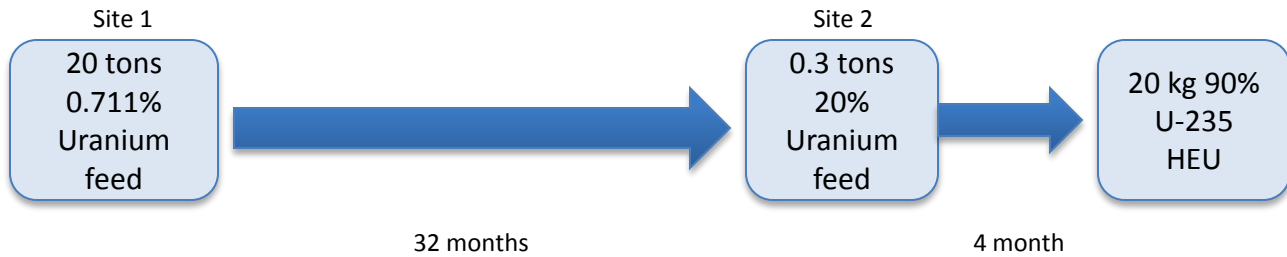
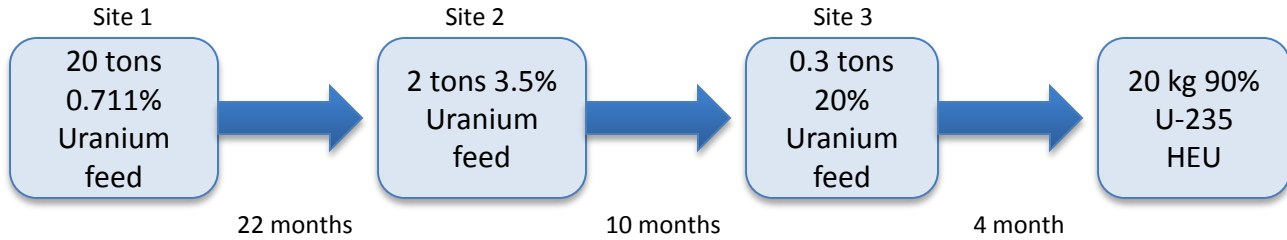
- Given the information available on nuclear weapons, and the enrichment process it is generally assumed that a simple implosion type nuclear weapon doesn't need testing. The design is straightforward and has been tried by a number of countries to the extent that scientists and engineers can be confident that the weapon will work without undergoing multiple testing.
- The question is how many nuclear bombs would Iran require to establish itself as a nuclear state. It is generally assumed that three bombs would be required. The first would be for testing purposes, the second in case Iran enters into a nuclear war, would be for "First Strike", and the third would be for a "Second-Strike" or "Deterrent".
- Because the activity to produce the required HEU material and the weaponization process can occur in parallel rather than in a sequence, then for 3 nuclear bombs it would take around three to four years for Iran to be considered a full Nuclear State, assuming further that it does not encounter any technical problems.
- If by the end of 2009 there existed another covert facility with 3,000 centrifuges (re-configured to produce HEU) each operating at 1.3 – 1.5 SWU/year, we estimate the time that Iran could have 3 fully operational nuclear weapons, that can even be carried on Ballistic Missiles, would be by 2014. The first could be sometime in 2010 or early 2011.
- With the public information and any Intelligence available it is very difficult to estimate the date when the political decision by the Iranian leadership was made, if one was made at all, to start a Nuclear Weapons program. We show that it will take 3 to 4 years for Iran to be a Nuclear State. However, one nuclear weapon could also be considered as enough to be considered a "Nuclear Threshold State".
- There does not exist any publicly available information if Iran has made an irreversible and definitive decision to acquire Nuclear Weapons no matter what the cost, or if it is still in the "option" stage. Nor do we know if Iran has become self-sufficient and is in the process of completing a network of clandestine facilities, to either move the enriched uranium around from one to the other until it can produce a nuclear weapon, or one facility that can undertake the total conversion to HEU independently.
- A possibility that has been talked about by Western analysts would be that Iran could produce 3.5% U-235 or 20% U-235, in these clandestine facilities, at the same continue with a diplomatic engagement with the P5+1, until it feels the political conditions are just right for it to go forward in producing Nuclear Weapons in a short period of time.

Time Line for 1 Implosion Type Nuclear Bomb (20 kg)
 (Estimated to be 1 Year with various Sites or one dedicated Site)



- Assuming each enrichment facility has 3,000 centrifuges, each operating at 1.3 SWU per year
- Assuming Iran has other covert facilities for uranium enrichment.

Time Line for 3 Implosion Type Nuclear Bomb (20 kg)
Estimated to be 3 Years with various Sites or one dedicated Site)



•Assuming each enrichment facility has 3,000 centrifuges, each operating at 1.3 SWU per year

- “Once at 20% (enrichment level) they’d be 90% of the way to 90% enrichment (weapons grade HEU) in terms Of the time it takes” David Albright quoted in Reuters “Iran to enrich uranium to higher levels: Ahmadinejad” Dec 2, 2009.

Other Time lines

- Israel believes that Iran will have a nuclear weapon capability by 2013. That Iran should not be allowed to obtain any nuclear capabilities that could eventually allow it to produce nuclear weapons. In addition Israel views Iran as an existential threat and must be dealt with in the immediate future.
- U.S. believes this will be beyond 2013, and its approach is to leave all options on the table, mainly further sanctions and containment if Iran continues its pursuit of Nuclear Weapons.

National Intelligence Estimate. Iran: Nuclear Intentions and Capabilities. November 2007.

- We assess centrifuge enrichment is how Iran probably could first produce enough fissile material for a weapon, if it decides to do so. Iran resumed its declared centrifuge enrichment activities in January 2006, despite the continued halt in the nuclear weapons program. Iran made significant progress in 2007 installing centrifuges at Natanz, but we judge with moderate confidence it still faces significant technical problems operating them.
- We judge with moderate confidence that the earliest possible date Iran would be technically capable of producing enough HEU for a weapon is late 2009, but that this is very unlikely.
- We judge with moderate confidence Iran probably would be technically capable of producing enough HEU for a weapon sometime during the 2010-2015 time frame. (INR judges Iran is unlikely to achieve this capability before 2013 because of foreseeable technical and programmatic problems.) All agencies recognize the possibility that this capability may not be attained until *after 2015*.

Light Water Reactors (1000 MW(t) Bushehr Light Water Reactor for Power Generation:

In a study 'A Fresh Examination of the Proliferation of Light Water Reactors' Victor Gilinsky, Marvin Miller, Harmon Hubbard, October 22, 2004. The Nonproliferation Policy Education Center. They write the following:

The report details how fresh and spent LWR fuel can be used to accelerate a nation's illicit weapons program significantly. In the case of a state that can enrich uranium (either covertly or commercially), fresh lightly enriched reactor fuel rods could be seized and the uranium oxide pellets they contain quickly crushed and fluoridated. This lightly enriched uranium feed material, in turn, could enable a would-be bomb maker to produce a significant number of weapons with one-fifth the level of effort than what would otherwise be required to enrich the natural uranium to weapons grade. As for spent LWR fuel, the report details how about a year after an LWR of the size Iran has was brought on line, as much as 60 Nagasaki bombs' worth of near-weapons grade material could be seized and the first bomb made in a matter of weeks. The report also details how the reliability of the bombs made of this material, moreover, is similar to that of devices made of pure weapons grade plutonium.

The study continues to say...

The running assumption today, of course, is that any nation diverting either the fresh or spent fuel from an LWR site would be detected by IAEA inspectors. This clearly is the premise of the deal the United Kingdom, France, Germany, and Russia are making to Iran: Russia will provide Iran with fresh reactor fuel if Iran promises to suspend activities at its known uranium enrichment facilities and surrenders spent fuel from its LWR for transit and storage in Russia. What's not fully appreciated, however, is that Iran might well be able to divert these materials to covert enrichment or reprocessing plants and might well be able to do so without detection. Lengthy exposure to spent fuel that has just left an LWR of the sort required to package and ship long distances out of the country is quite hazardous. If Iran was set on making bombs, though, it might be willing to take the risks associated with a much shorter transit for quick reprocessing. The health hazards associated with diverting fresh LWR fuel, on the other hand, are virtually nil.

- A growing amount of intelligence indicates Iran was engaged in covert uranium conversion and uranium enrichment activity, but we judge that these efforts probably were halted in response to the fall 2003 halt, and that these efforts probably had not been restarted through at least mid-2007.
- We judge with high confidence that Iran will not be technically capable of producing and reprocessing enough plutonium for a weapon before about 2015.
- We assess with high confidence that Iran has the scientific, technical and industrial capacity eventually to produce nuclear weapons if it decides to do so.

The Heavy Water Nuclear Reactor at Arak:

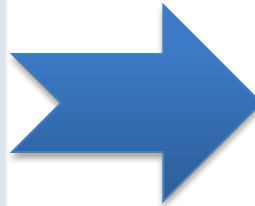
- Iran is building a new 40-megawatt thermal-cooled heavy water reactor in Arak. The heavy water program has raised some questions regarding Iran's intentions. Iran first informed the IAEA that it was planning to export heavy water, then they stated that the heavy water will be used as a coolant and moderator for the planned IR-40 reactor for research and development, radio-isotope production and training.
- It has been mentioned by some experts that the Iran IR-40 heavy water reactor could be operational by 2011
- and would allow Iran to begin producing weapons-grade material by 2014.
- Using the same basis and reactor operation factor of 0.6 as was done for the Israeli Dimona reactor, we find that the amount of Plutonium produced per year is up to 8 kg of weapons grade, enough for 1 nuclear bomb a year.

- Iranian Threat Perceptions & Response
 - U.S. response to Iranian Threat Perception
- West Perceptions of the Iranian Threat & Options to deal with Iran

Iranian Threat Perceptions

Iranian threat perceptions:

- Views itself as a Gulf power, its aim to keep the waters free from any foreign military presence.
- Prevent outside countries from shaping the political & security future of the Gulf.
- The occupation of Iraq by U.S. and presence of U.S. 5th fleet in the waters of the Gulf.
- Iran maintains that the U.S. is building bases in the Gulf as launching pads for a strike against it.
- Israel views Iran as an Existential Threat and must be dealt with in the immediate future.
- U.S. and Israel working to destabilize Iran and deny it a Nuclear Energy Program.
- Views itself as a regional power in the Muslim Middle East therefore has a say in any M.E. Peace Process.



Iranian actions dealing with its threat perceptions:

- Diplomatically active to convince GCC States that their security better ensured by signing mutual agreements with it, not US.
- Iran has been stressing that for longer term regional security & stability Iran and GCC states should replace the reliance on foreign military presence and intervention.
- The need to acquire nuclear weapons and long-range ballistic missiles as a deterrent, power projection and status.
- Accelerating a program to build a network of Uranium enrichment facilities in case any one of them is destroyed by a U.S. military strike.
- Develop short, medium and long range ballistic missiles to compensate for deficiencies in air power and as a deterrent.
- Building an Asymmetric Warfare capability. Political and Military support to Hezbollah and Hamas.

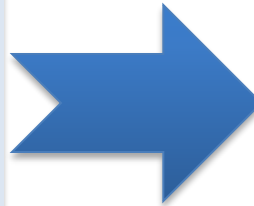
U.S. Response:

- As a response, the U.S. policy objective has been not to allow the Arabian Gulf region to be dominated by a hegemonic Iran. The United States believes that Iran cannot try to dominate the Gulf region as long as a U.S. military power is present
- By pursuing Nuclear Weapons the U.S. position is that this will:
 - not advance Iran's security;
 - not achieve its goal or enhance its power both regionally and globally;
 - spark an arms race in the region;
 - cause Iran to become more insecure;
 - Iran possessing nuclear weapons would be unacceptable to the U.S.;
 - Washington would arm allies in the region, and extend a "defense umbrella".
 - By extending assistance and a defense umbrella, Iran will not be able to intimidate and dominate its neighboring countries in particular the GCC, as Iran believes it can, once it possesses nuclear weapons.
- President Obama views Russia as an influential partner willing to help fight the proliferation of nuclear weapons mainly in Iran and North Korea. It has become clear that more collaboration between the US and Russia on nuclear non-proliferation could increase pressure on Iran, which has always taken advantage and benefitted from any disagreements between the two countries.
- It is believed that Russia and China could be key players in preventing Iran from having a nuclear weapons program. However, Russia seems to have a different perception of the threat and has not shown any interest so far in applying pressure on Iran.

West Perceptions of the Iranian Threat

Perceptions of Iranian threat:

- With occupation of Iraq, Iran now seeks to reemerge as the key power in Arabian Gulf and Muslim M.E. region.
- Nuclear Weapons program that poses as a serious threat to GCC and ME region in addition to the Short, Medium & Long Range Ballistic Missiles program capable of carrying WMD.
- Iran looks upon Nuclear Weapons and Ballistic Missiles as attractive alternatives to expensive modern conventional weapons for Power Projection and Deterrence purposes and as a means to increase status and prestige.
- Opposition to M.E. Process and its rising political influence there.
- Support for Int'l Terrorism; Hezbollah and Hamas as well as Train and Control Insurgency Groups.
- Threat to Stability of the Gulf States, has annexed the three Islands that dominate entrance to Straits of Hormuz. Considers itself Central to any Gulf Security Arrangements.
- Building Asymmetric Warfare capability.



Options to deal with Iran:

- Diplomacy & Dialog
- Incentives
- Containment
- Sanctions
- Regime Change
- Defense
- Deterrence
- Military Strike against Nuclear Facilities

Options to deal with Iran's Nuclear Program within the Time Frame

- **Diplomacy and Dialog:**
Efforts to persuade Iran to not proliferate, and by convincing Iran that it does not face a sufficient threat to proliferate and cannot make major gains in power or security by doing so.
- **Incentives:**
Options that give Iran security guarantees, economic and trade advantages.
- **Containment:**
Creation of a mix of defensive and offensive measures that would both deny Iran the ability to exploit its WMD capabilities and show that any effort to use such weapons to intimidate or gain military advantage would be offset by the response.
- **Sanctions:**
Controls and measures designed to put economic pressure on Iran, limit its access to technology, and/or limit its access to arms.
- **Regime change:**
Efforts to change the regime and create one that will not proliferate.
- **Defense:**
A mix of measures like missile defense, air defense, counterterrorism, counter smuggling/covert operations capability, civil defense, and passive defense that would both deter Iran and protect against any use it can make of its WMD capabilities.
- **Deterrence:**
Creation of military threats to Iran so great that no rational Iranian leader could see an advantage from using weapons of mass destruction.
- **Preventive or Preemptive Strikes Before Iran has a Significant Nuclear Force:**
Military options that would destroy Iran's ability to proliferate and/or deploy significant nuclear forces. To build an international consensus to allow the use military force as a last resort when all other options absolutely fail.

The Military Balance:

- Israel
- GCC
- Iran

- Israel's National Security Doctrine:

This is based on the perception that Arab countries are determined to destroy Israel; that Israel has no reliable international allies and must take care of itself; there is an asymmetrical balance of resources versus the Arab Countries in Demography, Geography, Economic Resources, Structure of Armed Forces in terms of man power.

- Israel's Operational Military Doctrine:

That Israel must have the capability to deter any possible Arab attack, and if deterrence fails then Israel must strive for an early war termination if war breaks out. That any war with the Arab countries would have to be short and decisive. That the war must quickly be carried into and fought on Arab territory giving rise to a rapid offensive and high degree of mobility to sustain continuous forward movement.

- Israel has to prepare against an Arab coalition - Israel has structural vulnerability and disparities vs adversaries

- Israel perceives that its qualitative edge is eroding i.e. advanced technology weapon systems are entering the Arab World. Not in favor of Israel as it used to be.

- Geography :

- Long borders vs small size of territory
- Lack of strategic depth (width of borders vs strategic depth)
- Short distance from source of threat
- High density of population along the coast
- High dependency on Sea and Air Lanes
- The aerial threat to Israel via Jordan, from Syria, Saudi Arabia and Iraq. (7 to 14 minutes).
- The Ballistic Missile threat to Israel, warheads are no longer just conventional, but more non-conventional (Biological, Chemical and Nuclear).

- The Operational Level:
 - Israel cannot afford to lose a single war
 - If war breaks out to determine the outcome of war quickly and decisively

Defensive Strategy -Offensive Tactics

- Prepare for Defense
 - A small standing army with an early warning capability, regular air force and navy.
 - An efficient reserve mobilization and transportation system.
- Move to Counter-Attack
 - Multi-arm coordination.
 - Transferring the battle to enemy's territory quickly
 - Quick attainment of war objectives.
- Capabilities
 - Intelligence
 - High capability to destroy mobile targets
 - Long-range capabilities
 - Anti-missile defense
 - All-weather and low-visibility capabilities
 - Advanced training systems
- Main Areas of Activity
 - Continuous high state of readiness for war
 - Anti-terrorist warfare
 - Building the armed forces for the future battlefield

- Israel's Nuclear Policy:

A nuclear capability is needed to deter threats to Israel's existence. The possible acquisition of nuclear weapons by any Arab or non-Arab Muslim State in the region is considered as a direct existential threat to Israel. Israel should prevent all States in the Middle East Region from developing a nuclear program that it sees as a threat, or attempting to acquire nuclear weapons. Israel has deliberately maintained a nuclear policy ambiguity about its own nuclear weapons program.

The purpose of the nuclear ambiguity policy was based on the belief that it had introduced an effective "deterrence through uncertainty". Arab states were never sure that Israel would use a nuclear weapon in retaliation to its survival in the event of a major war, or if any of the Arab states try to acquire a nuclear capability.

Israel's nuclear ambiguity policy has been stated by a number of Israeli leaders in such statements as:

" Israel will not be the first to use nuclear weapons" and

" Israel will not be the first to introduce nuclear weapons into the Middle East"

- The Arab States' view is that such nuclear doctrines can never be considered binding in case of war.
- Israel has never officially admitted that it possesses Nuclear Weapons, and is not a signatory to the Nuclear Non-Proliferation Treaty. Many see the present status of Israel as an "Undeclared Nuclear Weapon State", at the same time it has become to be recognized as possessing a very sophisticated arsenal of nuclear weapons.

Main Airbases

Hatzerim
F-15I
F-16I

Hatzor:
F-16C/D
F-16A/B

Ben Gurion:
KC-130H
B-707

Ovda:
F-16A/B
F-16I

Ramat David:
F-16C/D

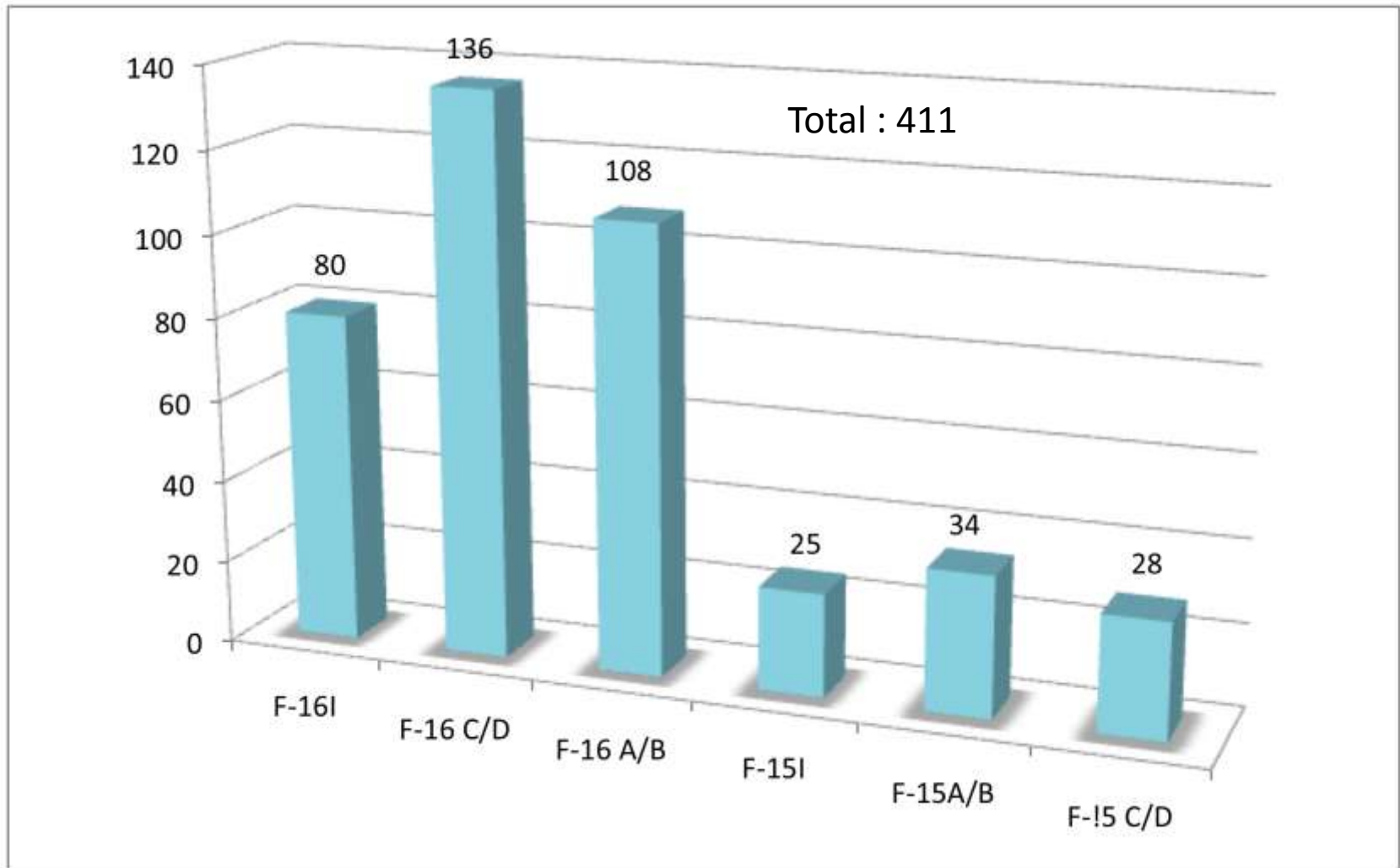
Ramon:
F-16I

Tel Nof:
F-15A/B
F-15C/D
F-15I
F-16A/B
F-16C/D

(Source:GlobalSecurity.org)



Israel Airforce Order of Battle 2008



(Source: Israeli-Syrian Air and SAM Strength Analysis. Cordesman and Toukan. CSIS, 10, November 2008)

Israel Ballistic Missiles

- Israel launched a Jericho II missile across the Mediterranean that landed about 250 miles north of Benghazi, Libya. The missile flew over 800 miles, and U.S. experts felt it had a maximum range of up to 900-940 miles (1,450 kilometers), which would allow the Jericho II to cover virtually all of the Arab world.
- The most recent version of the missile seems to be a two-stage, solid-fuel propellant with a range of up to 900 miles (1,500 kilometers) with a 2,200 pound payload.
- There are reports that Israel is developing a Jericho III missile, based on a booster it developed with South Africa in the 1980s. Jane's estimated that the missile has a range of up to 5,000 kilometers and a 1,000-kilogram warhead. This estimate is based largely on a declassified Defense Intelligence Agency estimate of the launch capability of the Shavit booster that Israel tested on September 19, 1988.

<u>System</u>	<u>Class</u>	<u>Payload</u>	<u>Warhead</u>	<u>Range (km)</u>	<u>Status</u>
Jericho I	Short Range Ballistic Missile (SRBM)	Single Warhead	450 kg; Nuclear 20KT; HE	500 km	Obsolete
Jericho II	Medium Range Ballistic Missiles (MRBM)	Single Warhead	Nuclear 1MT; HE	1500 km	Operational since 1990
Jericho III	Intercontinental Range Ballistic Missile	Single Warhead	750 Kg	4800 – 6500 km	Development Stage, Expected Service 2008

(Source: Israeli Weapons of Mass Destruction. An Overview Anthony H. Cordesman, CSIS, June 2008)

The Military Balance:

- GCC
- Iran

GCC States

- The Arab Gulf states have been investing heavily in the modernization and upgrading of their force structures. The United States, France and United Kingdom have been the major weapons suppliers.
- They also recognize that the assistance of outside regional powers will be required to deal with any military aggression in the region. As a result they have signed bilateral defense agreements with their Western allies - United States, Britain and France. In 2002 the GCC made a major security shift from a Common Security arrangement to a Joint Defense Pact which essentially is a Collective Security arrangement. Joint Defense Pact or Collective Security is directed against an aggressor coming from outside one's sphere.
- Agreement entails a commitment by each member to join the coalition and if one is attacked that implies an attack on the other partners. This being based either on defense in its traditional sense, or upon deterrence.
- The GCC has to plan its defenses so as to deter Iran or any other adversary. What they can do is to build their collective and national assets so as to provide a military deterrent sufficient to make any direct confrontation as costly as possible to Iran or any other adversary. It is in this deterrent role that lies the ultimate rationale for any GCC Joint Defense Pact and Cooperation.
- Two main considerations underlying the choice of a Military Doctrine by the GCC states have been: Balance of Forces and Strategic Depth. In particular for the Arabian Gulf "front line states" Kuwait, Bahrain, Qatar, UAE and Oman, the main concern would be strategic depth to an Iranian attack.
- Lack of Strategic Depth results in limitations on the area of operational maneuverability during conflict, time to respond, and an increase in the vulnerability of vital strategic economic centers due to the proximity to the borders. Saudi Arabia would be the only state that has strategic depth.
- When transformed into an operational doctrine, the GCC states would base their Force Structure Planning on:
 - Defensible Borders. Borders which can be defended without a pre-emptive initiative.
 - In parallel the capability to take the war to the enemy, fight on enemy territory.

GCC

- Concerns determining doctrine:
 - Balance of Forces
As the Balance of Forces is unfavorable then adopt
 - Technological Edge
 - Quality vs Quantity
 - Strategic Depth. None and therefore the need to take war to enemy territory.
- Force Structure Planning based on:
 - Defensible Borders
 - Take the war to the enemy, fight on enemy territory. Needs excellent C4ISR, near-real time situation awareness of the hostile and friendly military developments in the area, and their operational levels.
- Need to upgrade and further modernize conventional military capability to carry out such operational functions.
- The need to develop an Asymmetric Warfare capability.

Iran

- Concerns determining doctrine:

- Balance of Forces.

As the Balance of Forces is unfavorable then:

- Since Iran presently does not have access to modern technology weapon systems, it will need to Develop all ranges of Ballistic Missiles to compensate for deficiencies in conventional forces capabilities.

- No problem with Strategic Depth, can be an advantage fighting in and over familiar terrain.

- Force Structure Planning based on:

- High attrition rate inflicted on adversary civilians.
- In depth defense, as Iran has the strategic depth.

- Continue developing Asymmetric Warfare capabilities.

- As Iran sees it, the need and capability to develop Nuclear Weapons to further enhance Deterrence.

Weakness in the Operational Performance of the Iranian Air Force

- Long C4I Early Warning delay time due to antiquated System, semi-automated man in the loop.
- Long Response / Scramble Time by Combat Aircraft
- Low Operational Readiness Rate of Combat Aircraft
 - Need Improvement in maintenance operations
 - Need Improvement in supply of spare parts
- Low Combat Aircraft Sortie Rates, Sustained and Surge.
- High Loss Exchange Ratio in a Closing / BVR Environment and Visual Engagement Environment.
- Centralized Battle Management

Iran's Current Air/Missile Defenses

- U.S. never delivered integrated system before fall of Shah.
- Only modern short-range point defense system is TOR-M.
- Other short-range systems mix of older Russian system, SHORADs, and aging – possible inactive British and French systems.
- Medium to long-range systems are low capability or obsolescent.
- HAWKS and IHAWKs do not have capable ECM. Date back to 1960s and 1970s.
- Various versions of SA-2 obsolete.
- Radar sensor and battle management/C4I systems have major limitations.
- Less than 30 export versions of MiG-29, some not operational.
- F-14s do not have ability to use primary air defense missile since 1979-1980.

Gulf Land-Based Air Defense Systems in 2008

Country	Major SA	Light SAM	AA Gun
Bahrain	(8) IHAWK	(60) RBS-70 (18) FIM 92A Stinger (7) Crotale	(26) Guns (15) Orlikon 35mm (12) L/70 40mm
Iran	(16/150) IHAWK (3/10) SA-5 (45) SA-2 Guideline	SA-7/14/16 HQ-7 (29) SA-15; Some QW-1 Misaq (29) TOR-M1; Some HN-5 (30) Rapier; Some FM-80 (Ch Crotale) 15 Tigercat; Some FIM-92A Stinger	(1,700) Guns ZSU-23-4 23mm ZPU-2/4 23mm ZU-23 23mm M-1939 37mm S-60 57mm
Kuwait	(4/24) IHAWK Phase III (5) Patriot PAC-2	(6/12) Aspide (48) Starbust	12 Oerlikon 35mm
Oman	None	Blowpipe; (2) Mistral SP (34) SA-7; (6) Blindfire (20) Javelin; (40) Rapier S713 Martello	(26) Guns (4) ZU-23-2 23mm (10) GDF-(x)5 Skyguard 35mm (12) L-60 40mm
Qatar	None	(10) Blowpipe (12) FIM-92A Stinger (9) Roland II (24) Mistral (20) SA-7	
Saudi Arabia	(16/128) IHAWK (4-6/16-24) Patriot (17/141) Shahine Mobile (2-4/160) PAC-2 Launchers (17) ANA/FPS-117 Radar (73/68) Crotale Shahine	(40) Crotale (500) Stinger (ARMY) (500) Mistral (ADF) (500) FIM-43 Redeye (ARMY) (500) Redeye (ADF) (73-141) Shahine Static (500) FIM-92A Stinger (ARMY) (400) FIM-92A Avenger (ADF)	(1,220) Guns (92) M-163 Vulcan 20mm (30) N-167 Vulcan 20mm (NG) (850) AMX-30SA 30mm (128) GDF Orlikon 35mm (150) L-70 40mm (store) (130) M-2 90mm (NG)
UAE	(2/31) IHAWK	20+ Blowpipe (20) Mistral Some Rapier/Crotale/ RB-70/Javelin/SA-18	(62) Guns (42) M-3VDA 20mm SP (20) GCF-BM2 30mm

(Source: Iranian Weapons of Mass Destruction. Anthony Cordesman SCIS)

Iran TOR-M Short Range Air Defense

- Russia has delivered an undetermined number — possibly 29 --Tor-M1 systems (originally built for Greece) to the Islamic Republic of Iran, along with service contracts with an approximate value of \$700,000,000.
- The Tor is low- to medium-altitude, short-range surface-to-air missile system designed for engaging airplanes, helicopters, cruise missiles, precision guided munitions, unmanned aerial vehicles and ballistic targets. NATO reporting names are SA-15 Gauntlet and SA-N-9 Gauntlet. It is designed to protect targets from attack day or night in any weather, not only by shooting down attacking aircraft but also by destroying any munitions before they reach their target.
- From the start the Tor system was designed to provide air defense against modern and future threats equipped with precision guided weapons like the AGM-86 ALCM.
- Tor missile system was accepted into service on the 19th March 1986. The Tor-M1 air has an additional fire control channel allowing two targets to be engaged at once, an improved optical channel, computer, ECM protection and warhead The Tor-M1-1 or Tor-M1V has improved network connectivity and ECM functions. The latest variant -- the Tor-M2E—has improved fire control radar coverage and four guidance channels allowing four missiles to be guided at any one time, plus a new wheeled chassis as well as a new digital computer system and a new all weather optical tracking system.
- Each 9K331 vehicle is a completely autonomous transporter, launcher, and radar unit TLAR that carries a modern phased array radar and 8 missiles stored vertically, ready to fire.
- Target tracking range is 24 km (15 miles), engagement range is up to 12 km (1-7.5 miles) with minimum range varying between 100-2000 m (328-5,621 feet), depending upon version. Effective Altitude is 10-6000m (33-20,000 ft).
- The digital computers allow for a high degree of automation, similar to the US Patriot missile system. Target threat classification is automatic. The system can be operated with little operator input, if desired. It is equipped with NBC (nuclear, biological and chemical) protection.
- The missiles utilize command guidance and their detonation is via a radar proximity fuze. The missiles can maneuver at up to 30Gs and can engage targets flying at up to Mach 2.

(Source: Anthony Cordesman Security Challenges and Threats in the Gulf: A Net Assessment. September 2008)

Medium to Long Range Surface To Air Missile Systems

Air Defense System	Associated Early Warning/Acquisition Radars	Associated Tracking & Guidance Radars	Missile Ranges (km) Altitude (ft)	In Service Date
SA-2	Spoon Rest D (P-18) Flat Face A (P-15)	Fansong A/B	Max (km): 40 Min (km) : 8 Altitude (ft): 3,000 to 90,000	1971 Upgraded
SA-3	Flat Face B (P-19) Squat Eye	Low Blow	Max (km) : 30 Min (km) : 6 Altitude (ft): 150 to 160,000	1971
SA-6	Long Track (P-40) Height Finder: Thin Skin B (PRV-9)	Straight Flush	Max (km): 24 Min (km) : 4 Altitude (ft): 50 to 45,000	1973
SA-8	Flat Face B (P-19) Long Track (P-40) Height Finder: Thin Skin B (PRV-9)	Land Roll	Max (km) : 15 Min (km) : 0.2 Altitude (ft): 40 to 40,000	1982
SA-5	Back Trap (P-80) Tall King C (P-14) Spoon Rest D (P-18) Height Finder: Odd pair (PRV-13) Odd Group (PRV-16)	Square Pair	Max (km) : 250 Min (km) : 20 Altitude (ft): 1,500 to 130,000	1983
IHAWK	AN/MPQ-50 AN/MPQ-55(PIP II)/62 (PIP III) Range only Radar	AN/MPQ-57 (PIP II)/61 (PIP III)	Max (km): 35 Min (km): 3 Altitude (ft): 0 to 55,000 ft	1971
Patriot PAC-2	AN/MPQ-53 Phased-Array Radar Carries out Search, target detection, track and identification, missile tracking and ECCM functions	AN/MSQ-104 Engagement Control Station (ECS)	Max (km): 70 Min (km): 3 Altitude (ft): 80,000	1990

• For SAM kill envelopes See Appendix II

Air Bases & Combat Aircraft Order of Battle (2009)

Iran	158
Saudi Arabia	262
Bahrain	21
Kuwait	39
Oman	12
Qatar	12
UAE	142



Air Bases Source: Global Security.org
Order of Battle Source: Anthony Cordesman CSIS

Iran Airbases

Tabriz	F-5E/F, MiG-29
Hamadan	F-4E/D, Su-24
Dezful	F-5E/F
Bushehr	F-4E/D, F-14
Bandar Abbas	2 Helicopter Wings
Shiraz	Su-25, Su-24
Esfahan	F-5E, Su-24
Tehran	MiG-29, Su-24
Zahedan	F-7M
Kermanshah	F-5E/F

Three Main Iranian Nuclear Facilities

- Natanz: Uranium Enrichment Facility
- Arak: Heavy Water Nuclear Reactor and Possible Future Plutonium Production Reactor
- Esfahan: Nuclear Research Center. Uranium Conversion Facility (UCF)

	Iran	S.A.	Bahrain	Kuwait	Oman	Qatar	UAE
MiG-29	25	-	-	-	-	-	-
Su-24/25	43	-	-	-	-	-	-
F-14	25	-	-	-	-	-	-
F-4E/D	65	-	-	-	-	-	-
Tornado ADV	-	22	-	-	-	-	-
Tornado IDS	-	85	-	-	-	-	-
F-15S	-	71	-	-	-	-	-
F-15C/D	-	84	-	-	-	-	-
F-16C/D	-	-	21	-	12	-	80
F-18	-	-	-	39	-	-	-
M2000	-	-	-	-	-	12	62

GCC Airforce Tactical Fighter Capabilities - 2009

Type	Order of Battle	Operational Ready %	Force Available	Force Sorties per Day	Postulated Employment
Tornado IDS	Saudi Arabia: 25	75	19	57	Deep Strike
Tornado ADV	Saudi Arabia: 85	75	64	192	FS, BAS, AD, Escort
Mirage 2000	UAE: 62 Qatar: 12 (Total: 74)	75	UAE: 46 Qatar: 9 (Total: 55)	UAE: 138 Qatar: 27 (Total: 165)	FS, BAS, AD, Escort
F-18	Kuwait: 39	75	29	87	FS, BAS, AD, Escort, CAS, BI, SEAD
F-16C/D	Bahrain: 21 Oman: 12 UAE: 80 (Total: 113)	75	Bahrain: 16 Oman: 9 UAE: 60 (Total: 85)	Bahrain: 48 Oman: 27 UAE: 180 (Total: 255)	FS, BAS, AD, Escort, CAS, BI
F-15C/D	Saudi Arabia: 84	75	63	189	FS, BAS, AD, Escort, CAS, BI
F-15S	Saudi Arabia: 71	75	53	160	Deep Strike, FS, AD, Escort, CAS, BI
Total	491		368	1,105	

FS: Fighter Sweep, BAS: Battlefield Air Superiority, AD: Air Defense,
CAS: Close Air Support (Air to Ground Role), BI: Battle Field Interdiction (Air to Ground Role)
SEAD: Suppression of Enemy Air Defense

Sustained Conditions : 12 hr Operational Day
18 hr Maintenance Day
3 Sorties per aircraft per day

Iran Airforce Tactical Fighter Capabilities - 2009

Type	No	Operational Readiness (%)	Force Available	Total Sortie Per Day	Postulated Employment
MiG-29A	25	60	15	30	Air Defense/Escort/FS/BAS
Su-25	13	60	8	16	CAS/BI/Deep Strike
SU-24	30	60	18	36	CAS/BI/Deep Strike
F-14	25	60	15	30	Air Defense/FS CAS/BI/Deep
F-4E/D	65	69	39	78	Strike/SEAD
Total	158		95	190	

BAS: Battlefield Air Superiority

CAS: Close Air Support

BI: Battlefield Interdiction

DS: Defense Suppression

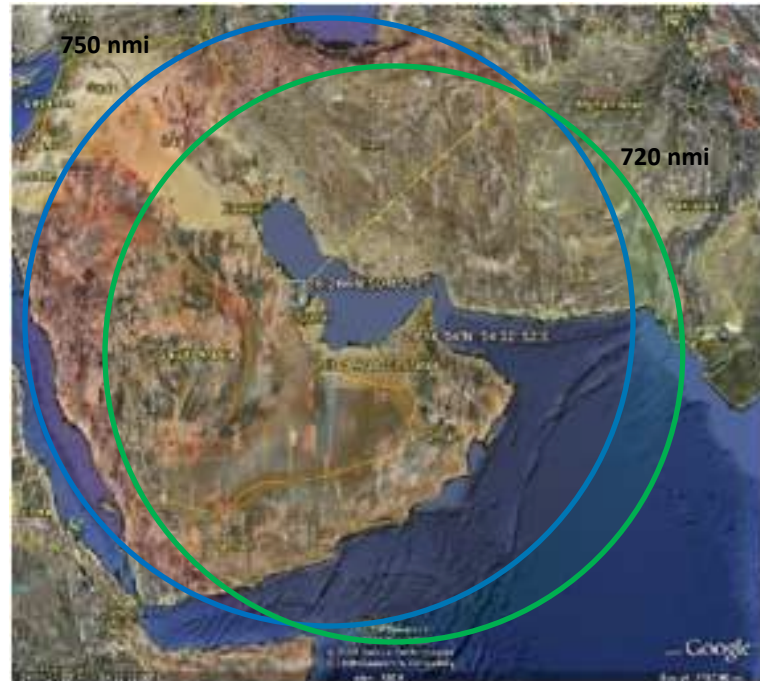
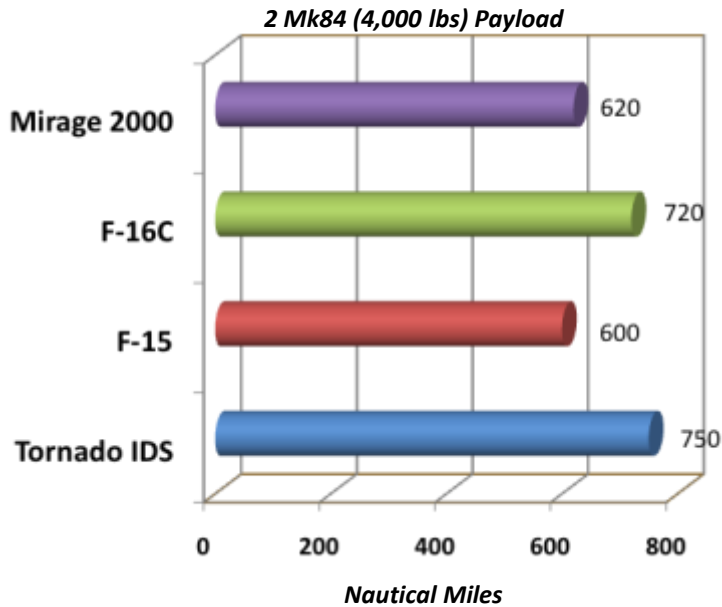
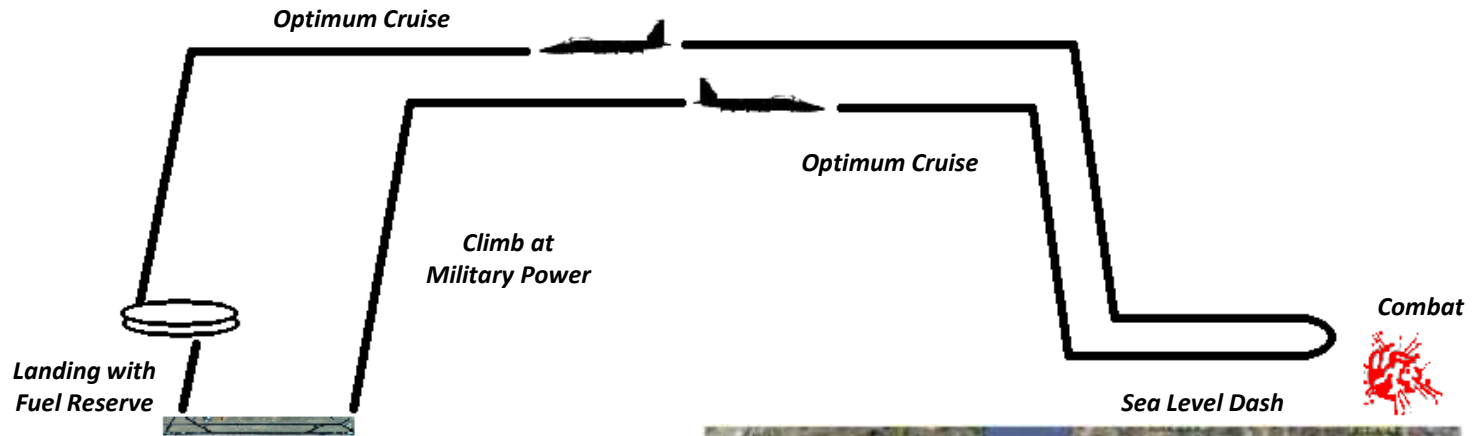
FS: Fighter Sweep

Sustained Conditions : 12 hr Operational Day

18 hr Maintenance Day

2 Sorties per Aircraft per day

Air to Ground Ranges of GCC Aircraft Hi-Lo-Lo-Hi Profile (External Fuel Tanks Dropped on Combat)



- Tornado IDS/F-15 Launched from King Abdulaziz Air Base
- F-16C/Mirage 2000 Launched from UAE

Air to Ground Ranges of Iranian Air Force



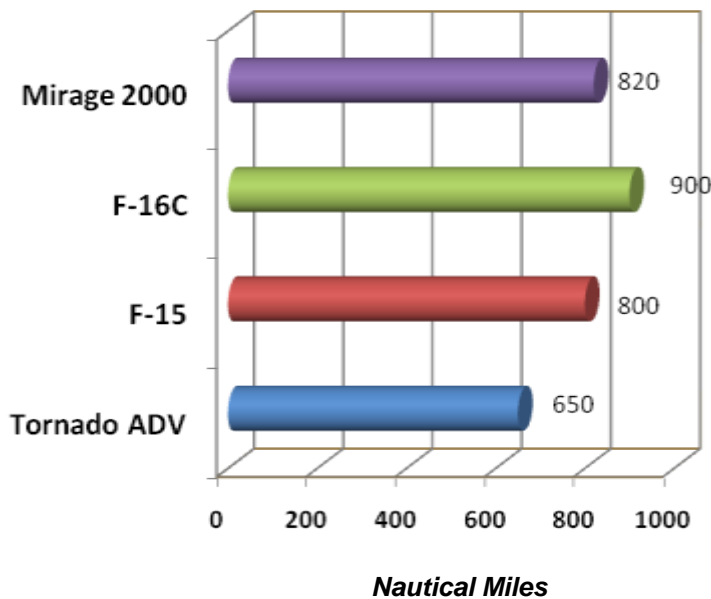
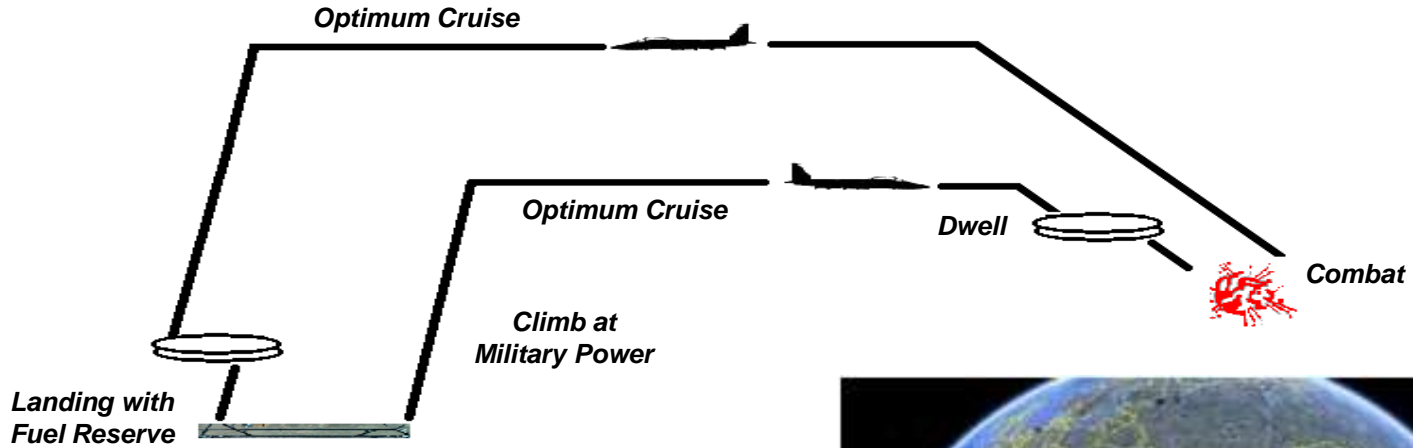
Mission Profile: Hi-Lo-Hi

F-4E (Bushehr):
(4) MK83 1000lb Bombs
(1) 600 Gallon Fuel Tank
10 Minutes loiter time
Range = 400 nmi

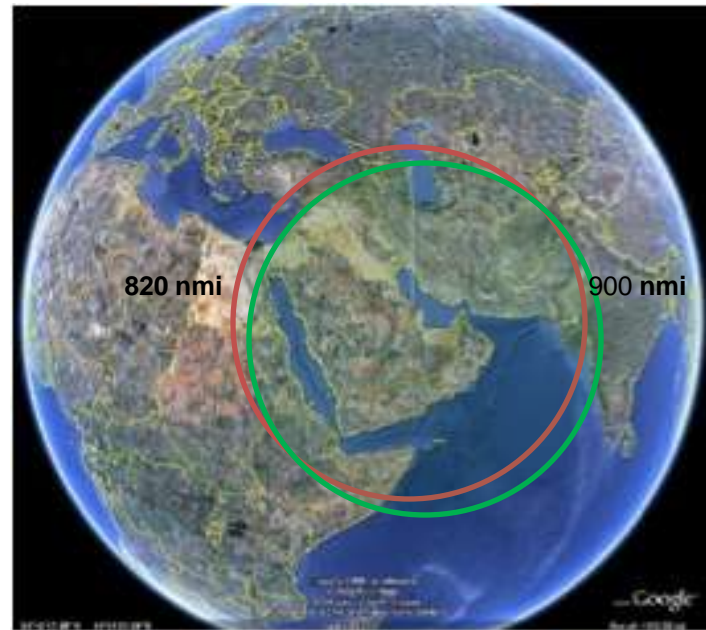
SU-24 (Shiraz):
(4) 500 kg/1000 lb Bombs
(1) 400 gallon tank
10 minutes loiter time
Range = 590 nmi

SU-25 (Shiraz):
(4) 500kg/1000lb Bombs
(1) 400 gallon tank
(2) 10 minutes loiter time
Range = 600 nmi

**Air to Air Ranges of GCC Aircraft
Air Superiority Mission
(External Fuel Tanks Dropped)**



**4 AAMs Payload
Zero Dwell Time**



- Tornado ADV/F-15 Launched from King Abdulaziz Air Base
- F-16C/Mirage 2000 Launched from UAE

Air Superiority Ranges of Iranian Air Force



F-4E (Bushehr):
 (2) AIM-7E
 (4) AIM-9
 (2) 370 Gallon Fuel Tank
 30 Minutes loiter time
 Range = 300 nmi
 80 Minutes loiter time
 Range = 100 nmi

MiG-29 (Bushehr)
 (2) R-27 (AA-10)
 (4) R-73 (AA-11)
 (1) 400 Gallon Fuel Tank
 15 Minutes Loiter Time
 Range = 350 nmi

Air Bases Source: Global Security.org
 Order of Battle Source: Anthony Cordesman CSIS

Iran's Current Air/Missile Defenses

- U.S. never delivered integrated system before fall of Shah.
- Only modern short-range point defense system is TOR-M.
- Other short-range systems mix of older Russian system, SHORADs, and aging – possible inactive British and French systems.
- Medium to long-range systems are low capability or obsolescent.
- HAWKS and IHAWKS do not have capable ECM. Date back to 1960s and 1970s.
- Various versions of SA-2 obsolete.
- Radar sensor and battle management/C4I systems have major limitations.
- Less than 30 export versions of MiG-29, some not operational.
- F-14s do not have ability to use primary air defense missile since 1979-1980.

(Source: Anthony Cordesman Security Challenges and Threats in the Gulf: A Net Assessment. September 2008)

Tactical Ballistic Missiles Threat:

- Iran's ballistic missiles cover the complete spectrum range from 150 km up to 5,500 km, the Short, Medium, and Intermediate Ranges of Ballistic Missiles. Iran believes that these will compensate for any deficiencies in its Air Power.
- Deploying Ballistic Missiles against military targets would require a number that is very likely to be beyond what the Inventory in Iran is. For instance to close one airfield 9000ft in length and 200 ft in width (leaving 3000ft of Minimum Clear Length and 50ft Minimum Clear Width), using a Shahab II class missile with a range of 500km and a 700kg warhead would require some 250 missiles.
- For Suppression of Enemy Air Defense (SEAD) Missions, just to destroy 1 radar, 18 missiles would be required. This is not taking into consideration that the tactical radar site could be mobile which would then require near real time intelligence information on the exact location and definitely more missiles will have to be allocated.
- On the other hand, Ballistic Missiles can be used with success against Soft Targets, in open areas and cities to inflict maximum human casualties and create terror. In essence what is considered as a major component in Asymmetric Warfare in the form of high civilian casualties.

Iran

SRBM < 1000 km	MRBM 1,000 – 3,000 km	IRBM 3,000 – 5,500 km	ICBM > 5,500 km
Shahab-1	Shahab-3	Shahab-5	Shahab-6
Shahab-2	Shahab-4	-	-
Mushak-120	Ghadr-101	-	-
Mushak-160	Ghadr-110	-	-
Mushak-200	IRIS	-	-
-	Sajil	-	-

Syria

SRBM < 1000 km	MRBM 1,000 – 3,000 km	IRBM 3,000 – 5,500 km	ICBM > 5,500 km
SCUD-B	-	-	-
SCUD-C	-	-	-
SCUD-D	-	-	-
SS-21b	-	-	-

Israel

SRBM < 1000 km	MRBM 1,000 – 3,000 km	IRBM 3,000 – 5,500 km	ICBM > 5,500 km
-	Jericho II	-	Jericho II

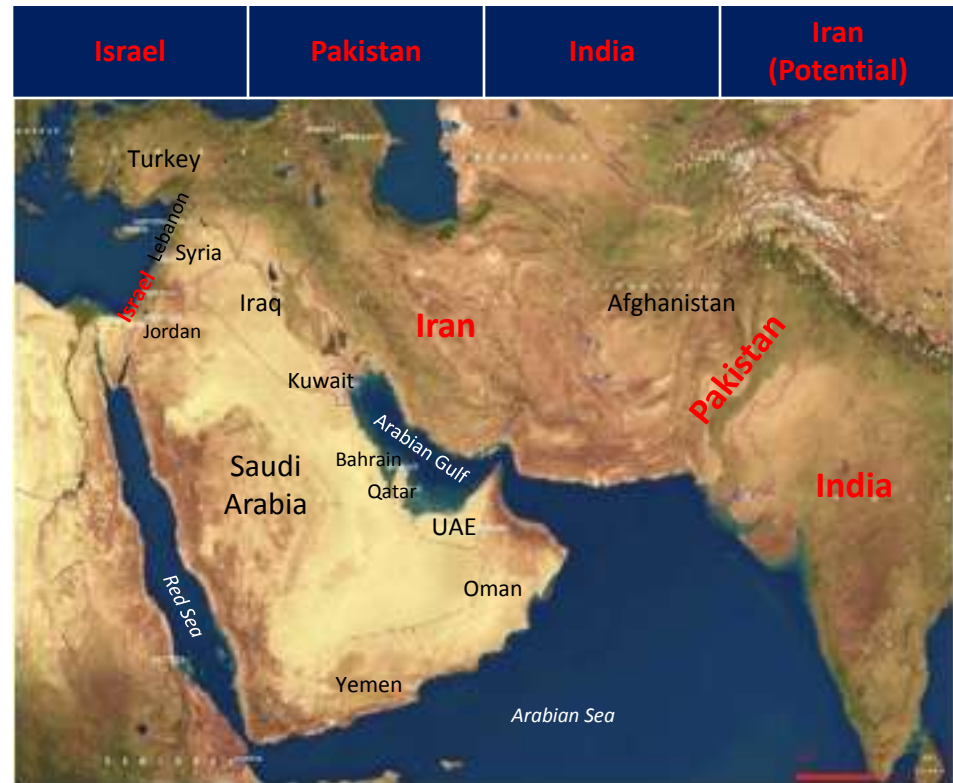
Pakistan

SRBM < 1000 km	MRBM 1,000 – 3,000 km	IRBM 3,000 – 5,500 km	ICBM > 5,500 km
Shaheen I	Shaheen II	-	-
Hatf I	Ghauri I	-	-
Hatf II	Ghauri II	-	-
Hatf III	Ghauri II	-	-
M-11	-	-	-

India

SRBM < 1000 km	MRBM 1,000 – 3,000 km	IRBM 3,000 – 5,500 km	ICBM > 5,500 km
Agni I	Agni II	Agni III	Surya
Prithvi I			
Prithvi II			

States with Nuclear Weapons



Iran has been heavily investing in:

- Precision Strike Munitions
- Naval-anti-ship weapons such as the Chinese C802 that hit the Israeli Navy ship during the 2006 war in Lebanon and the Ra'ad 350 km anti-ship missile.
- Ballistic Missiles
- Cruise Missiles such as the Kh55 Russian land attack cruise missile.
- Nuclear Program

This arsenal of Ballistic Missiles possessed by Iran has been declared to be for defensive purposes against any foreign invasion, in particular against the U.S. However, it has become very clear that it is an arsenal that is intended to inflict maximum casualties and damage, in essence a major component for Asymmetric Warfare in the form of high attrition and defenses in depth and to compensate for any deficiencies in its Air Power.

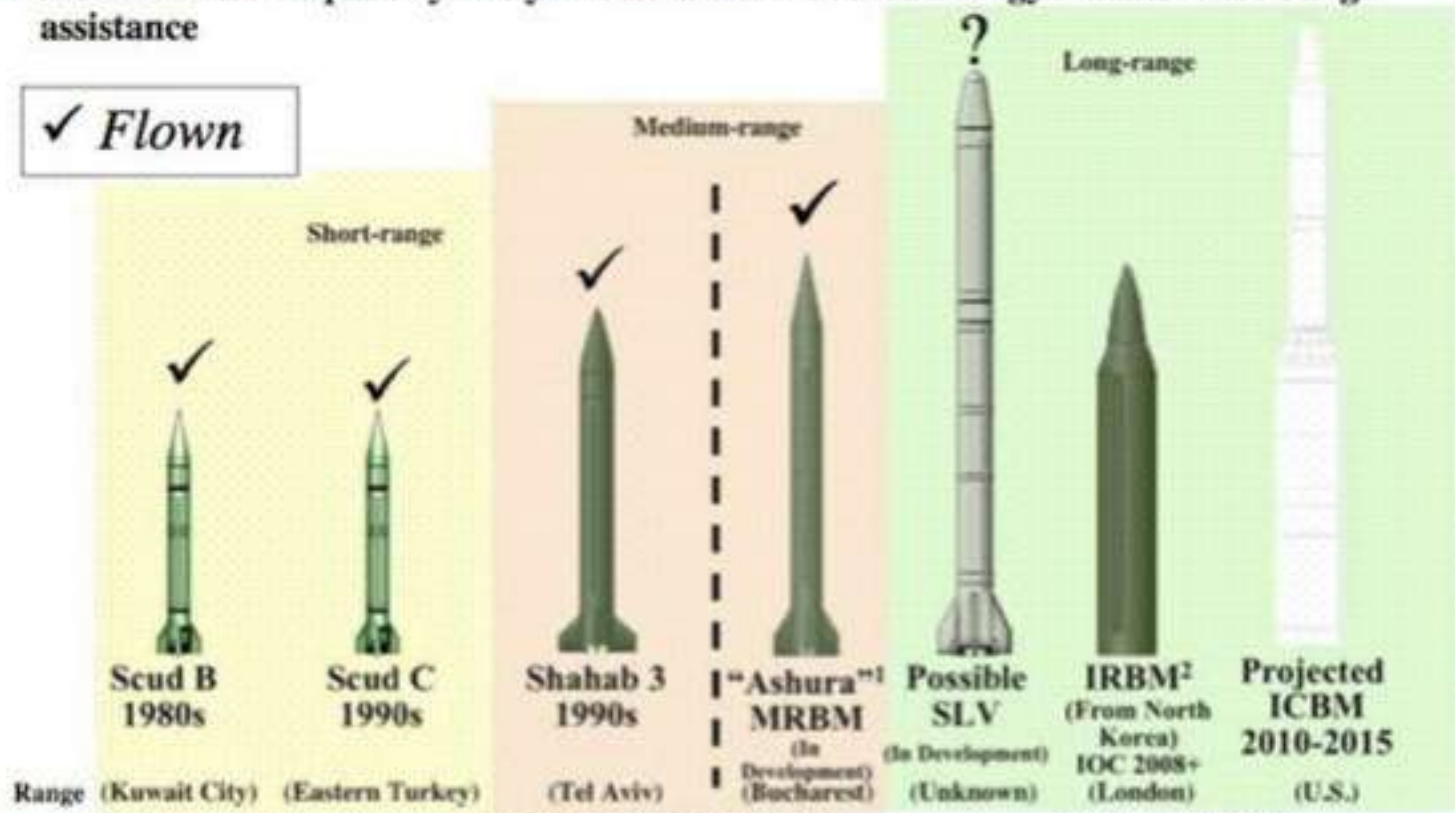
Stages of Development of Iran's Missiles

Designation	Stages	Progenitor Missiles	Propellant	Range (Km)	Payload (Kg)	IOC (Year)	Inventory
Mushak-120	1	CSS-8, SA-2	Solid	130	500	2001	?
Mushak-160	1	CSS-8, SA-2	Liquid	160	500	2002	?
Mushak-200	1	SA-2	Liquid	200	500	NA	0
Shahab-1	1	Soviet SSN-4, N Korean SCUD B	Liquid	300	987-1,000	1995	250-300
Shahab-2	1	Soviet SSN-4, N Korean SCUD C	Liquid	500	750-989	?	200-450 (these are very high estimates)
Shahab-3	1	N Korea Nodong-1	Liquid	1,300	760-1,158	2002	25-100
Shahab-4	2	N Korea Taep'o-dong-1	Liquid	3,000	1,040-1,500	NA	0
Ghadr 101	multi	Pakistan Shaheen-1	Solid	2,500	NA	NA	0
Ghadr 110	multi	Pakistan Shaheen-2	Solid	3,000	NA	NA	0
IRIS	1	China M-18	Solid	3,000	760-1,158	2005	NA
Kh-55	1	Soviet AS-15 Kent, Ukraine	jet engine	2,900-3,000	200kg nuclear	2001	12
Shahab-5	3	N Korea Taep'o-dong-2	Liquid	5,500	390-1,000	NA	0
Shahab-6	3	N Korea Taep'o-dong-2	Liquid	10,000	270-1,220	NA	0

Source: Adapted from [Iran Special Weapons Guide](http://www.globalsecurity.org/wmd/world/iran/missile.htm), Global Security.org, available at: <http://www.globalsecurity.org/wmd/world/iran/missile.htm>

Iranian Missile Developments

- Iranian missile capability likely to accelerate due to technology transfer and foreign assistance



***"Iran continues to develop and acquire ballistic missiles that can hit Israel and central Europe"* – General Maples, Director of U.S. Defense Intelligence Agency**

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Iranian Ballistic Missile Threat

• Long-Range Ballistic Missiles

- New Intermediate Range Ballistic Missile or Space Launch Vehicle (SLV) in development
- Likely to develop ICBM/SLV ... could have an ICBM capable of reaching the U.S. before 2015



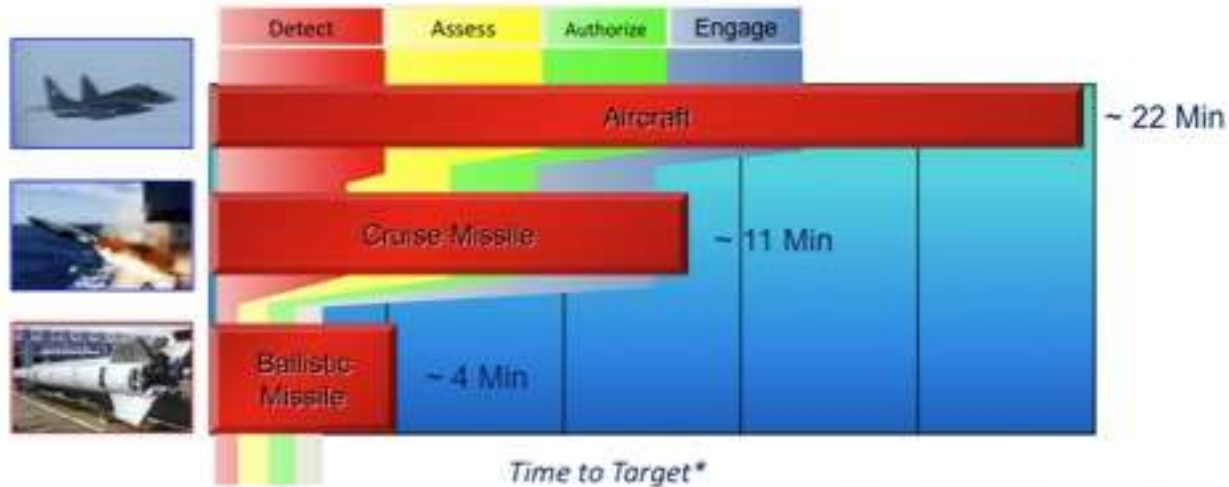
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Shahab 3/3A

Range (km)	Payload (kg)
1,350	1,158
1,400	987
1,500	760
1,540	650
1,560	590.27
1,580	557.33
1,600	550
1,780	240
2,000	0

(Source: Missile Defense Program Overview for the European Union, Committee on Foreign Affairs, Subcommittee on Security and Defense. Dr. Patricia Sanders. Executive Director. Missile Defense Agency)

Missile Defense Challenge



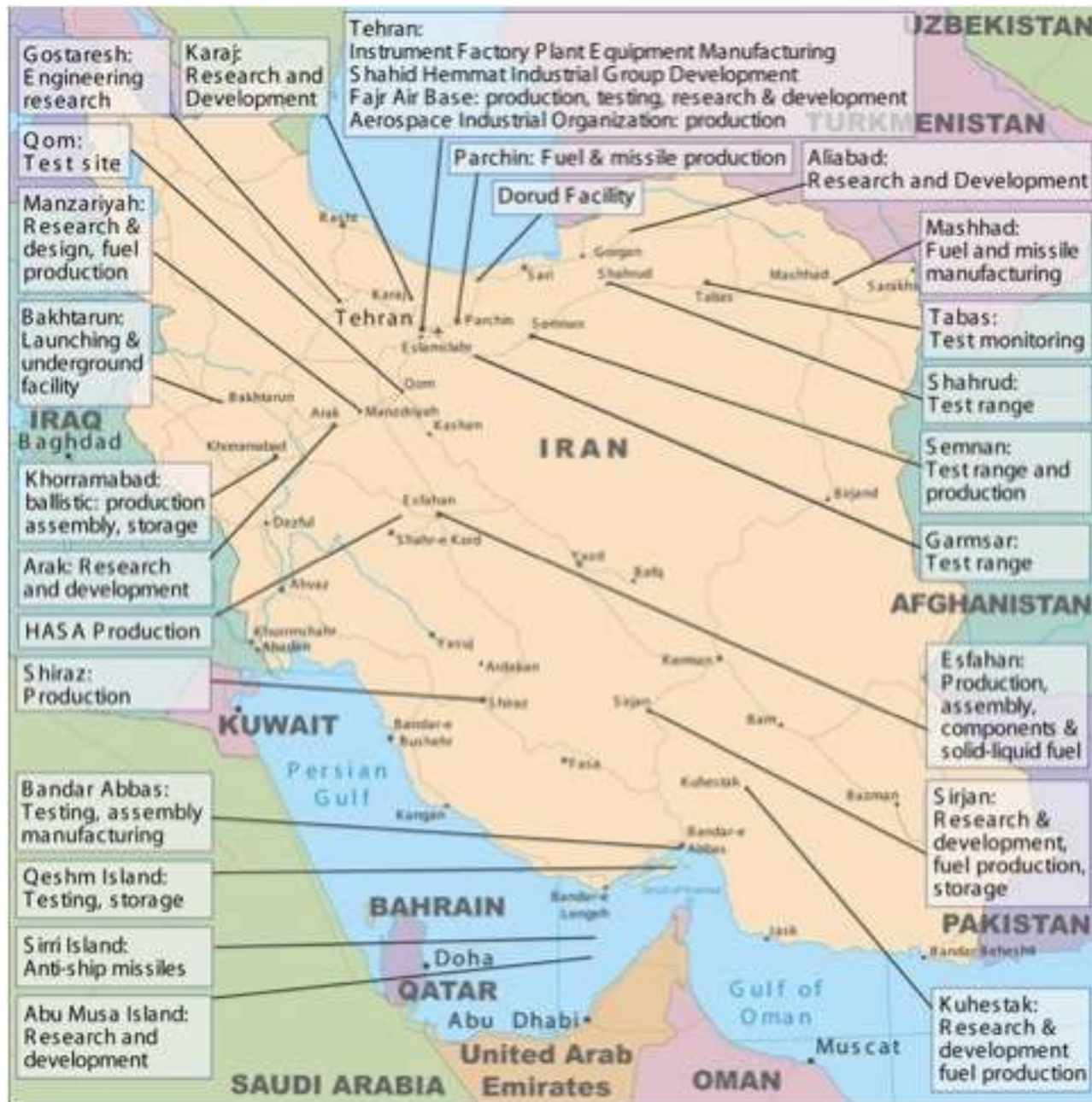
* Based on Approximate Range of 320 Km

Responsive Missile Defense System is Crucial

(Dennis Gavin, "Counterforce Capabilities Against Cruise and Ballistic Missiles", MEMAD 14 & 15 December, 2008)

Range (Km)	Class	Burn-out velocity (km/sec)	Boost Phase (sec)	Flight Time (min)
120	SRBM	1.0	16	2.7
500	SRBM	2.0	36	6.1
1,000	SRBM	2.9	55	8.4
2,000	MRBM	3.9	85	11.8
3,000	MRBM	4.7	122	14.8

Iran: Missile Sites



(Source:NTI)

Iranian UAV Projects / Assets 2009

Prime Manufacturer	Designation	Development / Production	Operation	Payload Wt.	Endurance (hr)	Range	Ceiling (ft)	Mission
Unknown	Stealth	Underway / Underway	Deployed			700 km		R/S*
HESA	Ababil (Swallow)	Complete / Underway	Deployed	45 kg	1.5+	150 km	14,000	Multiple variants for R/S* - attack - ISR**
Shahbal Group, Sharif Univ.	Shahbal	Underway		5.5 kg		12 km	4,500	R/S*
Asr-e Talai Factories	Mini-UAV	Underway						Surveillance
FARC	Sobakbal	Underway / Underway	Deployed	0.35 kg	2	2.7 - 13.5 mi	19,686	Surveillance
Qods Aeronautics Industries	Mohajer II/III (Dorna); Mohajer IV (Hodhod); Saeqeh I/II; Tallash I/Endeavor; Tallash II Hadaf 3000	Complete / Underway	Deployed					Multirole aka Lightning Bolt Target drone - aka Target 3000

Source: Adapted by Adam C. Seitz from AIAA Aerospace 2009 Worldwide UAV Roundup; available at: http://www.aiaa.org/Aerospace/images/articleimages/pdf/UAVs_APR2009.pdf.

*R/S: Reconnaissance / Surveillance; **ISR: Intelligence / Surveillance / Reconnaissance

Options:
Dialogue & Sanctions

- The United States recognizes Iran as having sovereign right to peaceful civilian nuclear power, but does not have the right to Nuclear Weapons as stipulated in the Nuclear Non-Proliferation Treaty (NPT). To the United States, Iran is in violation of the IAEA safeguards, and the United Nations Security Council Resolutions. These are also becoming the findings of the International Community and Institutions, and not those of the United States alone.
- Early in his administration, Obama had said he would give the Iranians until the end of 2009 to change their policy on nuclear weapons development. But the end of 2009 came, and the Iranians continued their policy. All along, Obama has focused on diplomacy on the Iran question.
- Some recommend that the U.S. should remain open to dialog and negotiations with Iran. However, It should be made clear to Iran, as the U.S. Secretary of State Hilary Clinton said, that the U.S. administration will work to impose a “crippling” sanctions on Iran “in the event that the offers presented are either rejected or the process is inconclusive or unsuccessful”.
- On 21 September 2009, Iran informed the IAEA that it had decided “to construct a new pilot fuel enrichment plant”, the Fordow Fuel Enrichment Plant (FFEP), located near the city of Qom. The Agency verified that FFEP is being built to contain sixteen cascades, with a total of approximately 3000 centrifuges.
- On Sept. 25, 2009, President Obama and leaders of Britain and France accused Iran of building a secret underground plant, known as “Fudrow” to manufacture nuclear fuel, saying the country has hidden the covert operation from international weapons inspectors for years.
- In talks with the United States and other major powers on Oct.1, the first such discussions in which the United States has participated fully, Iran agreed to open the newly revealed plant to international inspection within two weeks. Iran initially agreed in negotiations with the P5+1 (five permanent members of the UNSC plus Germany) to ship 70% (1,200 kg) declared Low Enriched Uranium (LEU) to Russia for further 20% enrichment and then to France for processing into fuel rods that can be used in the Medical Research Reactor facility in Tehran. In this way the deal reduces the LEU in Iran below the quantity needed which when enriched further could become weapons grade Highly Enriched Uranium (HEU).
- A month later, Iran stated that it would want the nuclear fuel to be delivered to Iran and its handing over of the LEU Stockpile to take place simultaneously in Iran. The P5+1 have been insisting that Iran transfer all of its LEU before any reactor fuel is shipped to Iran.

- Iranian President Mahmoud Ahmadinejad was quoted as saying by the Iranian Fars news agency that Iran has produced its first package of 20%-enriched uranium and provided to scientists. Iranian officials also said that 10 new enrichment facilities would be constructed within the next year.
- The head of the Atomic Energy Organization of Iran said Thursday that Iran's 20% uranium enrichment is proceeding "very well" and that Tehran has the capacity to enrich uranium to 100% but does not have the intention to do so, unless Iran needs to.
- Iran notified the UN nuclear watchdog of plans to produce 20% enriched uranium, saying it could not wait any longer to reach an agreement, based on its proposals, on exchanging its LEU uranium for 20% enriched uranium that will be used for its medical research reactor in Tehran.
- Iran's move to begin enriching uranium to 20% drew strong criticism from U.S. President Barack Obama, who reacted by stating that Washington and its allies would begin developing "significant" new sanctions against Iran. The move by Iran to enrich uranium up to 20% could very likely spur the UN Security Council to agree on tougher economic sanctions.
- Speaking in Italy, US Defense Secretary Robert Gates said:
 "If the international community will stand together and bring pressure to bear on the Iranian government, I believe there is still time for sanctions and pressure to work," Mr. Gates said following meetings with his Italian counterpart. "But we must all work together."
- Speaking at a joint Riyadh news conference with Mrs. Clinton, Saudi Arabia's Foreign Minister Prince Saud said: "Sanctions are a long term solution. They may work, we can't judge. "But we see the issue in the shorter term maybe because we are closer to the threat... So we need an immediate resolution rather than a gradual resolution."
- According to a report by Spiegel Online, the European Union is preparing to impose stiff sanctions against Iran in the energy and financial sectors, where the regime is particularly vulnerable, and will have a serious impact on the Iranian economy. The most crippling sanction would be stopping Iran's gasoline imports, as Tehran imports about 40 percent of its gasoline. These go beyond the typical sanctions such as: trade embargo on military equipment and dual use technologies, nuclear products, travel bans on Iranian officials involved in the Nuclear program.

- On September 25, 2009, U.S. President Obama, French President Sarkozy, and British Prime Minister made the following statements on the new Iranian Nuclear facility near Qom:

President Obama:

“Earlier this week, the Iranian government presented a letter to the IAEA that made reference to a new enrichment facility, years after they had started its construction. The existence of this facility underscores Iran's continuing unwillingness to meet its obligations under U.N. Security Council resolutions and IAEA requirements. We expect the IAEA to immediately investigate this disturbing information, and to report to the IAEA Board of Governors.

Now, Iran's decision to build yet another nuclear facility without notifying the IAEA represents a direct challenge to the basic compact at the center of the non-proliferation regime. These rules are clear: All nations have the right to peaceful nuclear energy; those nations with nuclear weapons must move towards disarmament; those nations without nuclear weapons must forsake them. That compact has largely held for decades, keeping the world far safer and more secure. And that compact depends on all nations living up to their responsibilities.

This site deepens a growing concern that Iran is refusing to live up to those international responsibilities, including specifically revealing all nuclear-related activities. As the international community knows, this is not the first time that Iran has concealed information about its nuclear program. Iran has a right to peaceful nuclear power that meets the energy needs of its people. But the size and configuration of this facility is inconsistent with a peaceful program. Iran is breaking rules that all nations must follow -- endangering the global non-proliferation regime, denying its own people access to the opportunity they deserve, and threatening the stability and security of the region and the world.

It is time for Iran to act immediately to restore the confidence of the international community by fulfilling its international obligations. We remain committed to serious, meaningful engagement with Iran to address the nuclear issue through the P5-plus-1 negotiations. Through this dialogue, we are committed to demonstrating that international law is not an empty promise; that obligations must be kept; and that treaties will be enforced.

And that's why there's a sense of urgency about the upcoming meeting on October 1st between Iran, the permanent members of the U.N. Security Council, and Germany. At that meeting, Iran must be prepared to cooperate fully and comprehensively with the IAEA to take concrete steps to create confidence and transparency in its nuclear program and to demonstrate that it is committed to establishing its peaceful intentions through meaningful dialogue and concrete actions.

To put it simply: Iran must comply with U.N. Security Council resolutions and make clear it is willing to meet its responsibilities as a member of the community of nations. We have offered Iran a clear path toward greater international integration if it lives up to its obligations, and that offer stands. But the Iranian government must now demonstrate through deeds its peaceful intentions or be held accountable to international standards and international law.”

President Sarkozy:

”I have recalled all the attempts that we have made to offer a negotiated solution to the Iranian leaders without any success, which what has been revealed today is exceptional. Following the enriching plant of Natanz in 2002, it is now the Qom one which is revealed. It was designed and built over the past several years in direct violation of resolutions from the Security Council and from the IAEA. I am expecting from the IAEA an exhaustive, strict, and rigorous investigation, as President Obama just said.

We were already in a very severe confidence crisis. We are now faced with a challenge, a challenge made to the entire international communities. The six will meet with the Iranian representatives in Geneva. Everything -- everything must be put on the table now.

We cannot let the Iranian leaders gain time while the motors are running. If by December there is not an in-depth change by the Iranian leaders, sanctions will have to be taken.”

Prime Minister Brown:

”Iran's nuclear program is the most urgent proliferation challenge that the world faces today.

As President Obama and President Sarkozy have just said, the level of deception by the Iranian government, and the scale of what we believe is the breach of international commitments, will shock and anger the whole international community, and it will harden our resolve.

Confronted by the serial deception of many years, the international community has no choice today but to draw a line in the sand. On October the 1st, Iran must now engage with the international community and join the international community as a partner. If it does not do so, it will be further isolated.

And I say on behalf of the United Kingdom today, we will not let this matter rest. And we are prepared to implement further and more stringent sanctions.”

In talks with the United States and other major powers on Oct.1, the first such discussions in which the United States has participated fully, Iran agreed to open the newly revealed plant to international inspection within two weeks.

Iran initially agreed in negotiations with the P5+1 (five permanent members of the UNSC plus Germany) to send 70% declared Low Enriched Uranium (LEU) abroad where it will be converted into fuel, or replaced by France with fuel, that can be used in the Medical Research Reactor facility in Tehran. In this way the deal reduces the LEU in Iran below the quantity needed which when enriched further could become weapons grade Highly Enriched Uranium (HEU).

A month later, Iran stated that it would want the nuclear fuel to be delivered to Iran and its handing over of the LEU Stockpile to take place simultaneously in Iran. The P5+1 have been insisting that Iran transfer all of its LEU before any reactor fuel is shipped to Iran.

- Some recommend that the U.S. should remain open to dialog and negotiations with Iran, even after December 31, 2009. However, It should be made clear to Iran, as the U.S. Secretary of State Hilary Clinton said, that the U.S. administration will work to impose a “crippling” sanctions on Iran “in the event that the offers presented are either rejected or the process is inconclusive or unsuccessful”.
- There is the suspicion that Iran wants to start an open ended dialog and negotiations to buy time to reduce pressure for sanctions, use it as a screen to crush all domestic opposition and unrest, with no commitments to terminate its pursuit of nuclear weapons.
- Iran to use the process domestically showing that the hard line stance of the regime, in not making any concessions, has made the West respect and acknowledge Iran’s sovereign right to pursue Nuclear Power.
- To show that there exists cooperation with the IAEA and it accepts a limited freeze, making sure it does not alter its fundamental aim and program in developing a knowledge in the enrichment of Uranium. As an enrichment program in Iran will give it the option to “breakout” of the NPT, and move towards the production of nuclear weapons. Furthermore, Iran will not accept any “Rollback” of its enrichment program.
- The current U.S. position towards Iran is based upon the choice of:
 - Further sanctions and containment if Iran continues its pursuit of Nuclear Weapons, plus prepositioning Defensive Military Systems in the Gulf States and developing defense corporation or;
 - Start a dialog with wider economic incentives if it abandons its nuclear weapons program.

Extracts from the IAEA Report, 18 February 2010

Possible Military Dimensions:

- “In order to confirm, as required by the Safeguards Agreement, that all nuclear material in Iran is in peaceful activities, the Agency needs to have confidence in the absence of possible military dimensions to Iran’s nuclear programme. Previous reports by the Director General have detailed the outstanding issues and the actions required of Iran,¹² including, inter alia, that Iran implement the Additional Protocol and provide the Agency with the information and access necessary to: resolve questions related to the alleged studies; clarify the circumstances of the acquisition of the uranium metal document; clarify procurement and R&D activities of military related institutes and companies that could be nuclear related; and clarify the production of nuclear related equipment and components by companies belonging to the defence industries.
- The information available to the Agency in connection with these outstanding issues is extensive and has been collected from a variety of sources over time. It is also broadly consistent and credible in terms of the technical detail, the time frame in which the activities were conducted and the people and organizations involved. Altogether, this raises concerns about the possible existence in Iran of past or current undisclosed activities related to the development of a nuclear payload for a missile. These alleged activities consist of a number of projects and sub-projects, covering nuclear and missile related aspects, run by military related organizations.
- Among the activities which the Agency has attempted to discuss with Iran are: activities involving high precision detonators fired simultaneously; studies on the initiation of high explosives and missile re-entry body engineering; a project for the conversion of UO₂ to UF₄, known as “the green salt project”; and various procurement related activities. Specifically, the Agency has, inter alia, sought clarification of the following: whether Iran was engaged in undeclared activities for the production of UF₄ (green salt) involving the Kimia Maadan company; whether Iran’s exploding bridge wire detonator activities were solely for civil or conventional military purposes; whether Iran developed a spherical implosion system, possibly with the assistance of a foreign expert knowledgeable in explosives technology; whether the engineering design and computer modeling studies aimed at producing a new design for the payload chamber of a missile were for a nuclear payload; and the relationship between various attempts by senior Iranian officials with links to military organizations in Iran to obtain nuclear related technology and equipment.

- The Agency would also like to discuss with Iran: the project and management structure of alleged activities related to nuclear explosives; nuclear related safety arrangements for a number of the alleged projects; details relating to the manufacture of components for high explosives initiation systems; and experiments concerning the generation and detection of neutrons. Addressing these issues is important for clarifying the Agency's concerns about these activities and those described above, which seem to have continued beyond 2004.
- Since August 2008, Iran has declined to discuss the above issues with the Agency or to provide any further information and access (to locations and/or people) to address these concerns, asserting that the allegations relating to possible military dimensions to its nuclear programme are baseless and that the information to which the Agency is referring is based on forgeries.
- With the passage of time and the possible deterioration in the availability of information, it is important that Iran engage with the Agency on these issues, and that the Agency be permitted to visit all relevant sites, have access to all relevant equipment and documentation, and be allowed to interview relevant persons, without further delay. Iran's substantive engagement would enable the Agency to make progress in its work. Through Iran's active cooperation, progress has been made in the past in certain other areas where questions have been raised; this should also be possible in connection with questions about military related dimensions."

In the Summary, the report continues to say:

- "While the Agency continues to verify the non-diversion of declared nuclear material in Iran, Iran has not provided the necessary cooperation to permit the Agency to confirm that all nuclear material in Iran is in peaceful activities.
- Iran is not implementing the requirements contained in the relevant resolutions of the Board of Governors and the Security Council, including implementation of the Additional Protocol, which are essential to building confidence in the exclusively peaceful purpose of its nuclear programme and to resolve outstanding questions. In particular, Iran needs to cooperate in clarifying outstanding issues which give rise to concerns about possible military dimensions to Iran's nuclear programme, and to implement the modified text of Code 3.1 of the Subsidiary Arrangements General Part on the early provision of design information.

- Contrary to the relevant resolutions of the Board of Governors and the Security Council, Iran has continued with the operation of PFEP and FEP at Natanz, and the construction of a new enrichment plant at Fordow. Iran has also announced the intention to build ten new enrichment plants. Iran recently began feeding low enriched UF₆ produced at FEP into one cascade of PFEP with the aim of enriching it up to 20% in U-235. The period of notice provided by Iran regarding related changes made to PFEP was insufficient for the Agency to adjust the existing safeguards procedures before Iran started to feed the material into PFEP. The Agency's work to verify FFEP and to understand the original purpose of the facility and the chronology of its design and construction remain ongoing. Iran is not providing access to information such as the original design documentation for FFEP or access to companies involved in the design and construction of the plant.
- Contrary to the relevant resolutions of the Board of Governors and the Security Council, Iran has also continued with the construction of the IR-40 reactor and related heavy water activities. The Agency has not been permitted to take samples of the heavy water which is stored at UCF, and has not been provided with access to the Heavy Water Production Plant.
- The Director General requests Iran to take steps towards the full implementation of its Safeguards Agreement and its other obligations, including the implementation of its Additional Protocol."

Options:
Active Defense & Deterrence

- Ballistic missile defense (BMD) have been provided to four countries on the Arabian Peninsula. The New York Times carried a front-page story that the BMD systems were provided to Kuwait, the United Arab Emirates, Qatar and Oman, as well as stationing BMD capable, Aegis-equipped warships in the waters of the Arabian Gulf.
- Developing an integrated warning system across a broad geographic expanse could help U.S. forces to quickly shoot down an Iranian missile. U.S. officials hope that the expansion of the early-warning system also has the effect of calming Israeli concerns about Iran; they believe a preemptive strike by Israel could provoke a war.
- The moves are intended to reassure Gulf countries that they would be protected against possible offensive action from Tehran. U.S. officials stressed the defensive nature of the actions being taken throughout the region.
- The Washington Post carried a story saying that “the Obama administration is quietly working with Saudi Arabia and other Persian Gulf allies to speed up arms sales and rapidly upgrade defenses for oil terminals and other key infrastructure in a bid to thwart future attacks by Iran”.
- Central Command head Gen. David Petraeus recently said the four countries named by the Times were receiving BMD-capable Patriot Advanced Capability-3 (PAC-3) batteries. Early-warning radar systems and missile defenses that will be integrated with U.S. systems, including those on the cruisers and elsewhere. Early-warning agreements between various countries in the region, Petraeus said, were enabling the U.S. to create a "common operational picture" for the region to counter the Iranian missile threat.
- U.S. officials also are working with allies in the Gulf to ensure freedom of navigation in the region. Arab countries worry that during a crisis, Iran could try to prevent their ships from traversing the Strait of Hormuz, cutting off their oil export business.
- US officials have repeatedly insisted they are keeping "all options on the table," which includes a military option, when it comes to Iran. When it comes to Iran's alleged intent to develop nuclear weapons, Mullen stressed it was "important that leaders throughout the world do everything we can to make sure that, one, they don't consummate it and, two, we don't get to a point where an attack is imminent."

U.S. Israel Military Cooperation:

- A two week air defense exercise dubbed “Juniper Cobra” involving E.S. European Command and the Israeli Defense Forces was conducted in October/November 2009. The military exercise was described as being the largest joint exercise ever held by the U.S. and Israel.
- One of the aims of the joint military exercises was to test four Ballistic Missile Defense Systems and inter-operability between the Israeli BMD systems and those of the U.S., to counter attacks by short, medium and intermediate range ballistic missiles, in particular those launched by Iran:
 - The High Altitude Air Defense system (THAAD) battery,
 - 2 Israeli purchased Patriot (PAC-3) batteries,
 - Israeli Arrow 2 Ballistic Missile Defense system,
 - The U.S. Navy AEGIS BMD system.

Israeli “Iron Dome” short and medium range defense system to counter rockets:

- Israel states that in the first week of 2010, it had completed its final test on the “Iron Dome” system, which is supposed to provide protection against rockets with a range between 4 to 70 km. The system with the Arrow II (a medium range Ballistic Missile Defense system), will be part of the multi-layered BMD system Israel is building.
- Israel is planning to deploy the system along the Gaza borders in the south to counter Hamas rockets, and along the northern borders with Lebanon to protect against rockets fired by Hezbollah.

Arrow III:

- Aviation Week reported on Feb 12, 2010, that “the U.S. and Israel have started development of an upper stage component to Israel’s Arrow-3 missile defense architecture and that the main element will be a highly maneuverable exo-atmospheric interceptor (kill vehicle) that zeros in on an incoming missile”. The Arrow-3 is designed to counter Iran’s Shahab 3 Ballistic Missile which is reported to have a range up to 1,250 miles. The Arrow-3 will be developed jointly by the Israeli Aircraft Industries and Boeing Co in the U.S.

Unmanned Aerial Vehicle (UAVs):

- Israel is examining the possibility of boost-phase defenses. The Rafael Moab UAV forms part of the Israeli Boost-Phase Intercept System. This is intended to engage ballistic missiles soon after launch, using weapons fired from a UAV. Moab would launch an improved Rafael Python 4 air-to-air missile. Range is stated as 80-100 km depending on the altitude of release.

Combating WMD and Ballistic Missiles

Support of
Non-Proliferation
Treaties & Agreements

Extended
Deterrence

Counterforce/
Interdiction

Active
Defense

Passive
Defense

Non-Proliferation

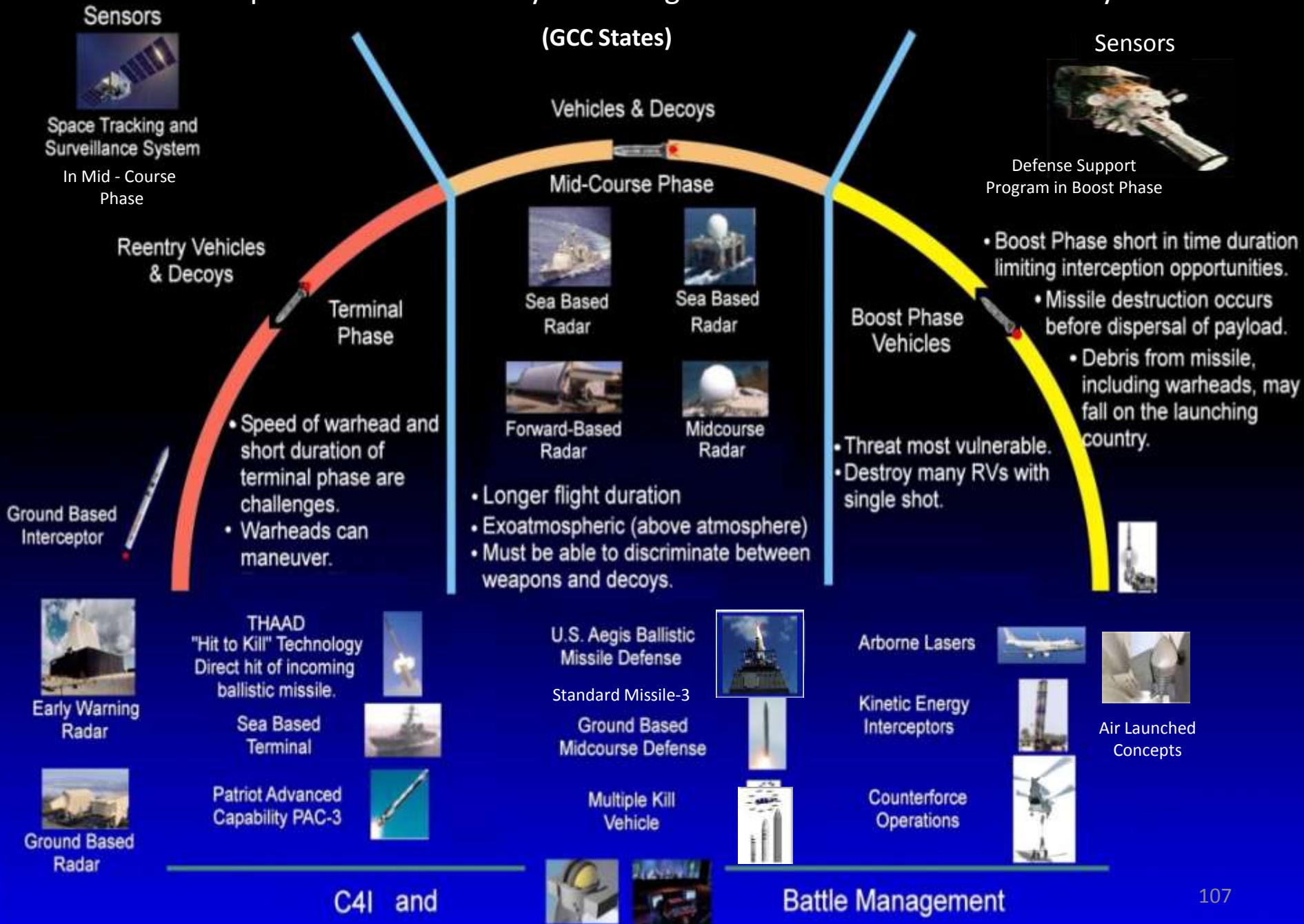
Counter- Proliferation

Political, Economic and Diplomatic actions taken to prevent Proliferation by dissuading or impeding access to or distribution of WMD and Ballistic Missile technology, material and expertise.

Treaties & Agreements:
NPT, CWC, BWC, MTCR, CTBT, NSG, WMD FZ, IAEA Safeguards, Export Controls, Arms Control Measures, Conflict Management/Resolution & Prevention...

- Counter-Proliferation is “the full range of military activities” that will “deter, identify, deny, and counter adversary development, acquisition, possession, proliferation and use of WMD and Ballistic Missiles”.
- Extended Deterrence which is an attempt to prevent a military attack against an ally by threatening retaliation using conventional or unconventional weapons.
- Counterforce is offensive military operations taken to eliminate the threats by denying an adversary the asset. Counterforce includes interdicting, seizing securing and/or destroying an adversary’s WMD and related infrastructure.
- Active Defense is preventing the delivery of an adversary’s WMD via Ballistic Missiles. This is the detection and destruction of a weapon once it has been fired.
- Passive Defense is measures taken to reduce the vulnerability of friendly personnel and assets to WMD effects—basically the NBC defense programs.

Components of a multi-layered integrated Ballistic Missile Defense System



Sea Based Air Defenses The Navy's Role in Missile Defense Network

Role of the Navy Aegis System:

- Will provide an efficient and highly mobile sea-based defense against Short and Medium – Range Ballistic Missiles in their midcourse phase.
- The system will allow the BMD Command to move its defense capabilities close to the enemy sites.
- The system will have the Engagement & Long Range Tracking Capability
- Intercepting Short to Medium Range Ballistic Missiles in the midcourse phase of the flight with Standard Missile – 3.
- Serves as a forward deployed sensor, providing early warning and long range search & track capabilities for ICBMs and IRBMs.

Contributions:

- Will extend the battle space of the BMDs and contribute to an integrated layered defense.
- The Naval Aegis system extends the range of the Ground Missile defense (GMD) element by providing reliable track data used to calculate firing solutions.
- Aegis BMD will coordinate engagements of short and medium range ballistic missiles with terminal missile defense systems.
- As tracking information is shared among these systems, the BMDS will have the opportunity to follow the engagement of a target during the midcourse segment with coordinated terminal engagements.



Sea Based Radar



Sea Based Radar



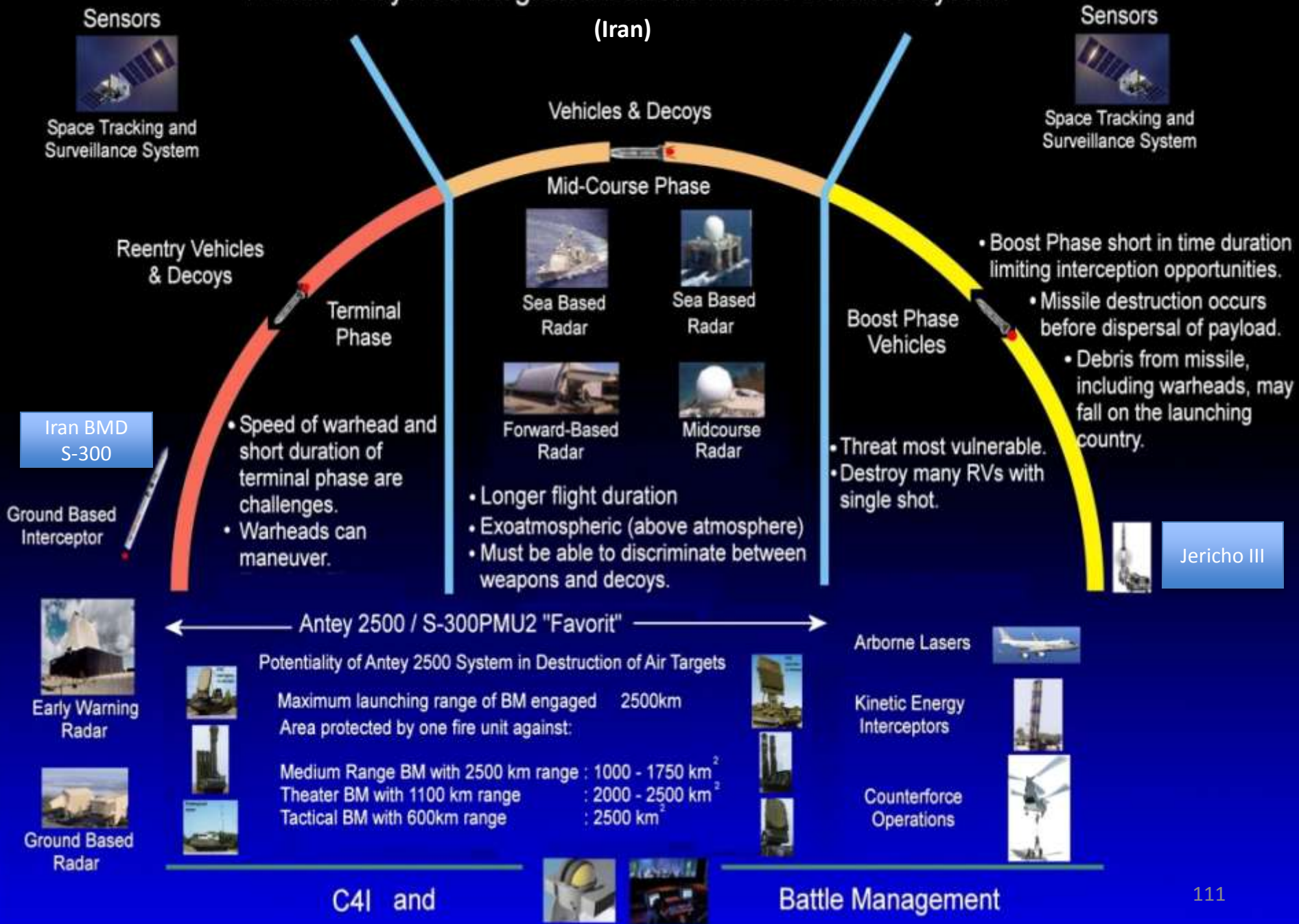
Aegis Ballistic Missile

Combat Characteristics Vs Attacking Ballistic Missiles	S-300PMU2 “Favorit”	Antey 2500 S-300V
Number of SAM complexes to one firing unit	6	4
Missile Guidance	Illumination & Radar Command	SAR during last leg of flight
Maximum Range (km)	40	40
Minimum Range (km)	5	5
Minimum Altitude (meters)	20	25
Maximum Altitude (km)	25	30
Rate of Fire (sec)	3	1.5
Reaction Time (sec)	7 to 8	7.5
Missile Maximum Speed (meters/sec)	2,000	2,600
Number of Guided Missiles by one Launcher	4	2
Missile Warhead (kg)	180	150
Illumination and Guidance Radar:		
• Maximum Tracking Range (km)	200	200
• Number of simultaneously tracked BM targets	36	24
• Number of simultaneously guided missiles	72	70
• Maximum Speed of Tracked Target (meters/sec)	2,800	4,500
Time to deploy launcher (minutes)	5	5

Comparative Chart between PAC-3 and the S-300 BMD Systems

	PAC-3	S-300
Maximum Firing Range (km)	150	200
Maximum Range for Destruction of BM (km)	40	40
Maximum Launching Range of BM Destroyed (km)	1,000	2,500
Upper Limit of Destruction Zone (km)	30	30
Area Covered Against BM Strike (km ²)	1,200	2,500
Maximum Speed of Destroyed Target (meter/sec)	3,000	4,500
Maximum Scattering RCS of Destroyed Target (m ²)	0.05 - 1	0.02

A Multi - Layered Integrated Ballistic Missile Defense System (Iran)



Ballistic Missile Defense System, C4ISR & Battlefield Management.

- The Challenge for the GCC States is to design an effective multi-layered Ballistic Missile Defense System (BMDS) to counter the Short, Medium and Intermediate Ballistic Missiles.
- Due to the very short time window in the defense against Ballistic Missiles, they will have to be engaged automatically, which requires intercept authorization and rules of engagement to be agreed upon in advance. All part of an effective C4ISR / BM system in both peace time and war. This will also act as a Force Multiplier.
- Evident that the key to an effective BMD lies in regional cooperation, which can take a range of forms from coordination and cooperation between command centers and defense systems for BMD purposes - while enabling each state to control its own defenses. Similar to the “Cooperation Belt” that links together all the operations command centers in the GCC states, which produces a Common Operational Picture.
- Cooperation to be comprehensive in nature, leading to a near-real time situation awareness of the military developments in the area, hostile and friendly military capabilities and their operational levels. This would also be in the form of cooperation into BMDs and NBC threat assessment. This requires an C4ISR capability in all its Components, such as, Unmanned Air Systems (UAS's) / Unmanned Air Vehicles (UAV's).
- As the Front Lines will be over the Arabian Gulf region, the Navy will have to play a role in Air Defenses and in a Ballistic Missile Defense Network. Sea based systems will provide an efficient and highly mobile defense against Theater Ballistic Missiles.
- The Naval System, such as the U.S. Navy Aegis system, will allow the BMD command to move its defense capabilities close to the enemy sites and serve as a forward deployed sensor and will have the Long Range Engagement and Tracking Capability. This will extend the battle space of the BMDs and contribute to an integrated layered defense.

Unmanned Air Vehicles/Systems (UAVs/UAS's)

- UAV's/UAS's were initially employed in a range of conventional missions such as:
 - Intelligence, Surveillance & Reconnaissance (ISR)
 - Target Acquisition
 - Signal Intelligence (COMMINT and ELINT)
- UAV's/UAS's were further developed with the capability to carry Air to Surface missiles, and to attack targets autonomously. This gave the UAV's/UAS's the ability to carry out Strategic and Tactical Missions:
 - Strategic Missions which require more endurance and weapons payload
 - Tactical Missions which require a reduction in size.
- Both missions require a weaponization capability for the destruction of enemy forces and Air Defense systems. UAV's/UAS's have the advantage of being low risk for the missions and have become an indispensable weapon of war. UAV's/UAS's survivability against heavily defended targets is higher than that in manned aircraft
- Tactical UAV/UAS Missions cover:
 - ISR
 - SEAD
 - Electronic Attack (Deception/Jamming....)
 - Mobile Network Node/Communications Relay. UAV's/UAS's can be utilized as nodes in a mobile communications network for the maneuvering forces.



U.S. AIR FORCE

Air Force ISR Surge



Integrity - Service - Excellence

(Source: Headquarters U.S. Air Force. Air Force Unmanned Aerial System (UAS) Flight Plan 2009-2047. Lt. Gen Dave Deptula, Deputy Chief of Staff Intelligence, Surveillance and Reconnaissance; Colonel Eric Mathewson AF UAS Task Force).

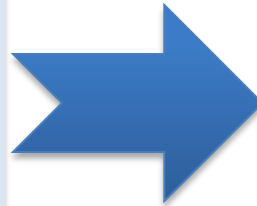
Option: Military Strike

Target Analysis and
Mission Planning Payloads

Military Confrontation with Iran

What could accelerate a military confrontation with Iran:

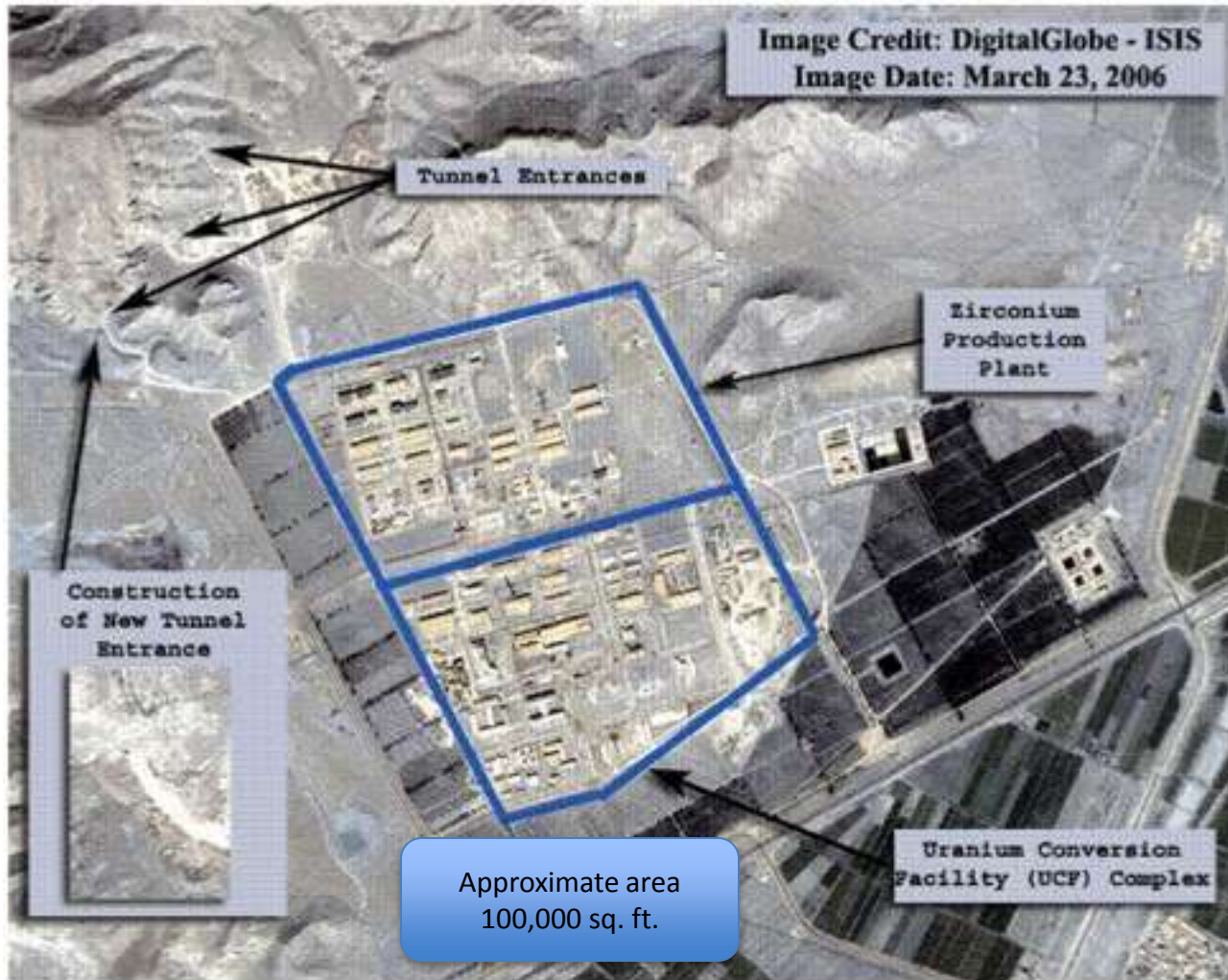
- Discovery of further Iranian covert activities in establishing Uranium enrichment facilities for the purpose of building Nuclear Weapons.
- Iran to possess enough weapons grade HEU for a nuclear weapon that can serve as a deterrent against U.S. and Israeli strike.
- Having in its possession highly accurate short, medium and long range ballistic missiles, capable of carrying WMD weapons.
- A modern SAM air defense system, such as Russian S-300PMU2 "Favorit", giving Iran an advanced BMD capability as well.
- A Maritime capability that can start threatening commercial shipping and Naval Forces in the Gulf, and possibility of interrupting flow of oil through Straits of Hormuz.
- Train and control a number of Insurgency groups and terrorists, increasing threat of asymmetric attacks against US allies in the region.



Iran military response:

- Immediate retaliation using its Shehab III BMs on Israeli military, civilian and nuclear sites including the use of CBR warheads.
- Give rise to regional instability through conflict as well as terrorism.
- Destabilizing Iraq through the Shia against U.S. presence, and further arming insurgency groups when possible.
- Support and upgrade Taliban capabilities in Afghanistan.
- Increase threat of asymmetric attacks against American interests and allies in the region. Attack U.S. military bases that are active and stationed in the Gulf States
- Use proxy groups such as Hezbollah or Hamas to attack Israel proper with suicide bombings and rocket attacks.
- Target U.S. and Western shipping in the Gulf, and attempt to disrupt the flow of oil through Straits of Hormuz.
- Withdraw from NPT Treaty and start accelerated nuclear weapons program.

Esfahan
Nuclear Research Center.
Uranium Conversion Facility (UCF)



NATANZ : Uranium Enrichment Facility

Two earth and concrete – covered underground buildings.

323,000 sq.ft.

95,000 sq. ft
Underground
Building.

323,000 sq.ft.

Original Uranium Separation
Pilot Plant : Six buildings over
120,000 total square feet.

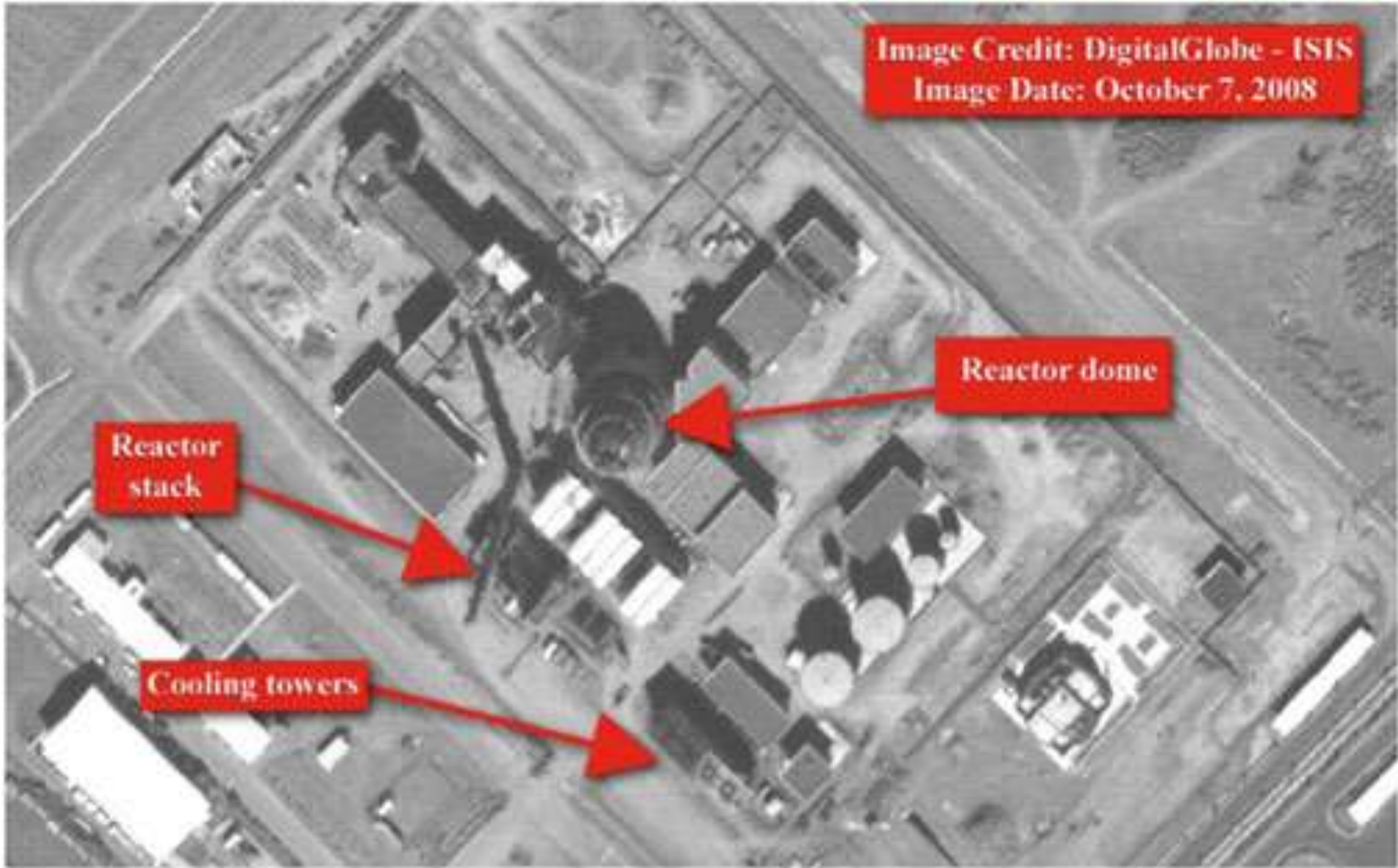
Administration
Building

Vehicle access
tunnel



ARAK
Heavy Water Nuclear Reactor
And
Future Plutonium Production Reactor





October 7, 2008 Digital Globe Image of Arak Heavy Water Reactor in Iran



Image Source: Digital Globe-ISIS
Image Date: January 2009

Fordow Facility

Tunnel entrances

Tunnel entrances inside military facility, north-east Qom.



Image Source: GeoEye – ISIS
Image Date: September 26, 2009

Fordow Facility

September 26, 2009 GeoEye satellite image of the suspected gas centrifuge facility under construction in a tunnel facility inside a mountain. This site is located approximately 30 kilometers north-east of Qom, Iran.

- We consider four main target facilities which if attacked could either destroy the program or delay it for some years. After analyzing the targets a damage criteria is suggested measured by the blast pressure of the weapon used. It would be safe to assume a required 5 to 10 psi which would be sufficient to either destroy or damage the facility for a long period of time. Care must be taken not to overkill for this could practically double the strike force required.
- Damage Criteria:
 - 10 psi : Reinforced concrete buildings are severely damaged or demolished. Most people are killed.
 - 5 psi : Most buildings collapse
 - 3 psi : Residential structures collapse
- We then work out how many bombs must be dropped to cover a certain area above and below ground. To be on the safe side, we consider weapons that penetrate hard and deeply buried targets (HDBTs). The Natanz facility for instance is reported to have underground facilities where the centrifuges are installed for uranium enrichment
- Natanz facility apparently covers some 670,000 sq ft in total, the Fuel Enrichment Plant (FEP) complex was built some 8 meters-deep into the ground and protected by a concrete wall 2.5 meters thick, itself protected by another concrete wall. By mid-2004 the Natanz centrifuge facility was hardened with a roof of several meters of reinforced concrete and buried under a layer of earth some 75 feet deep. It is reported that this facility will eventually house some 50,000 centrifuges.
- The Esfahan Nuclear Technology Center (ENTC) is an Industrial-Scale Uranium Conversion Facility (UCF). The U3O8 is transported to ENTC to convert it to UF6 (Uranium Hexafluoride). The area of the buildings is estimated to be around 100,000 sq ft. and are above ground.
- The Arak Facility covers an area of approximately 55,000 sq ft and contains the Heavy Water Reactor and a set of cooling towers. There are no underground facilities reported in this complex.
- Fordow Facility, 2 tunnel entrances. Mission objective to close tunnels.
- **See Appendix for Target Analysis**

(Source:GlobalSecurity.org)

Strike Force Required

Target Facility	If 2 PG Bombs are carried	If 1 PG Bomb is carried
Natanz	25 F-15E	50 F-15E
Esfahan	3 F-16I	5 F-16I
Arak	4 F-16I	8 F-16I
Qom	5 F-15E	10 F-15E
<i>Total</i>	30 F-15E + 7 F-16I	60 F-15E + 13 F-16I

- F-15E Empty Weight plus Maximum Fuel = 66,831 lbs
- F-15E Take off Gross Weight = 81,000 lbs
- So each F-15E will still be capable of carrying an extra 10,000 lbs, 2 BLU-113 5,000 lb class warheads (2 GBU-28 PG Bombs).

- Total Force could be 30 F-15E for strike and 7 F-16I, with 38 F-16I for Air Escort/Fighter Sweep and Suppression of Enemy Air Defense (SEAD).
- Bringing the total allocated strike force against Nuclear Targets in Iran to 75 aircraft.

**Possible Missile Production Target Sites North of Esfahan
as well being close to the Nuclear Target Sites**

Site	Nuclear	Missiles
Arak	Plutonium Production	Research & Development
Esfahan	Uranium Conversion facility	Production, assembly components & sold fuel propellants
Bakhtarun (Close to Arak)	-	Launching & Underground Facility
Khorramabad (close to Arak)	-	Ballistic, Production, Assembly Storage
Manzariyah (Close to Arak)	-	Research & Design Fuel Production
Qom (Close to Natanz)	Natanz: a Uranium Enrichment Facility	Test Site
Hasa (Close to Esfahan)	-	Production Facility

- The GBU-27, 2000lb weapon would be most likely used against the Missiles Sites. In addition the GBU-10 can also be used.
- Allocating 4 GBU-27 per site would require 2 F-16I aircrafts per site. For the 5 sites this would bring number of F-16I to 10. Arak and Esfahan will be affected during the Nuclear Facilities strikes.

Israeli Strike

Scenario I:
Conventional Air Strike

Israeli Strike against Iranian Nuclear Facilities Possible Strike Routes

Northern Route

Central Route

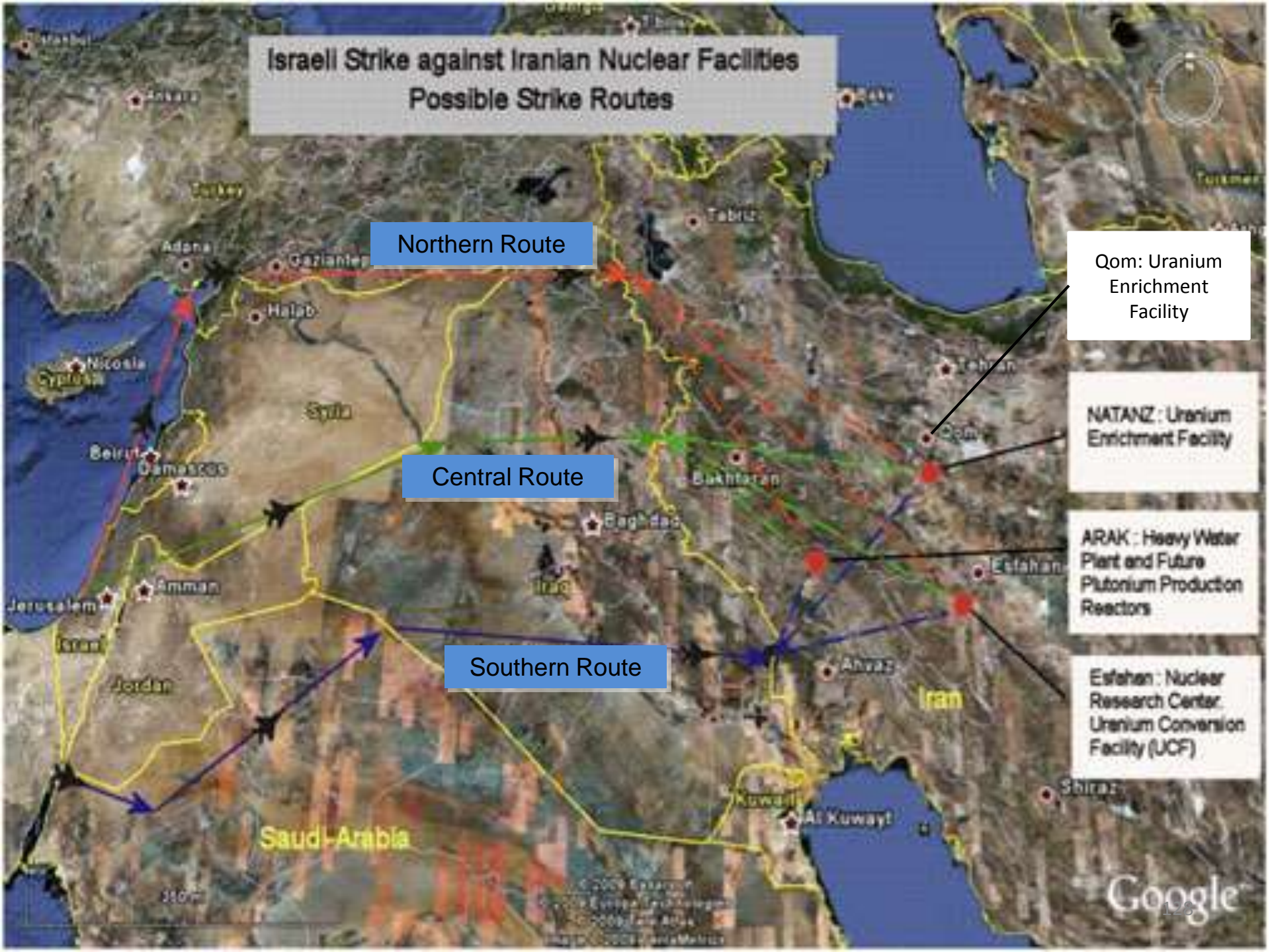
Southern Route

Qom: Uranium Enrichment Facility

NATANZ: Uranium Enrichment Facility

ARAK: Heavy Water Plant and Future Plutonium Production Reactors

Esfahan: Nuclear Research Center, Uranium Conversion Facility (UCF)



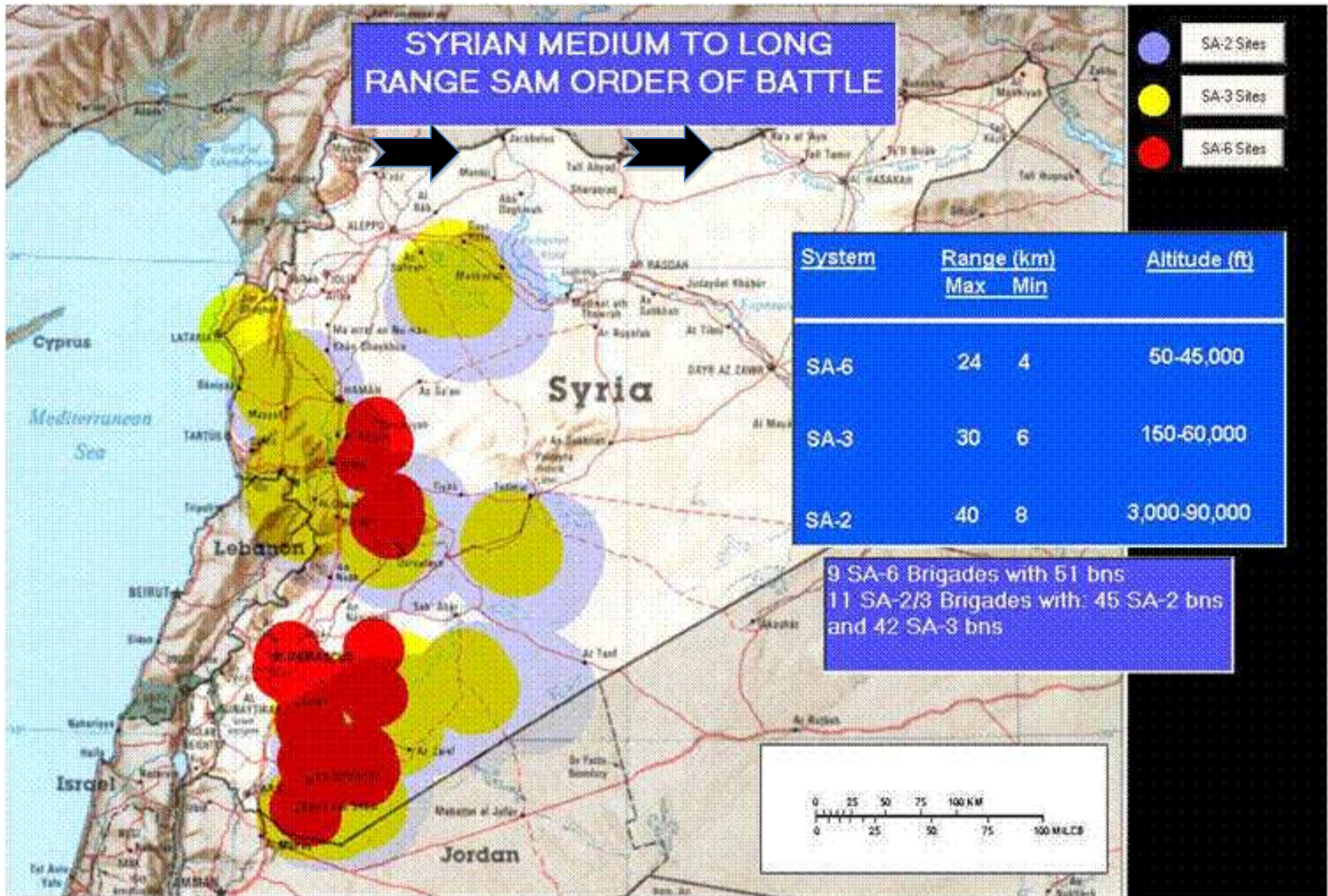
Northern Route:



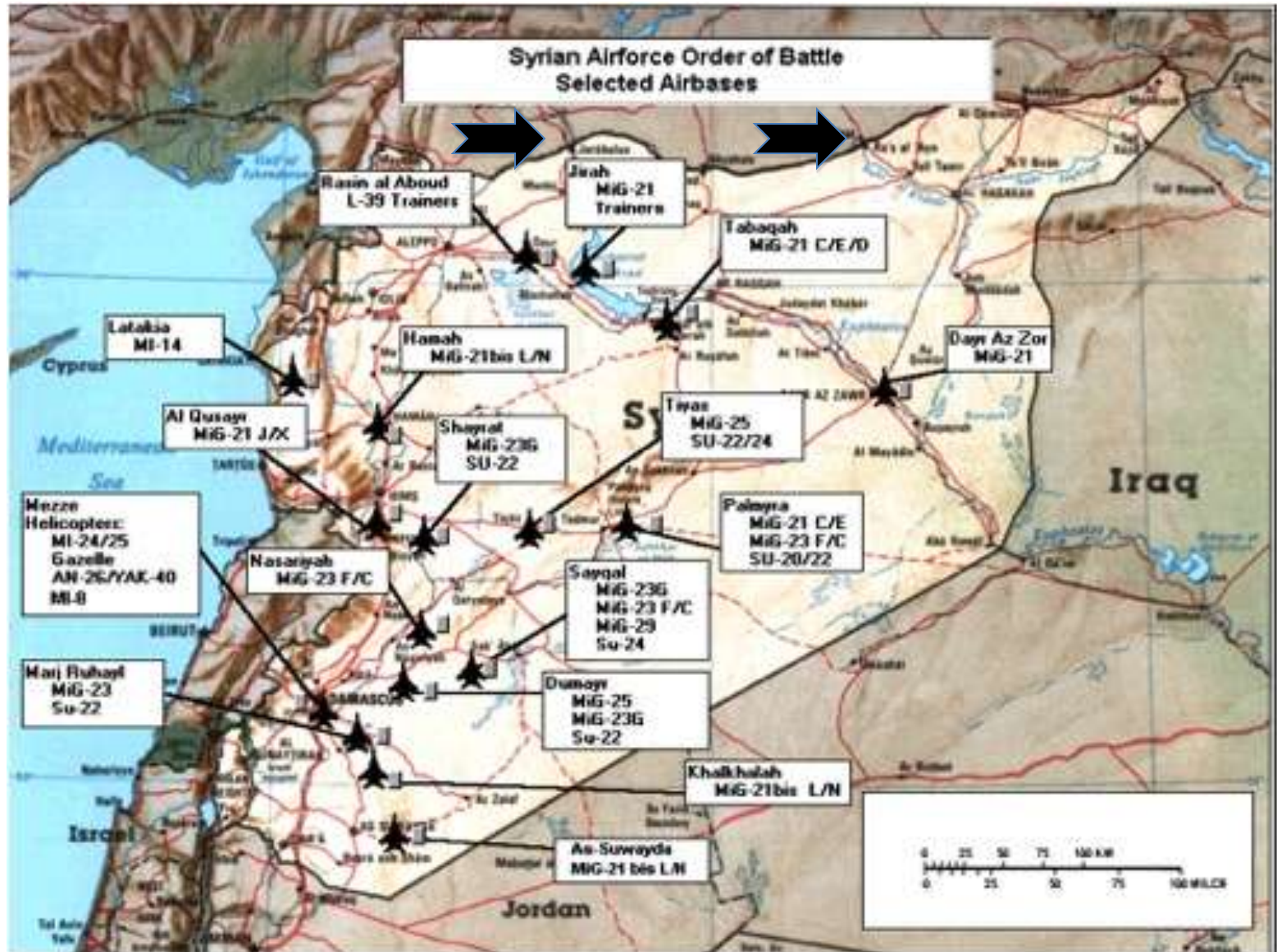
- Flying to the North towards the corner of the Syrian – Turkish borders, then turning East hugging the Syrian border all throughout the West to East flight route.
- Israel could again utilize its EW capabilities as during the raid on Dayr az-Zawr, Syria, on September, 2007
- The Israeli F-15s and F-16s that got through the Syrian air defense radars without being detected is attributed to a Network Attack System, similar to the U.S. “Suter” system.
- The technology allows users to invade and hack enemy communication networks, so enemy sensors can be manipulated into positions that approaching aircraft can’t be seen.
- The process involves locating enemy emitters and then directing data streams into them that can include false targets and cause algorithms that allow control over the system.
- In essence the elements of the attack included:
 - Brute Force jamming
 - Network penetration involving both remote air to ground electronic attack and penetration through computer to computer links.

- In this EW environment even if Turkey detects an aerial activity it very likely might look upon the Aircraft as friendly and not flying over its territory. Whereas Syria would be spoofed to believe no major threats are flying over its border.
- No major Syrian Airbases are close to the Northern border and the aircraft stationed are the MiG-21 type, one airbase for training.
- On the last leg of the flight, only a small fraction of the distance left to the Iranian border could be in Turkey or the Northern tip of the Iraqi borders.
- The flight route would also be ideal for the F-15's and the F-16's to do aerial refueling from airborne tankers, on ingress and egress from Iran.
- This northern route, along the Syrian – Turkish borders, could result in a low political risk with Syria, whom Israel has no Peace Treaty with and not even a formal negotiations process any more.
- If the Israeli aircraft do actually fly over Turkey that would constitute a clear Turkish – Israel and even U.S. conspiracy to attack Iran, so the Political risks could be high with Turkey.
- Operationally, the risk from Syria would be low, whereas the risk from Turkey could be of medium level if Turkey deems it necessary to react militarily.

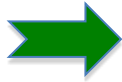
Northern Route



Northern Route

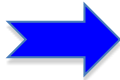


Central Route:

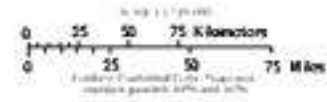


- Israel has a Peace Treaty with Jordan signed in October 1994.
- Therefore Israel is obligated legally to notify Jordan of any planned flights over Jordan.
- Jordan will not accept an Israeli over flight through Jordanian Airspace to strike Iran.
- High political risks for Israel to violate Jordanian airspace, in effect jeopardizing the Peace Treaty.
- Operationally, an Israeli Strike Mission of the size envisioned would certainly be detected and challenged by Jordan, and the whole region will be informed.
- Israel will encounter some operational risks due to Jordanian Airforce Intercepting the Israeli aircraft. This could upset the whole mission.
- So the Central Route through Jordan, or the Jordanian Syrian border would be of High Risk politically and High Risk Operationally.
- Iraqi airspace will also have to be violated. Iraq would object to this, and the U.S. most probably would detect this and would not allow Israel to proceed through Iraq.

Southern Route:



- Israel could try the June 1981 Iraqi Osirak Nuclear Reactor strike route again, flying through the southern tip of Jordan and into Saudi-Arabia then through Iraq or even Kuwait.
- Politically the U.S. would not allow Israel to take such risks which would jeopardize its strategic relationship with Saudi-Arabia.
- Iraq would also object to any violation of its airspace by Israel, and so would Kuwait.
- This route would create high political risks even though the operational risks could be somewhat low.



Strike Mission Route Planning

Northern Route Syria - Turkey

Risks	Turkey	Syria
Political	High	Low
Operational	Medium	Low

Central Route Jordan – Syria - Iraq

Risks	Jordan	Syria	Iraq
Political	High	Low	High
Operational	High	High	Low

Southern Route Jordan – Saudi Arabia - Iraq

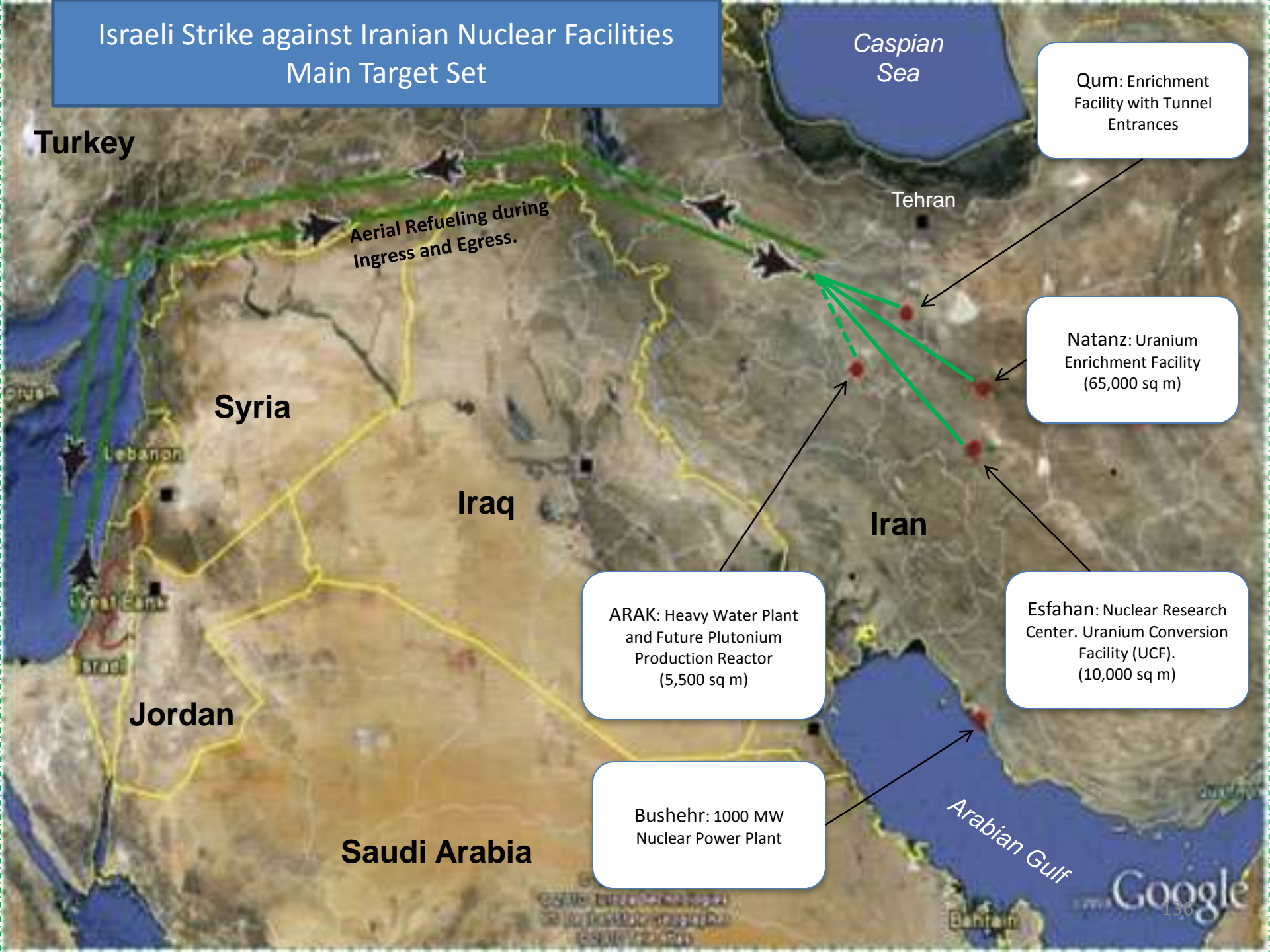
Risks	Jordan	Saudi-Arabia	Iraq
Political	High	High	High
Operational	Low	Low	Low

Israel Mission Force Allocation

Aircraft	Number	Payload	Mission	Fuel Required (lbs)	KC-130 Tankers required for Refueling
F-15E	30	4 AAM 2 GBU-28	Natanz & Qom	657,500	6
F-16I	3	2 AAM 2 GBU-27	Esfahan	44,265	0.5
F-16I	4	2 AAM 2 GBU-10	Arak	59,000	0.5
F-16I	10	2 AAM 2 GBU-27	Bakhtarun (Close to Arak) Khorramabad (close to Arak) Manzariyah (Close to Arak) Qom (Close to Natanz) Hasa (Close to Esfahan)	147,550	1
F-16C	38	AAM ASM	Fighter Sweep Battlefield Air Superiority Suppression of Enemy Air Defense	560,690	5
TOTAL	85				13

The KC-135A has a Range of 1,150 nmi with 120,000 lbs of transferable fuel. (GlobalSecurity.org)

Israeli Strike against Iranian Nuclear Facilities Main Target Set



Turkey

Syria

Iraq

Jordan

Saudi Arabia

Caspian Sea

Tehran

Iran

Arabian Gulf

Qum: Enrichment Facility with Tunnel Entrances

Natanz: Uranium Enrichment Facility (65,000 sq m)

ARAK: Heavy Water Plant and Future Plutonium Production Reactor (5,500 sq m)

Esfahan: Nuclear Research Center. Uranium Conversion Facility (UCF). (10,000 sq m)

Bushehr: 1000 MW Nuclear Power Plant

Aerial Refueling during Ingress and Egress.

Mission Analysis:

- Approximate range to the furthest target Esfahan is some 1,110 nmi. When approaching the 550 nmi range, the F-15Es and F-16Is need to refuel on the way to Iran and on the way back.

- Refueling can be done in three ways:
 - Refueling from KC-135A and KC-10 tankers.
 - Buddy Refueling between F-15Es and F-16Is
 - A temporary landing strip, along the Syrian, Turkish and Northern Iraq region, where aircraft refueling is available.

- Total Fuel in an F-15E for the Hi-Lo-Lo-Hi strike mission is 26,300 lbs, whereas that for an F-16I is about 14,755 lbs. The total maximum strike package was around 80 aircraft, all the 30 F-15I in the Israeli Airforce Inventory plus 55 F-16I/C. The F-15E would then need 5 to 6 KC-130s to refuel from, and the F-16Is would require 6 to 7 KC-130.

- Israel presently has 5 KC-130H and 4 B-700 (Source IISS). So all the Israeli Tankers will have to be airborne to service the F-15E and F-16I Strike Force during the outbound leg and inbound legs of the mission. Could be difficult to find a location along the route such that the tankers could avoid detection and possible interception.

- These estimates were done assuming a 100% aircraft and weapons operational reliability and the strike force not encountering any Iranian Air and Ground Defense. So if we give the overall reliability to be 90% then we should add around 9 to 10 more aircraft, bringing the total strike force to 95.

- So in essence over 25% of the high end combat aircraft of Israeli Airforce and 100% of the Tankers will have to be allocated for this mission.

- One strike would not necessarily be enough to achieve the mission objectives. Strike aircraft might need to return for another strike. This would put a heavy burden on the Israeli Airforce thereby limiting it to one strike.
- We can conclude that a military strike by the Israeli Airforce against Iranian Nuclear Facilities is possible, however, it would be complex and high risk in the operational level and would lack any assurances of a high mission success rate.
- Iranian retaliation will have a devastating regional consequences. U.S. expects Israel to be responsible and not to carry out such a strike.
- In return the U.S. will increase its financial and technical support for the Israeli Ballistic Missile Defense System, ARROW.

Israeli Strike

Scenario II:
Low Yield Earth Penetrating Nuclear Weapons:
Ballistic Missiles
Sea Launched Cruise Missiles

- We have seen how an air to ground strike mission can be difficult to implement and would involve some risks. Flying on a very tight route, practically hugging the Turkish-Syrian borders. Aerial refueling along the way and avoid being detected by Turkey, Syria and the U.S. Flying down to S/L when in Iranian territory, avoid being detected by flying low and applying ECM all the way. If detected by Iranian air defense be prepared to encounter interceptors and the firing of ground based SAMs.
- If Ballistic Missiles are used to carry out the mission, Israel has this capability whereas Iran does not have a Ballistic Missile Defense System yet, such as the Russian S-300PMU2 “Favorit”, that was designed to intercept ballistic missiles as well as combat aircraft. It has been reported that Iran has been negotiating with Russia for the procurement of the S-300PMU2 and they might get it now that the present US administration is taking the diplomatic dialogue approach with Iran.

Low Yield Earth Penetrating Nuclear Weapons

- Another scenario is using these warheads as a substitute for conventional weapons to attack deeply buried nuclear facilities in Iran. Some believe that nuclear weapons are the only weapons that can destroy targets deep underground or in tunnels.
- The gun-type Uranium based nuclear bomb dropped on Hiroshima by the U.S. in August of 1945 was about 8,000 pounds in weight, and contained about 60 kg of weapons grade Highly Enriched Uranium (HEU), of which about 0.7 kg underwent fission producing a Yield of 12.5 kilotons.
- The Plutonium implosion bomb dropped on Nagasaki weighed about 10,800 pounds and contained about 6.4 kg of weapons-grade Plutonium PU-239. Producing a yield of 22 kilotons.
- We note that in the subsequent years the U.S. was able to produce Plutonium-implosion nuclear bombs in the same yield range with weights down to 2,000 lbs and less.

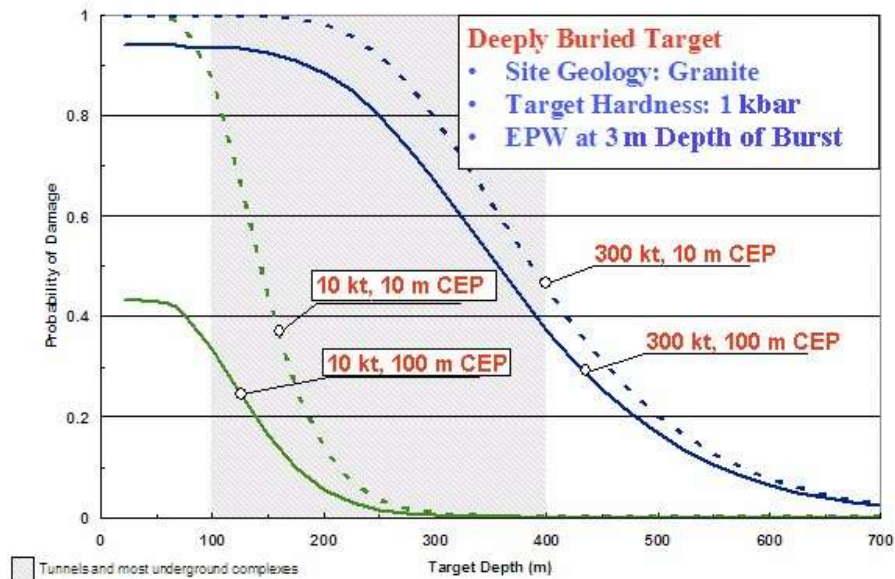
- The Israeli Sea Launched Cruise Missile (SLCM), Popeye Turbo, with a range of 1,500km launched from the German built Dolphin-class submarine, is capable of carrying these nuclear warheads.
- Israel is reported to possess a 200kg nuclear warhead containing 6 kg of weapons grade Plutonium that could be mounted on the Sea Launched Cruise Missiles and producing a Yield of 20KT.
- The guidance system is reported to be GPS guidance system improving the missile trajectory accuracy to a CEP of 10m.
- The first Dolphin Class submarines were supplied to Israel by Germany in the 1990s, two of them as a gift. At Israel's request, they were then outfitted with 4 additional 659mm tubes for launching long range cruise missiles, this in addition to the six 533mm tubes suitable for short range cruise missiles.
- According to some reports, 1 of the 3 Dolphins supplied by Germany patrols the Red Sea and the Arabian Gulf, the second is deployed in the Mediterranean while the third is held in reserve. With the addition of two more of these submarines Israel will have four submarines fitted with nuclear SLCM.
- Very unlikely that any U.S. President would authorize the use of such nuclear weapons, or even allow any other country, even a strong ally such as Israel, to use them, unless another country had used nuclear weapons against the U.S. and its allies.

(Sources: Global Security.org and NTI)

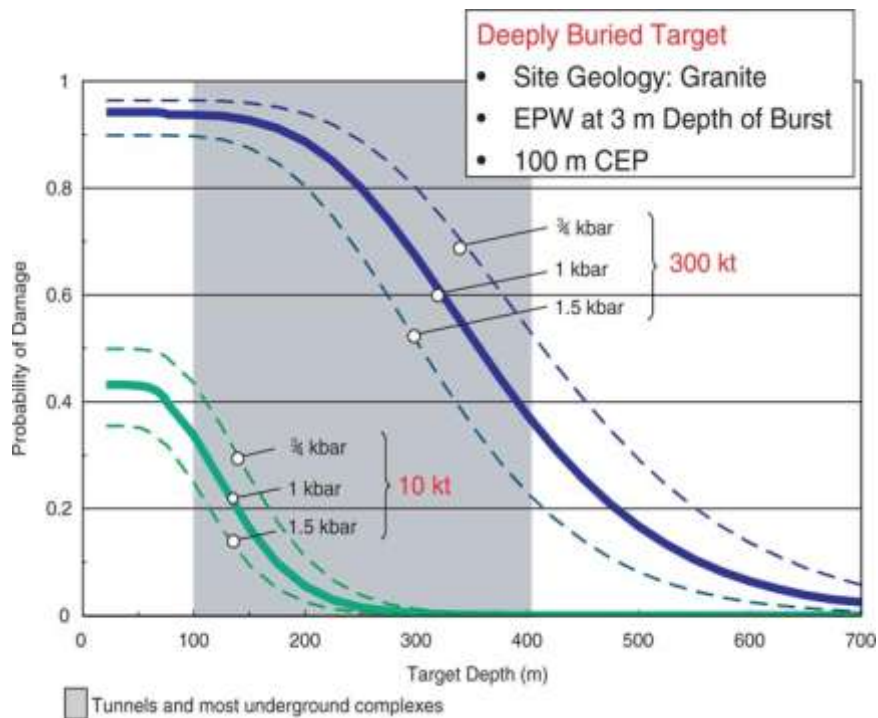
Target Damage Probability Estimates

We present the destructive capabilities of various nuclear weapons:

- Surface Bursts or Contact Bursts at the ground surface
- Those that burst after penetrating the surface

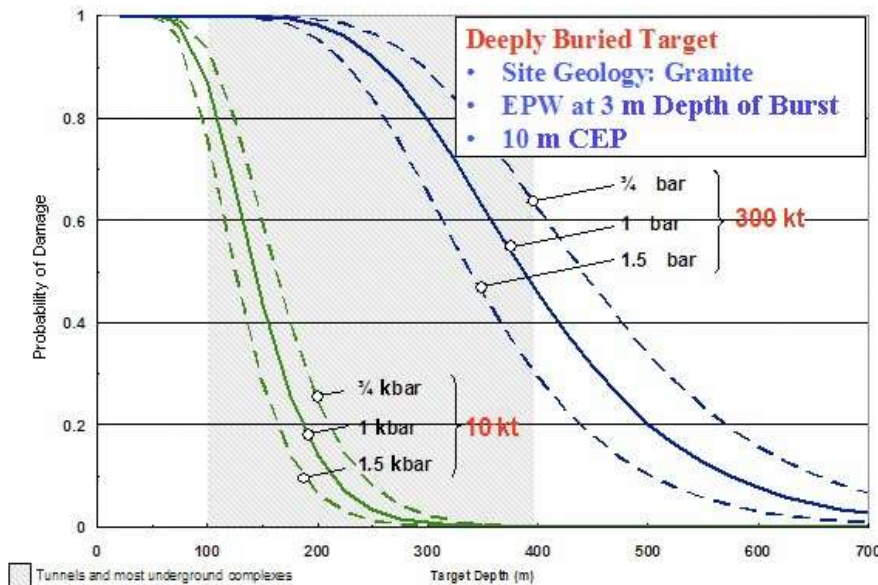


- The above shows that the Earth Penetrator Weapon (EPW) needs to be of sufficient yield to be effective against targets of interest.
- For deeply buried targets, an EPW is more effective than a contact burst (surface burst) of the same yield. The probability of damage for a 300kt EPW at 3 meters Depth of Burst (DOB) is equivalent to that for a 5 to 6 Megaton Surface Burst of the same accuracy.
- In general, for deeply buried targets, an EPW yields in the range of several hundreds of kilotons to a Megaton are needed to effectively hold these targets of interest at risk with a high probability of destruction.



- Earth Penetrator Weapon (EPW) at 3 meters depth of burst with 100 meters CEP accuracy, against a deeply buried target.

- For a fixed CEP, effectiveness is not strongly dependent on target hardness.

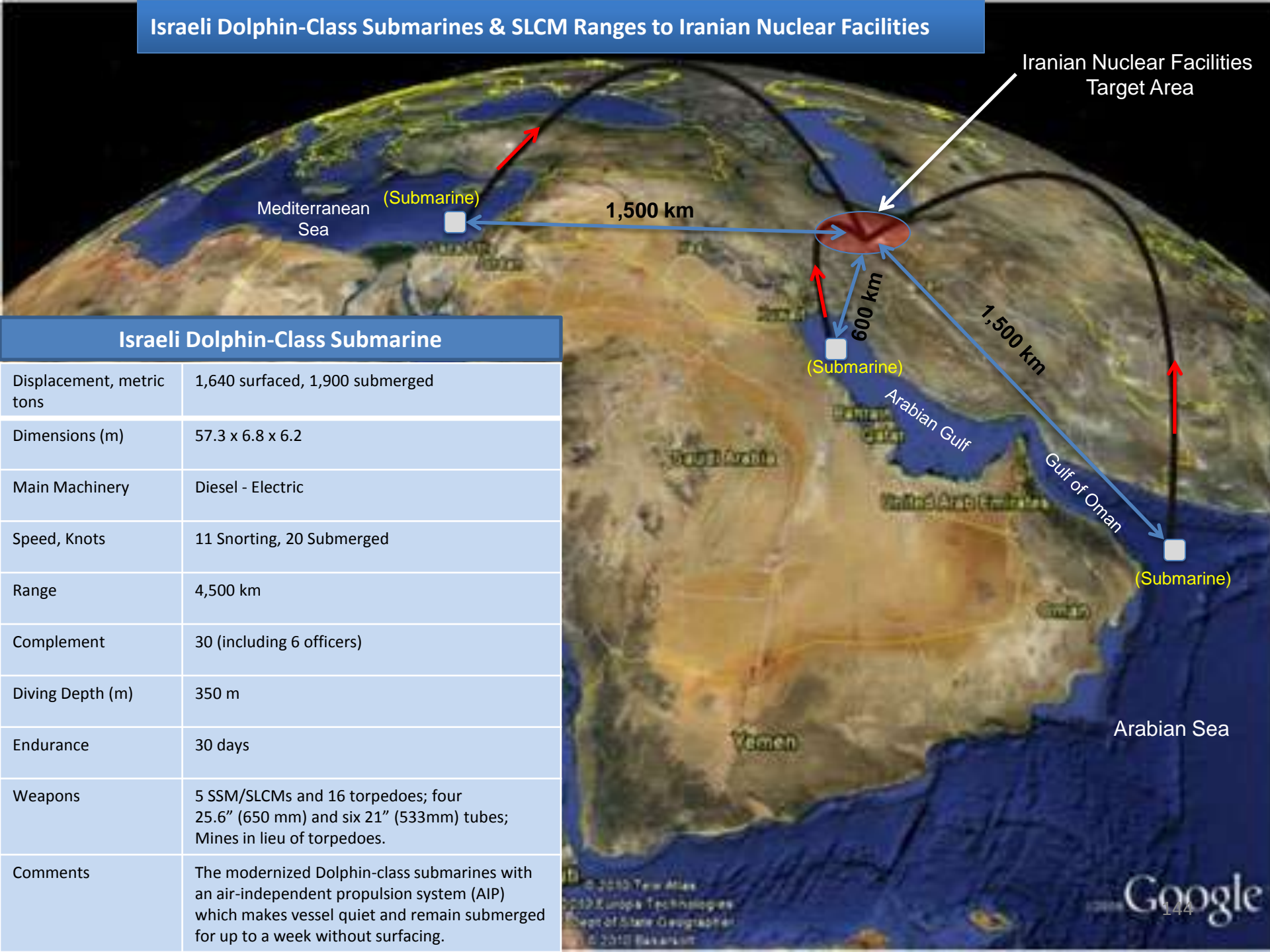


- Earth Penetrator Weapon (EPW) at 3 meters depth of burst with 10 meters CEP accuracy, against a deeply buried target.

- For a fixed CEP, effectiveness is not strongly dependent on target hardness.

(Source: Effects of Nuclear Earth-Penetrator and Other Weapons. National Research Council. <http://www.nap.edu/catalog/11282.html>)

Israeli Dolphin-Class Submarines & SLCM Ranges to Iranian Nuclear Facilities



Iranian Nuclear Facilities Target Area

Mediterranean Sea

(Submarine)

1,500 km

(Submarine)

600 km

1,500 km

Arabian Gulf

Gulf of Oman

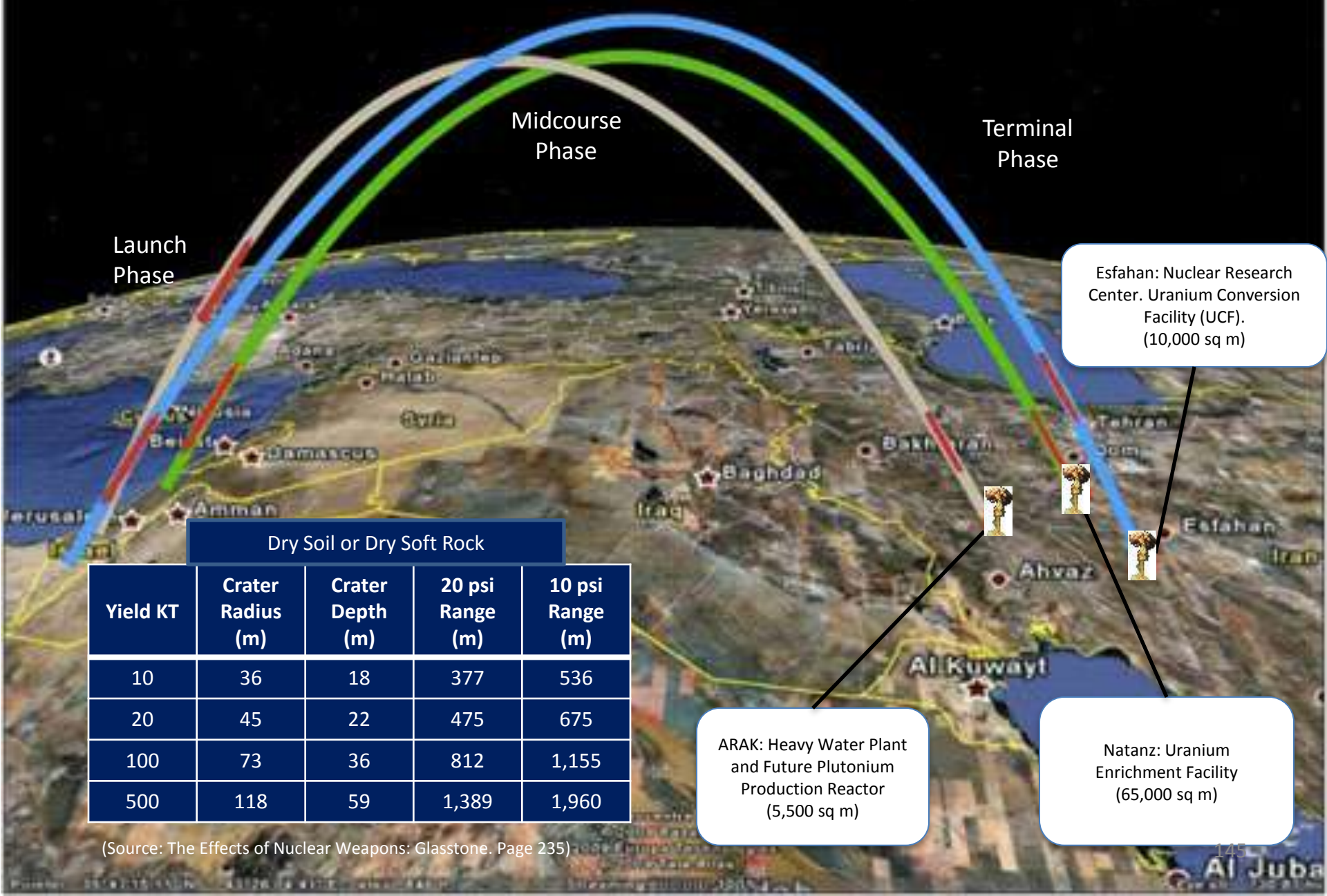
(Submarine)

Arabian Sea

Israeli Dolphin-Class Submarine

Displacement, metric tons	1,640 surfaced, 1,900 submerged
Dimensions (m)	57.3 x 6.8 x 6.2
Main Machinery	Diesel - Electric
Speed, Knots	11 Snorting, 20 Submerged
Range	4,500 km
Complement	30 (including 6 officers)
Diving Depth (m)	350 m
Endurance	30 days
Weapons	5 SSM/SLCMs and 16 torpedoes; four 25.6" (650 mm) and six 21" (533mm) tubes; Mines in lieu of torpedoes.
Comments	The modernized Dolphin-class submarines with an air-independent propulsion system (AIP) which makes vessel quiet and remain submerged for up to a week without surfacing.

Israeli Strike against Iranian Nuclear Facilities with Jericho II/III Ballistic Missiles with Low Yield Nuclear Warheads



Launch Phase

Midcourse Phase

Terminal Phase

Dry Soil or Dry Soft Rock

Yield KT	Crater Radius (m)	Crater Depth (m)	20 psi Range (m)	10 psi Range (m)
10	36	18	377	536
20	45	22	475	675
100	73	36	812	1,155
500	118	59	1,389	1,960

Esfahan: Nuclear Research Center. Uranium Conversion Facility (UCF). (10,000 sq m)

ARAK: Heavy Water Plant and Future Plutonium Production Reactor (5,500 sq m)

Natanz: Uranium Enrichment Facility (65,000 sq m)

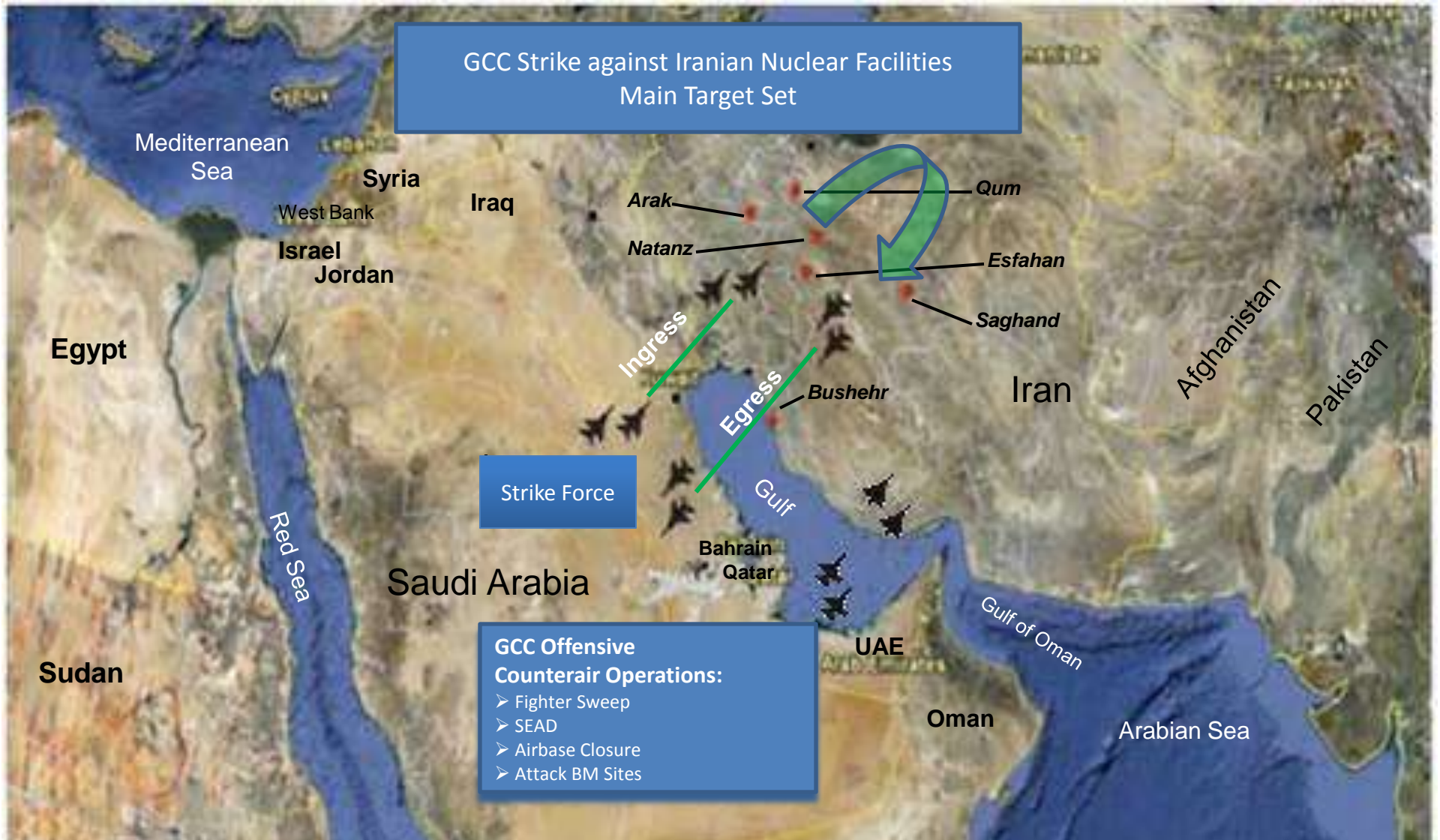
(Source: The Effects of Nuclear Weapons: Glasstone. Page 235)

GCC Strike

GCC Mission Force Allocation

Aircraft	A/C allocated	Payload	Mission	Sortie/AC/Day	Total Sorties Per Day
F-15S	30	4 AAM 2 GBU-28	Natanz & Qum	2	60
F-16C	3	2 AAM 2 GBU-27	Esfahan	3	9
F-16C	4	2 AAM 2 GBU-10	Arak	3	12
F-16C	10	2 AAM 2 GBU-27	Bakhtarun (Close to Arak) Khorramabad (close to Arak) Manzariyah (Close to Arak) Qom (Close to Natanz) Hasa (Close to Esfahan)	3	30
Mirage 2000C	38	AAM ASM	Fighter Sweep Battlefield Air Superiority Suppression of Enemy Air Defense	3	114
TOTAL	85				225

GCC Strike against Iranian Nuclear Facilities Main Target Set



Strike Force

- GCC Offensive Counterair Operations:**
- Fighter Sweep
 - SEAD
 - Airbase Closure
 - Attack BM Sites

Aircraft	Total in Inventory	Operational Ready (75%)	Allocated for Mission	Sortie per AC per day	Total Sorties (225)	Aircraft left for other missions	Projected Sorties (283)
F-15S	71	53	30	2	60	23	46
F-16C	104	78	17	3	51	61	183
M2000	74	56	38	3	114	18	54

GCC Strike Mission Analysis and Grand Strategy

- GCC aircraft allocated for the strike mission would be: F-15S, F-16C and Mirage 2000, equipped with GBU-27A and GBU-28A bombs.
- Mission, can be operationally achieved with a much higher success rate than an Israeli strike, given the same aircraft and weapons. Shorter distances to cover giving the capability to keep up a sustained GCC attack over a couple of days.

However,

- GCC countries will not launch a strike on Iran, nor will they allow their territories to be used as a launching stage in any pre-emptive strikes against Iran. The GCC States military posture has always been a Defensive Posture.
- GCC has been calling for a peaceful resolution of the Nuclear weapons issue between the West and Iran in the form of Dialog and Negotiations. GCC states might approve of sanctions however, not to the “crippling” level that is being presently advocated and definitely or in a way that would affect the Iranian people, such as Financial, Gasoline and Economic.

Gulf News, Mar 14 2009:

- The UAE hopes the standoff between Iran and the West over Tehran's nuclear programme will be resolved diplomatically, without the need to resort to additional sanctions against the Islamic republic or, worse, military action. However, according to Foreign Minister Shaikh Abdullah Bin Zayed Al Nahyan, the UAE will "respect international sanctions" against Iran, if the crisis is not solved diplomatically. All countries are bound to respect United Nations resolutions.

U.S. Strike

- Admiral Mullen, Chairman of the Joint Chiefs of Staff, had been asked whether the US military was stretched too thin to take further action in trouble spots beyond Iraq and Afghanistan. "We're very hard-pressed right now" because of the two wars, he noted, but added that it is primarily ground troops that have been deployed, and "the likelihood that our ground forces would have to go somewhere in these kinds of numbers in some other part of the world, or even in the same region, I think is pretty low."
- Many experts assess that any American military engagement with Iran would most likely rely on air and naval power. Admiral Mullen was even more definitive when asked to assess whether Teheran was seeking to acquire nuclear weapons. "I believe that they're on a path that has a strategic intent to develop nuclear weapons and have been for some time," he said.
- The United States has developed contingency plans to address Iran's nuclear ambitions if negotiations falter between the Islamic republic and Western nations, a top US general said Sunday -- raising questions again over the US military's secret strategies on Iran.
- "It would be almost literally irresponsible if CENTCOM were not to have been thinking about the various 'what ifs' and to make plans for a whole variety of different contingencies," said General David Petraeus, who heads the US Central Command that oversees the Middle East, the Gulf region and Central Asia. Petraeus declined to comment on reports that Israel, which says Iran presents an existential threat to it, may attack it Iran's nuclear facilities.
- But he told CNN the facilities "certainly can be bombed" even though they are reportedly heavily fortified. "The level of effect would vary with who it is that carries it out, what ordnance they have, and what capability they can bring to bear," he added. Without elaborating on the contingency plans, the general said it could be some time before Washington decides whether to execute them and that diplomatic efforts would continue in the meantime.
- He also said Iran has a "strategic intent" to develop nuclear weapons but urged a new diplomatic push to stem Tehran's nuclear drive, warning that a strike on the Islamic republic would be "very destabilizing."
- "I think that would be an incredibly destabilizing outcome and potentially generate a nuclear weapons race in that part of the world," Admiral Michael Mullen, the chairman of the Joint Chiefs of Staff, told CNN. "I think an attack would also be, by us or by anybody else, be very destabilizing."

The B-2 Bomber



Primary Function	Multi role heavy bomber
Engines:	Four GE F-118-GE-100 engines, each with a thrust of 17,300 pounds (7,847 kg)
Speed, Cruise:	High subsonic
Ceiling:	50,000 ft (15,000 meters)
Weight Takeoff, (typical):	335,500 – 350,000 pounds (152,600 – 159,000 kg)
Weight, Empty (typical):	125,000 – 160,000 pounds
Range:	6,000 nmi (9,600 km), unrefueled range for a Hi-Lo-Hi mission with 16 B61 nuclear free-fall bombs 10,000 miles with one aerial refueling.
Payload:	40,000 pounds (18,000 kg)
Crew:	Two pilots
Current Armament:	<p>Nuclear: 16 B61, 16 B83</p> <p>Conventional: 80 MK82 (500lb), 16 MK84 (2000lb), 34-36 CBU-87, 34-36 CBU-89, 34-36 CBU-97</p> <p>Precision: 216 GBU-39 SDB (250 lb), 80 GBU-30 JDAM (500 lb), 16 GBU-32 JDAM (2000 lb), GBU-27, GBU-28, GBU-36, GBU-37, AGM-154 HSOW, 8-16 AGM-137 TSSAM, 2 MOP / DSHTW/ Big BLU</p>

(Source: [http://www.GlobalSecurity.org/wmd/systems/b-2-s\[ecs.html](http://www.GlobalSecurity.org/wmd/systems/b-2-s[ecs.html))

- 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.

GBU-57A/B Massive Ordnance Penetrator (MOP)	Specifications
Weight, total	13,600 kg (slightly less than 30,000 pounds)
Weight, explosive	2,700 kg (6,000 lb)
Length	6m / 20.5 feet
Diameter	31.5 in diameter
Control	Short-span wings and trellis-type tail
Penetration	60 meters (200ft) through 5,000 psi reinforced concrete 40 meters (125 ft) through moderately hard rock 8 meters (25 feet) through 10,000 psi reinforced concrete
Contractors	Boeing, Northrop Grumman
Platforms	B-52, B2
Guidance	GPS aided Inertial Navigation System

U.S. Strike against Iranian Nuclear Facilities Main Target Set

Air Superiority Aircraft Escorting the B2 Bombers could be F-18's off the US 5th Fleet, or could be F-15E/F-16C launched from Forward Area Bases.

These aircraft can also perform all Offensive Counterair Operations:

- Fighter Sweep
- SEAD (Suppression of Enemy Air Defense)
- Interdiction
- Escort



- B2 Bombers stationed in Diego Garcia
- Payload: 2 B-57 A/B Massive Ordnance Penetrator (MOP)
- Range from Diego Garcia to Target area in Iran about 5,000 km



US Strike Mission Analysis

- B-2 bombers out of Diego Garcia, each carrying 2 GBU-57 MOP bombs.
- Mission can be achieved with a high success rate also maintaining a sustained strike over a couple of days.
- B-2 bombers escorted by F-18s from the 5th fleet stationed in the Gulf area, or F-15Es and F-16Cs from forward area air bases.
- United States and Western allies considered to be the only countries involved, no GCC or any Arab country involvement and especially no-Israeli direct involvement.
- Still though, Iran most probably will accuse Israel to be part of the Strike and will try to retaliate, either by launching a Ballistic Missile on Israel carrying conventional or WMD (chemical, biological, radiological) and activating Hezbollah to launch cross border attacks against Israel.
- Iran would also try to attack any U.S. military airbases that are active in the Gulf even if they are stationed in GCC countries.
- If Iran attacks any of the GCC countries, then they will have the right to self-defense. In addition the whole Arab Middle East will not accept an Iranian attack on any of the GCC countries.

Iranian Response

Iran's Nuclear Program

- Increase Iran's long term resolve to develop a nuclear deterrent program. Could be the beginning rather than the end of such a program. Iran could start an accelerated program in building its own nuclear weapons. It could also covert its dispersed facilities into a full weapons development program and be brought online in a very short period of time.

Iran and the IAEA

- Iran would withdraw from the NPT based on the argument that it needs to acquire nuclear weapons to deter any further aggression by Israel and the U.S.

Iranian response against Israel

- 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.
- Using proxy groups such as Hezbollah or Hamas to attack Israel proper with suicide bombings, covert CBR attacks, and rocket attacks from southern Lebanon.

Regional Security

- Give rise to regional instability and conflict as well as terrorism.
- Destabilizing Iraq through the Shia against US occupation, further arming insurgency groups when possible.
- Support and upgrade Taliban capabilities in Afghanistan.
- Increase the threat of asymmetric attacks against American interests and allies in the region, especially against countries that host the US military such as Qatar and Bahrain.
- Target U.S. and Western shipping in the Gulf, and possibly attempt to interrupt the flow of oil through the Gulf.

Iranian Response to an Israeli or US Attack

Estimating the Iranian military response and its operational readiness, it can be assumed that a conflict can initiate with relatively short warning. It can be further assumed that the Iranian armed forces would not have sufficient time to boost Operational Readiness Rate of its Combat Forces much higher than Peacetime or Training Operations. One can therefore get a fair idea by analyzing the Iranian large scale military exercises over the past couple of years.

Iranian Military Exercises

Date

- | | |
|-------------------|--|
| January 27, 2006 | Iran completes major military exercise that testes Teheran's ability to attack Gulf shipping and Arab oil facilities. The exercise was meant to show the West that Iran could stop all oil shipments in the Gulf and destroy numerous oil facilities in Gulf Arab countries |
| August 19, 2006 | Iran launches a series of large-scale military exercises aimed at introducing the country's new defensive doctrine: Ballistic Missiles and Asymmetric Warfare (Defiance, Deception, Deterrence, Demonstration). |
| November 3, 2006 | Iran began the 10 days of maneuvers in the Gulf by test firing dozens of missiles, including the long-range Shahab-3 (estimated range: 2000 km or 1,240 miles), and the Shahab-2, which Iran says can carry a cluster warhead that can deliver 1,400 bomblets at once. Aim is to show our deterrent and defensive power to trans-regional enemies. |
| March 23-30, 2007 | Iran's regular Navy launches week-long war-games on its southern shores. The military exercises are being carried out in the Gulf by Iran's regular Navy |
| January 7, 2008 | US ships harassed by Iran. Iranian boats approach three U.S. Navy ships in the strategic Strait of Hormuz, threatening to explode the American vessels. U.S. forces are reported to be on the verge of firing on the Iranian boats, when the boats - believed to be from the Iranian Revolutionary Guard's navy - turn and move away. |
| July 7, 2008 | Iran's elite Islamic Revolutionary Guards Corps launch large-scale, five-day war-games, dubbed "Exercise Stake Net", was carried out in the Straits of Hormuz and the Sea of Oman, where an assortment of new weapons were brought into play. Iran later test-fires nine missiles including what is claims is an upgraded version of Shahab-3 ballistic missile with a one-ton warhead capable of destroying targets within a 2,000-kilometer (1,245-mile) range |

(Source: Anthony Cordesman , CSIS "Threats, Risks and Vulnerabilities: Terrorism and Asymmetric Warfare")

Date

Iranian Military Exercises

- October 10, 2008 The Islamic Republic Air Force tests Iran's domestic-made warfare in a joint military exercise with the IRGC, the Defense Ministry says. The joint aerial maneuver is aimed at boosting Iran's defensive capabilities and operational tactics.
- December 2-7, 2008 Iran says it will seek to accomplish objectives that include defense against an Israeli and US threat, closing the Strait of Hormuz to local and international shipping, and the testing of new and improved military equipment and tactics.
- December 1-7, 2008 Kayhan quotes Admiral Habibollah Sayyari, commander of the navy as saying "In this six-day long maneuver there will be more than 60 combat vessel units," and it will include destroyers, missile-equipped battleships, submarines, special-operations teams, helicopters, and fighter planes.

An Iranian naval commander says a week earlier that the country's navy could strike an enemy well beyond its shores and as far away as Bab al-Mandab, the southern entrance to the Red Sea that leads to the Suez Canal. Iran test-fires a new surface-to-surface missile from a warship in a strategic shipping route, as part of the war games in the Sea of Oman and the Gulf region: State radio reports, "The surface-to-surface Nasr-2 missile was tested in the (Sea of) Oman operational region,". IRNA reports that, "The Nasr-2 was fired from a warship and hit its target at a distance of 30 km (19 miles) and destroyed it," adding it was the first test of the new, medium-range missile.

IRGC Commander and Asymmetric Strategy

- On September 1, 2007, Khamenei promoted Mohammad Ali Jafari, then coordinator of the IRGC Research and Command Center, to the rank of major general and the post of commander in chief of the IRGC. Jafari has outlined the strategy he means to promote as IRGC commander, reiterating his commitment to developing Iran's ballistic missile capabilities and the asymmetrical warfare capacities of the IRGC:

"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."

Tehran November 29, 2008. IRNA:

Commander of the Islamic Republic Army's Navy Force Rear Admiral Habibollah Sayyari said that Iranian Navy is capable of blocking the Straits of Hormuz.

Iran warned that in the case of an attack against its nuclear installation, it would not hesitate to take necessary measures to protect itself including the closure of the Strait of Hormuz.

Sayyari told IRNA on Navy Day "Iran's Navy Force is powerful enough to block the Hormuz Strait. Anybody doubting this is advised to go into action to accept the reality."

Tactical Ballistic Missiles Threat:

- Iran's ballistic missiles cover the complete spectrum range from 150 km up to 5,500 km, the Short, Medium, and Intermediate Ranges of Ballistic Missiles. Iran believes that these will compensate for any deficiencies in its Air Power.
- Ballistic Missiles can be used with success against Soft Targets, in open areas and cities to inflict maximum human casualties and create terror. In essence what is considered as a major component in Asymmetric Warfare in the form of high civilian casualties.

Arabian Gulf will turn into the "front line" in the event of an Iranian conflict with Israel and the U.S.



Iranian Ballistic Missile Retaliatory Attack against
Israeli Nuclear & Missile Facilities

Targets

Israel: Nuclear Facilities

Yodefat:
Possible assembly and dismantling

Haifa:
Rafael-Israel Armament Development Authority. Reported Nuclear Design and Assembly.

Soreq:
Nahal Soreq Nuclear Research Center (MAMAG) 5 MW safeguarded pool type reactor; possible weapon design and Research Facility.

Tiresh:
Possible Storage Facility

Eilat:
Possible Storage Facility

Dimona
Negar Nuclear Research Center (KAMAG): Houses a Reactor, Enrichment and Reprocessing Facilities.

Mishor Rotem:
Negar Phosphates Chemical Company. Uranium Mining from Phosphate Deposits.



Targets

Israel: Missile Facilities

Haifa:
Rafael-Israel Armament
Development Authority.
Reported Nuclear
Missile Design and
Development.

Tel Aviv:
Israel Space Agency
and Israel Aircraft
Industries.

Palmachim Airbase:
Missile Test Range
and Space Launch
Facility.

Be'er Yaakov:
Missile Assembly
Facility; Arrow,
Jericho and Shavit
Missiles.

Kfar Zeharya:
A.K.A. Hirbut
Zachariah/Sdot Micha.
Jericho I missiles,
possible Jericho II.



Oil Facilities & Oil transit Chokepoints as Iranian Targets

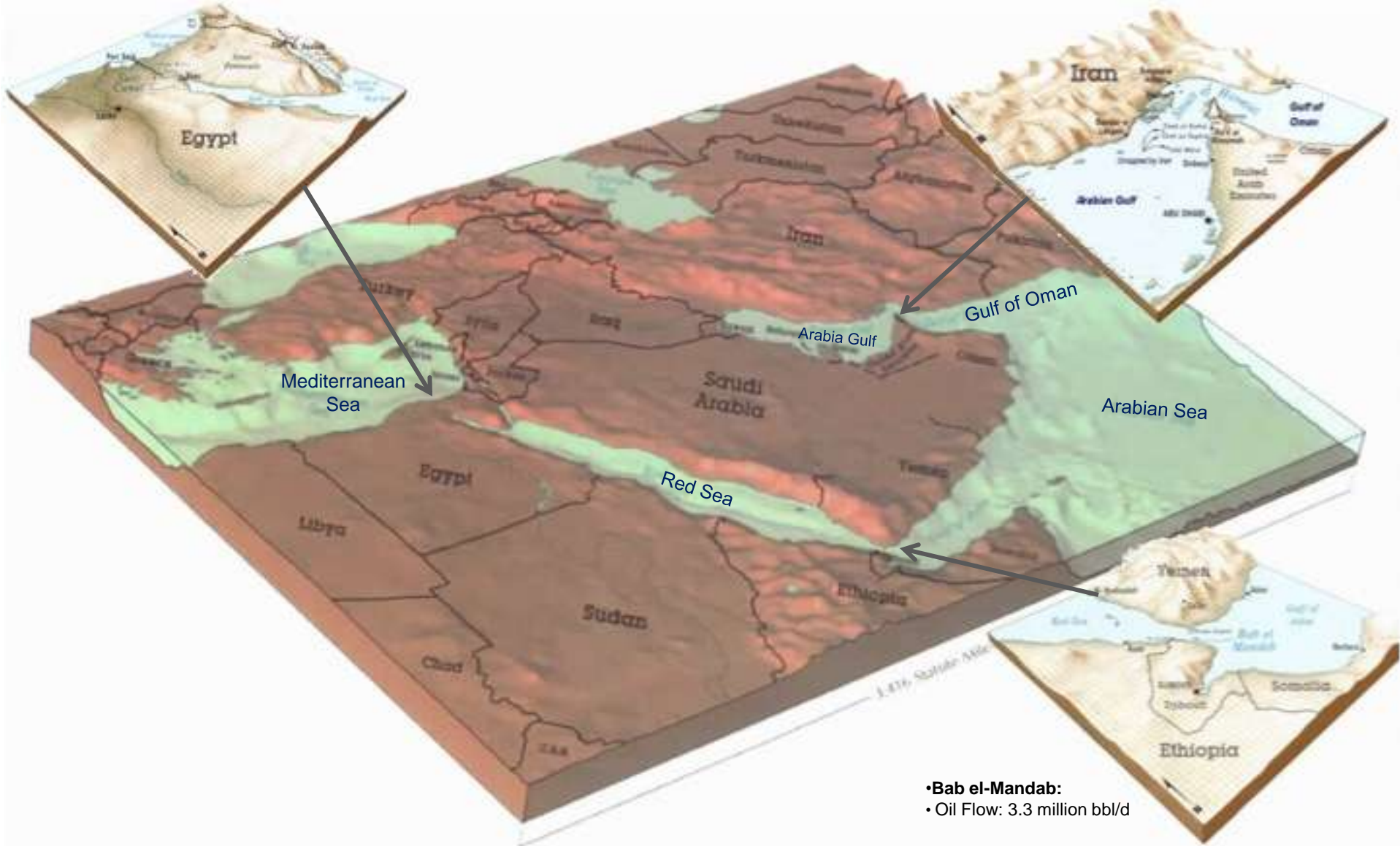
Oil Transit Chokepoints

•The Suez Canal/Sumed Pipeline:

• Oil Flow: 4.5 million bbl/d

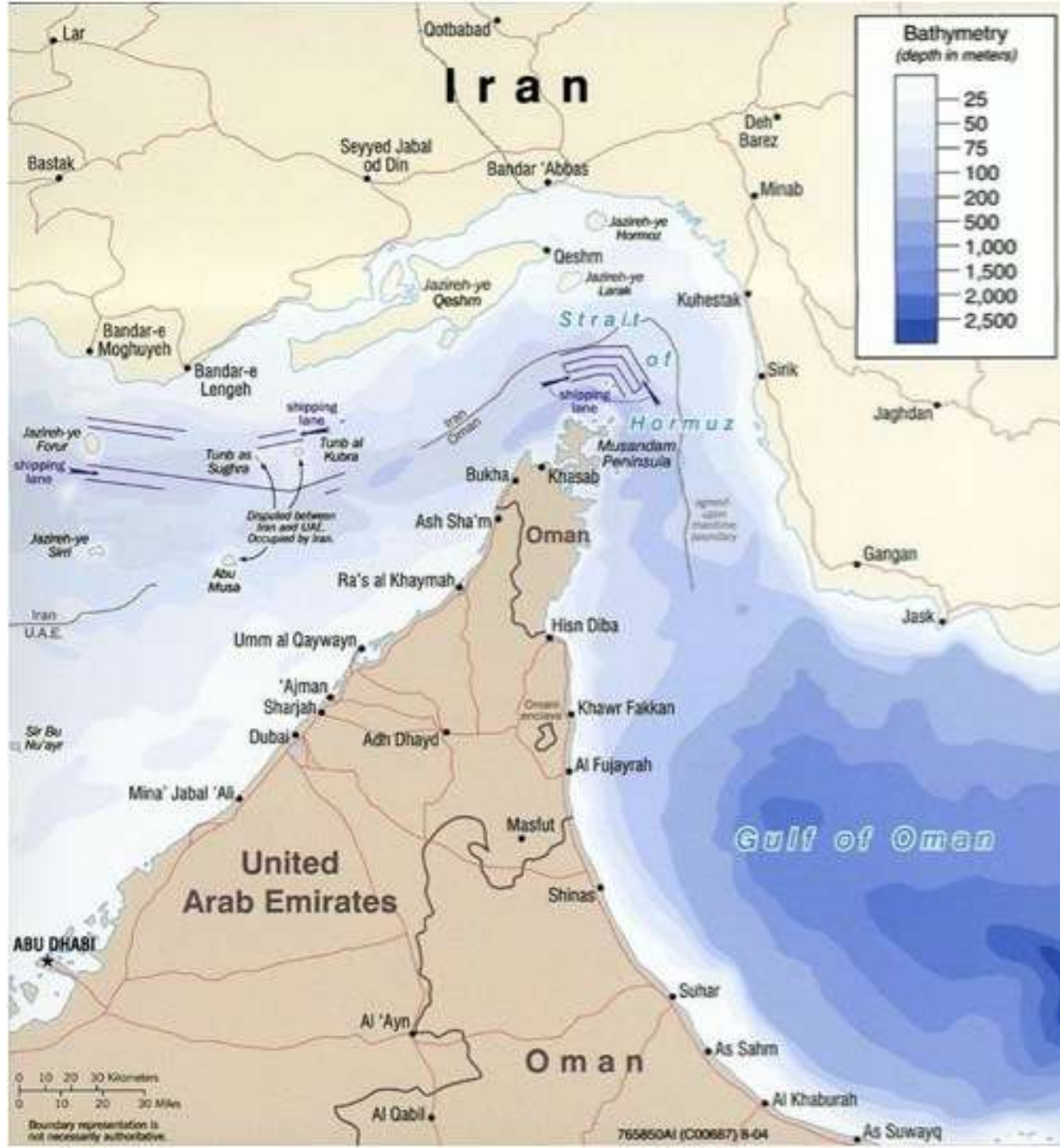
•The Strait of Hormuz:

• Oil Flow: 16.5 million bbl/d



•Bab el-Mandab:

• Oil Flow: 3.3 million bbl/d



Important World Oil Transit Chokepoints

Name	2006E oil flow (bbl/d)	Width at Narrowest Point	Oil Source Origin	Primary Destination	Past Disturbances	Alternative Routes
The Strait of Hormuz	16.5 – 17 million (70% of Gulf Supply 24.3 mn b/d)	21 miles	Gulf Nations including Saudi Arabia, Iran and UAE	Japan, The United States, Western Europe, other Asian countries	Sea mines were installed during the Iran-Iraq War in the 1980s. Terrorist threats post September 11, 2001	745 miles long East-West Pipeline through Saudi Arabia to the Red Sea
The Strait of Malacca	15 million	1.7 miles	Gulf Nations, West Africa	All Asia/Pacific consumers including Japan and China	Disruptions from pirates are a constant threat, including a terrorist attack in 2003. Collisions and oil spills are also a problem. Poor visibility from smoke haze.	Reroute through the Lombok or Sunda Strait in Indonesia. Possible pipeline construction between Malaysia and Thailand.
The Suez Canal/Sumed Pipeline	4.5 million	1,000 feet	Gulf Nations especially Saudi Arabia, and Asia.	Europe and The United States.	Suez Canal was closed for eight years after the Six Day War in 1967. Two large oil tankers ran aground in 2007 suspending traffic.	Reroute around the southern tip of Africa (the Cape of Good Hope) additional 6,000 miles.
Bab el-Mandab	3.3 million	18 miles	The Gulf Nations	Europe and The United States	USS Cole attack in 2000; French oil tanker in 2002, both attacks off the coast of Aden, Yemen.	Northbound traffic can use the East-West oil pipeline through Saudi Arabia; Reroute around the southern tip of Africa (the Cape of Good Hope) additional 6,000 miles
The Turkish Straits	2.4 million	0.5 mile	Caspian Sea Region	Western and Southern Europe	Numerous past shipping accidents due to the straits sinuous geography. Some terrorist threats were made after September 11, 2001	No clear alternative; potential pipelines discussed including a 173 mile pipeline between Russia, Bulgaria, and Greece.
The Panama Canal	0.5 million	110 feet	The United States	The United States, and other Central American countries	Suspected terrorist target.	Reroute around Straits of Magellan, Cape Horn and Drake Passage; additional 8,000 miles.

Strait of Hormuz

- Strait of Hormuz is the world's most important oil chokepoint due to its daily oil flow of 16.5-17 million barrels (first half 2008E), which is roughly 40 percent of all seaborne traded oil (or 20 percent of oil traded worldwide). Oil flows averaged over 16.5 million barrels per day in 2006, dropped in 2007 to a little over 16 million barrels per day after OPEC cut production, but rose again in 2008 with rising Gulf supplies.
- At its narrowest point the Strait is 21 miles wide, and the shipping lanes consist of two-mile wide channels for inbound and outbound tanker traffic, as well as a two-mile wide buffer zone. The majority of oil exported through the Strait of Hormuz travels to Asia, the United States and Western Europe. Currently, three-quarters of all Japan's oil needs pass through this Strait. On average, 15 crude oil tankers passed through the Strait of Hormuz daily in 2007, along with tankers carrying other petroleum products and liquefied natural gas (LNG).
- Closure of the Strait of Hormuz would require the use of longer alternate routes at increased transportation costs. Alternate routes include the 745 miles-long Petrolina, also known as the East-West Pipeline, across Saudi Arabia from Abqaiq to the Red Sea. The East-West Pipeline has a capacity to move five million-bbl/d. The Abqaiq-Yanbu natural gas liquids pipeline, which runs parallel to Petrolina to the Red Sea, has a 290,000-bbl/d capacity. Other alternate routes could include the deactivated 1.65-million bbl/d Iraqi Pipeline across Saudi Arabia (IPSA), and the 0.5 million-bbl/d Tapline to Lebanon. Oil could also be pumped north to Ceyhan in Turkey from Iraq.

(Source: http://www.eia.doe.gov/emeu/cabs/World_Oil_Transit_Chokepoints/Hormuz.html)

Bab el-Mandab

- The Strait of Bab el-Mandab is a chokepoint between the horn of Africa and the Middle East, and a strategic link between the Mediterranean Sea and Indian Ocean. It is located between Yemen, Djibouti, and Eritrea, and connects the Red Sea with the Gulf of Aden and the Arabian Sea. Exports from the Gulf must pass through Bab el-Mandab before entering the Suez Canal. In 2006, an estimated 3.3 million bbl/d flowed through this waterway toward Europe, the United States, and Asia. The majority of traffic, around 2.1 million bbl/d, flows northbound through the Bab el-Mandab to the Suez/Sumed complex.
- Bab el-Mandab is 18 miles wide at its narrowest point, making tanker traffic difficult and limited to two 2-mile-wide channels for inbound and outbound shipments. Closure of the Strait could keep tankers from the Gulf from reaching the Suez Canal or Sumed Pipeline, diverting them around the southern tip of Africa. This would effectively engage spare tanker capacity, and add to transit time and cost.
- The Strait of Bab el-Mandab could be bypassed through the East-West oil pipeline, which crosses Saudi Arabia with a 4.8 million bbl/d capacity. However, southbound oil traffic would still be blocked. In addition, closure of the Bab el-Mandab would block non-oil shipping from using the Suez Canal, except for limited trade within the Red Sea region.
- Security remains a concern of foreign firms doing business in the region, after a French tanker was attacked off the coast of Yemen by terrorists in October 2002.

(Source: http://www.eia.doe.gov/emeu/cabs/World_Oil_Transit_Chokepoints/Bab_el-Mandab.html)

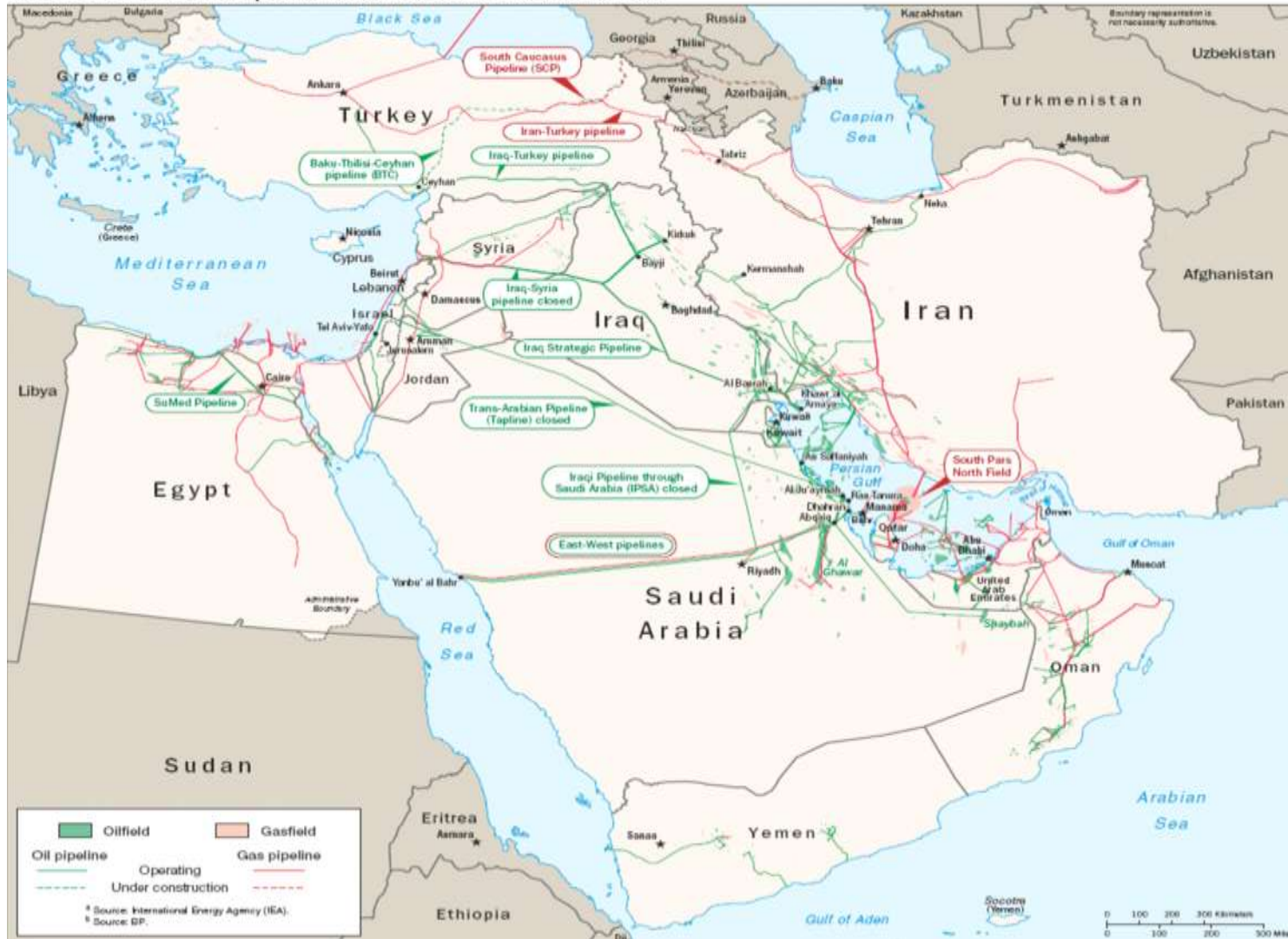
Suez/Sumed

- The Suez Canal is located in Egypt, and connects the Red Sea and Gulf of Suez with the Mediterranean Sea. The Canal is one of the world's greatest engineering feats covering 120 miles. Oil shipments from the Gulf travel through the Canal primarily to European ports, but also to the United States. In 2006, an estimated 3.9 million bbl/d of oil flowed northbound through the Suez Canal to the Mediterranean, while 0.6 million bbl/d travelled southbound into the Red Sea.
- Over 3,000 oil tankers pass through the Suez Canal annually, and represent around 25 percent of the Canal's total revenues. With only 1,000 feet at its narrowest point, the Canal is unable to handle large tankers. The Suez Canal Authority (SCA) has discussed widening and deepening the Canal to accommodate VLCCs and Ultra Large Crude Carriers (ULCC).
- The 200-mile long Sumed Pipeline, or Suez-Mediterranean Pipeline, also provides a route between the Red and Mediterranean Seas by crossing the northern region of Egypt from the Ain Sukhna to the Sidi Kerir Terminal. The pipeline provides an alternative to the Suez Canal, and can transport 3.1 million bbl/d of crude oil. In 2006, nearly all of Saudi Arabia's northbound shipments (approximately 2.3 million bbl/d of crude) were transported through the Sumed pipeline. The pipeline is owned by Arab Petroleum Pipeline Co., a joint venture between EGPC, Saudi Aramco, Abu Dhabi's ADNOC, and Kuwaiti companies.
- Closure of the Suez Canal and the Sumed Pipeline would divert tankers around the southern tip of Africa, the Cape of Good Hope, adding 6,000 miles to transit time.

(Source: http://www.eia.doe.gov/emeu/cabs/World_Oil_Transit_Chokepoints/Suez.html)

Overland Oil Supply Pipelines

Selected Oil and Gas Pipeline Infrastructure in the Middle East



(Source: http://www.eia.doe.gov/emeu/cabs/Persian_Gulf/images/pg_map.pdf)

- By April of 2010, a 375 km, 64 inch oil-pipeline running from Habshan in Abu Dhabi to Fujairah in the Arabian Sea will be complete. The pipeline overland route will bypass and avoid the strategic chokepoint at the Strait of Hormuz.
- In addition to the pipeline project, Abu Dhabi is building eight oil storage tanks, each with a capacity to hold 1 million barrels of crude oil.
- Work has started on an industrial zone and oil terminals in Fujairah.

(Source: MEED Feb 11, 2010. "Fujairah offers a contingency plan to combat Iran's oil threat")

Terrorism & WMD

- It is generally understood that when we talk about Weapons of Mass Destruction (WMD) we imply nuclear, biological, and chemical (NBC) weapons. More recently, other means of mass destruction or mass disruption effects entered the lexicon. Radiological weapons, often called radiological dispersal devices (RDD), add to a grouping of weapon capabilities as chemical, biological, radiological, and nuclear (CBRN). High yield explosives can be considered, in some cases, a weapon of mass destruction. This characteristic is incorporated in a contemporary acronym of CBRNE. Cyber Terrorism can in part cause severe disruption and physical damages, one example could be a cyber attack on nations air traffic control system.
- The devastating impacts of WMD include chemical, biological, radiological, nuclear, and enhanced high explosive weapons as well cyber attacks. WMD may, at times, rely more on disruptive impacts than on destructive effects.
- The devastation of 9/11 raised the bar in terms of the kind of carnage that a future terrorist act must produce to capture similar news coverage. That, in turn, induces the terrorists to innovate in order to find a new means to cause greater destruction.
- Terrorist groups that acquire WMD pose a critical danger. Terrorists armed with these weapons can gain leverage for their demands by threatening use of WMD to influence political or military actions, or to achieve a specific economic or financial objective. Likewise, some groups simply want to employ WMD to create large numbers of casualties, both military and civilian, and capitalize on the effects of these events.

Terrorist Acts with Mass Casualties

- 23 Oct 1983 : truck bombings of U.S. Marine and French barracks, Beirut, Lebanon (301) fatalities.
- 21 Dec 1988 : mid-air bombing of Pan-Am flight over Lockerbie, Scotland (270) fatalities.
- 26 Feb 1993 : truck bombing in garage of World Trade Center, NYC, USA. (6) fatalities, (1,000) injuries.
- 20 Mar 1995 : sarin nerve gas attack in subway in Tokyo, Japan. (12) fatalities, (5,511) injuries. (Chemical Terrorism)
- 19 Apr 1995 : truck bombing of Federal Building, Oklahoma City, Oklahoma, USA (169) fatalities.
- 26 Jun 1996 : truck bombing at U.S. military housing complex in Dhahran, Saudi Arabia. (19) fatalities, (513) injuries.
- 8 Aug 1998 : truck bombings of U.S. Embassies in Nairobi, Kenya, and Dar as Saalam, Tanzania (303) fatalities.
- 31 Oct 1999 : intentional crash of Egypt Air flight over Massachusetts USA by pilot, (217) fatalities .
- 11 Sep 2001 : crashing of hijacked planes into World Trade Center, NYC, Pentagon in Alexandria, and site in Pennsylvania USA (2,993) fatalities.
- 18 Sep 2001 : anthrax-laced letters mailed to Florida and NYC, (1) fatalities, (10) injuries. (Bio-Terrorism)
- 9 Oct 2001 : anthrax-laced letters mailed to Washington DC, USA. (4) fatalities (Bio-Terrorism)
- 11 Mar 2004 : bombings of four trains in Madrid, Spain, (191) fatalities, (7) injuries.
- 7 July 2005 : bombings of three subway trains and one bus in London, UK (54) fatalities, (700) injuries.

- One important aim of the U.S. invasion of Afghanistan was to destroy and eliminate the main bases of al-Qaida and its central command structure. The 9/11 attacks demonstrated that transnational terrorism is becoming more lethal, and that it can produce a fundamental political and strategic impact. The threat of terrorist use of WMD is still possible and perhaps inevitable given the goals of al-Qaida.
- The threat of terrorist use of weapons of mass destruction (WMD), is a real one that represents a very serious threat to the U.S. and other nations that are potential targets of sub-national terrorist groups or networks. Transnational terrorism and the potential acquisition by terrorists of weapons of mass destruction are part of the 'asymmetric' dynamics of the new threats that have emerged and have thrust the international community into a new era of warfare.
- As far as is presently known, terrorist groups do not have in their possession nuclear weapons. However they could have the capability sometime soon given that knowledge about these kinds of weapons are available worldwide. Recent terrorist attacks have shown a rise in the tendency towards the use of mass-causality weapons for which WMD could be very well suited.
- The attempted terrorist attacks to simultaneously bomb locations in Jordan, in April 2004, using conventional explosives to disperse toxic chemical material, clearly demonstrates the deliberate planning for use of toxic chemical material in terrorism. Jordanian security forces foiled the attack on Jordanian and U.S. targets with a preemptive raid on the facilities used by the terrorists. Reports estimate that approximately 20 tons of chemicals were confiscated, which could have caused tens of thousands of casualties. The intent for the indiscriminate nature of the terrorist attacks was clear and projected how fast and how large a future attack using mass destruction bombs would occur.
- For radiological attacks a study was conducted by the Federation of American Scientists in which the destructive effects of various types of radiological bombs were analyzed. The case studies consisted of Cobalt, Cesium and Americium bombs. The conclusion was that "While radiological attacks would result in some deaths, they would not result in the hundreds of thousands of fatalities that could be caused by a crude nuclear weapon. Attacks could contaminate large urban areas with radiation levels that exceed the Environment Protection Agency (EPA) health and toxic material guidelines".

The Comparative Effects of Biological, Chemical and Nuclear Weapons.

	Area Covered (sq. km.)	Estimated Fatalities					
		Kuwait City	Manama Bahrain	Doha Qatar	Abu Dhabi UAE	Muscat Oman	Riyadh Saudi Arabia
Chemical: 300 kg of Sarin nerve gas with a density of 70 milligrams per cubic meter	0.22	1000	650	350	330	800	1020
Biological: 30 kg of Anthrax Spores with a density of 0.1 milligrams per cubic meter	10	41,260	28,570	14,710	14,880	36,370	46,330
Nuclear: One 12.5 kiloton nuclear devise achieving an over pressure of 5psi	7.8	32,180	22,290	11,470	11,610	28,360	36,140
Using one aircraft dispensing 1,000 kg of Sarin nerve gas or 100 kg of Anthrax spores.							
Clear sunny day, light breeze:							
Sarin Nerve Gas	0.74	3,050	2,110	1,090	1,100	2,700	3,420
Anthrax Spores	46	190,000	131,430	67,647	68,440	162,270	213,100
Overcast day/night, moderate wind:							
Sarin Nerve Gas	0.8	3,300	2,290	1,170	1,190	2,910	3,710
Anthrax Spores	140	570,000	400,000	205,800	208,300	510,000	648,650
Clear Calm Night:							
Sarin Nerve Gas	7.5	30,900	21,430	11,030	11,160	27,270	34,750
Anthrax Spores	300	1,237,800	857,100	441,100	446,300	1,090,910	1,390,000

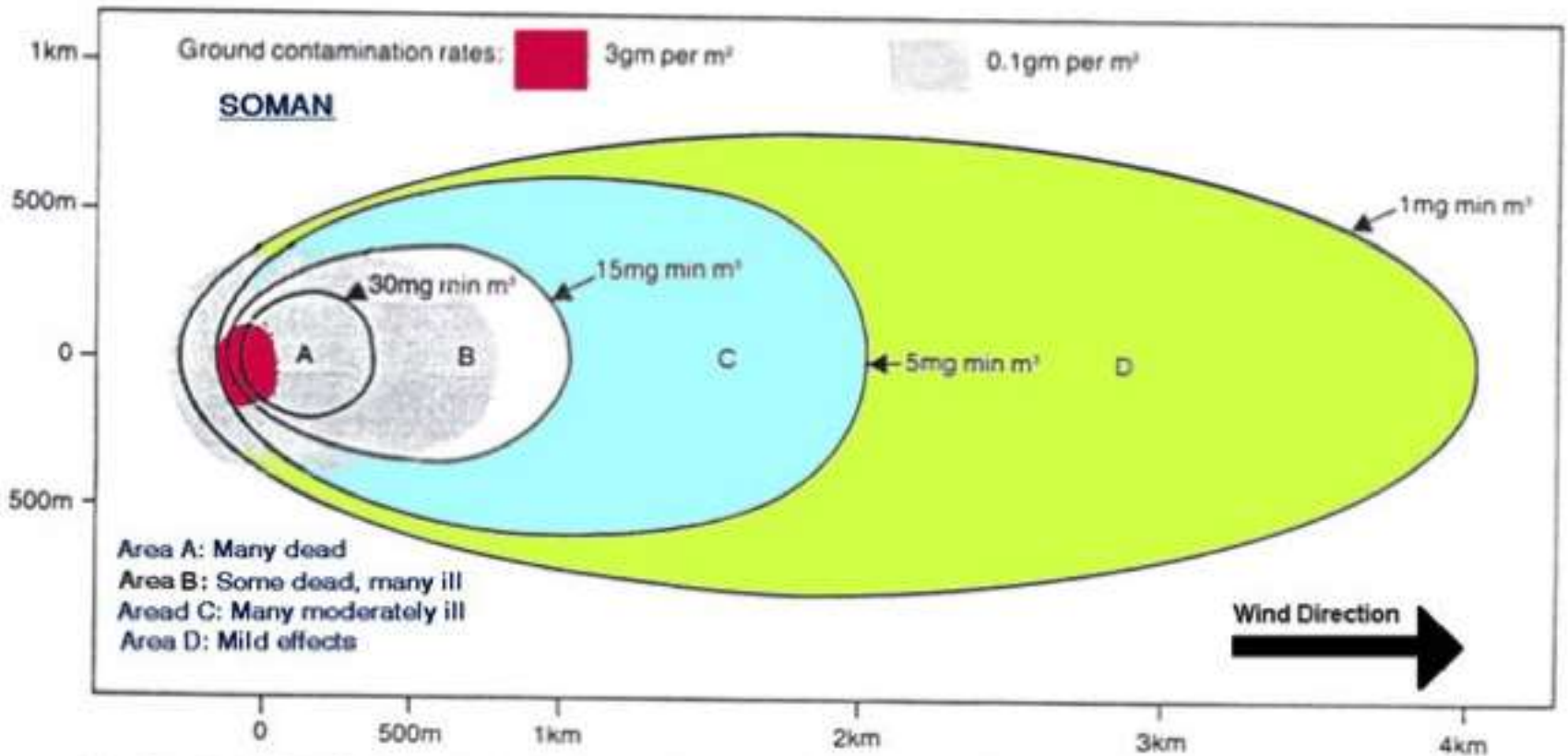
Chemical Terrorism

Chemical Weapons

Chemicals can be used to kill or incapacitate personnel and to deny use of areas, materiel, or facilities. Agents can be both lethal and non-lethal, and can be either persistent or non-persistent in effects. Terrorists have already used chemical weapons and although examples often display a basic use of chemicals, a tendency exists to demonstrate ever increasing death, damage, and psychological stress on a target.

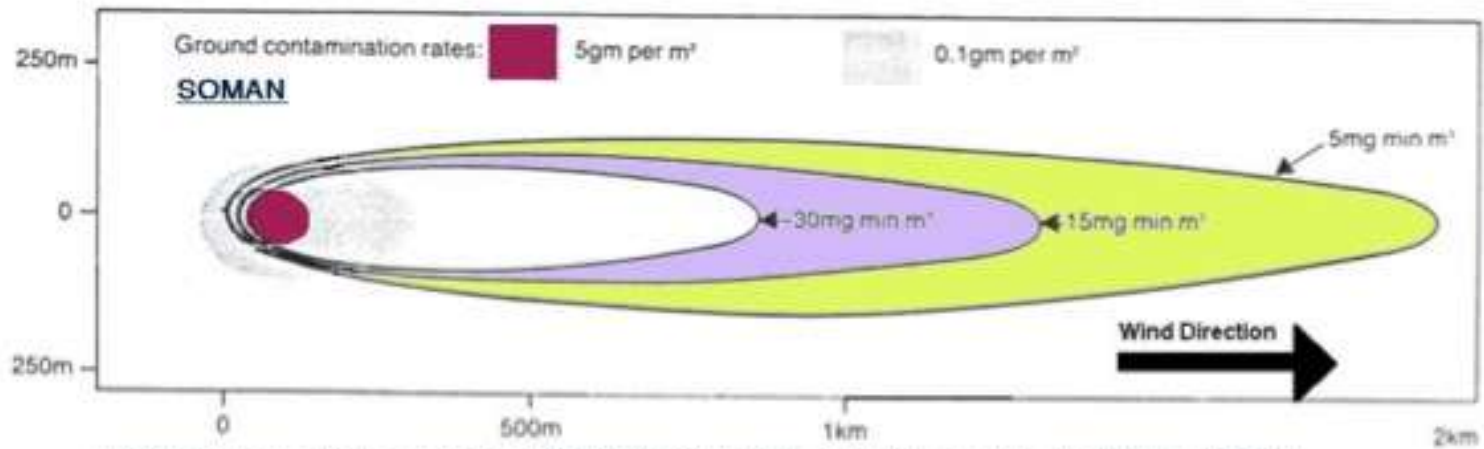
Agent	Known As	Route of Entry	Rate of Action	Persistency
Choking	Phosgene (CG) Chlorine (C)	Respiratory	Immediate	Minutes to Hours
Blood	Hydrogen Cyanide (HC) Cyanogen Chloride (CK)	Respiratory	Rapid (seconds)	Minutes to Hours
Blister	Mustard (H) Lewisite (L) Phosgene Oxime (CX)	- Skin - Inhalation - Eyes	Rapid	Hours to Days
Nerve	Tabun (GA) Sarin (GB) Soman (GD) VX	- Skin - Inhalation - Eyes	- Inhalation: Rapid - Skin: Seconds to minutes	Tabun: Minutes to Hours Sarin: Minutes to Hours Soman: Hours VX: Hours to Days

(Reference: US Army TRADOC Handbooks. A Military Guide to Terrorism in the 21st Century. 2007)



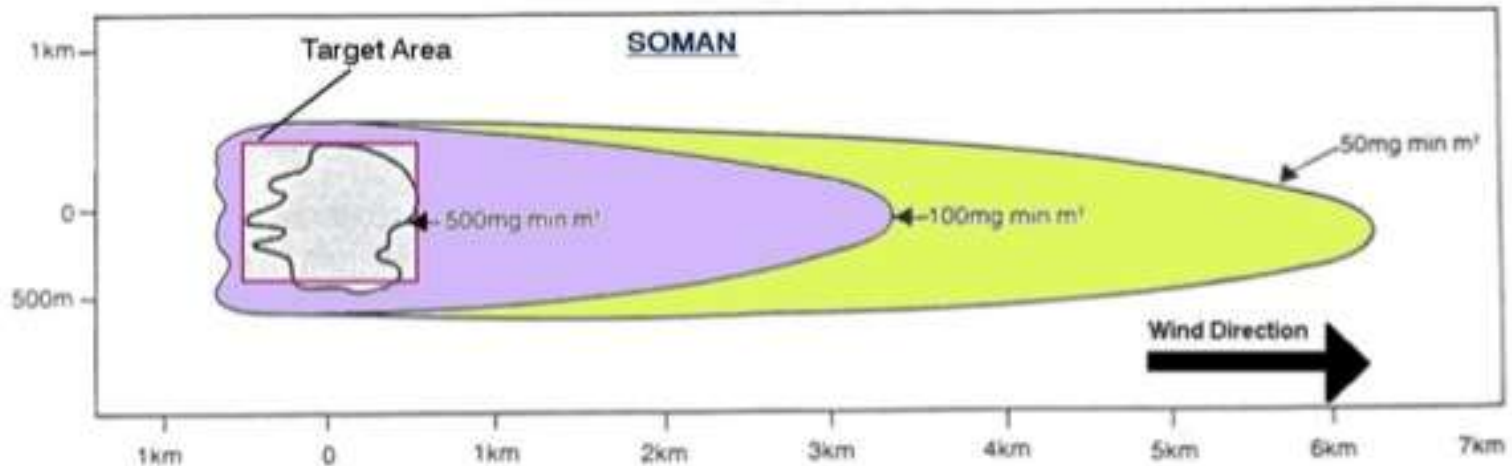
SCUD MISSILE ATTACK: One missile fired (CEP:900m); wind speed 5 m/sec; neutral atmospheric conditions.

SSM	Single Warhead (kg)	Range (km)
SS-1C (SCUD B)	985	300
SS-1D (SCUD C)	500	500



FROG Missile Attack: One missile fired (CEP: 400 m); windspeed 5 m/sec; neutral atmospheric conditions.

SSM	Single Warhead (kg)	Range (km)
Frog 7b	200 to 457	68



BM-21 MRL Attack: One battalion of 18 launchers (each 40 rockets) fired at target area 1 x 1 km; wind speed 3 m/sec; neutral atmospheric conditions.

Biological Terrorism

Biological Weapons

- Biological Weapons are easier and cheaper to produce than either chemical or nuclear weapons, and the technology is readily available in open literature and on the Internet. Biological agents can be very lethal in comparison with other WMD agents or material. As one example assuming optimum conditions, about 1,800 pounds of chemical agent Sarin is required to inflict a large number of casualties over a square mile area, while only a quarter ounce of anthrax spores is required to achieve the same effect over the same area under ideal distribution conditions.
- Biological warfare agents include three basic categories: pathogens, toxins, and bioregulators. Pathogens are disease producing microorganisms such as bacteria, rickettsia, or viruses. Pathogens can occur naturally or can be altered with biotechnology. Toxins are poisons formed by a vegetable or animal, but can be produced synthetically also. Bioregulators affect cell processes in the body. Used as a bioweapon, they can cause severe adverse effects or death.
- Biological agents can be isolated from sources in nature, acquired from laboratories or bioweapons stockpiles, or synthesized or genetically manipulated in a laboratory.

Biological Weapons

Type	Agent	Incubation Period
Bacteria	Anthrax Tularemia Plaque	Typically 1-6 days, but up to 42 days 1-21 days (average 3-6 days) 1-7 days (usually 2-3 days)
Toxins	Botulism Ricin	12 hours to 5 days 18-24 hours
Viruses	Smallpox Ebola	7-17 days (average 12) 4-21 days
Rickettsia	Q fever	7-41 days

(Reference: US Army TRADOC Handbooks. A Military Guide to Terrorism in the 21st Century. 2007)

Biological Weapons Estimated Casualties Using Aerosol Delivery Mechanism

	Amount Released	Estimated Damage/Lethality
Anthrax	100 kg spores released over a city the size of Washington DC	130,000 – 3 million deaths
Plague	50 kg <i>Y. pestis</i> released over city of 5 million people	150,000 infected 36,000 deaths
Tularemia	50 kg <i>F. tularensis</i> released over city of 5 million people	250,000 incapacitated 19,000 deaths

Basis of Dose Calculations:

Wind Speed 5 meter/sec at 10 meters height

Release Height = 10 meters

Source Strength = 1 gram = 10^{12} spores

Breathing Rate = 30 L/min (as for a man engaged in light work)

Atmospheric Stability “Neutral” : Briggs “D”

Atmospheric Stability “Slightly Stable” : Briggs “E”

ID50 (Dose in spores to cause effect in 50% of a population) = 8,000

Briggs “D” ID50 Downwind Distance = 1,190 meters

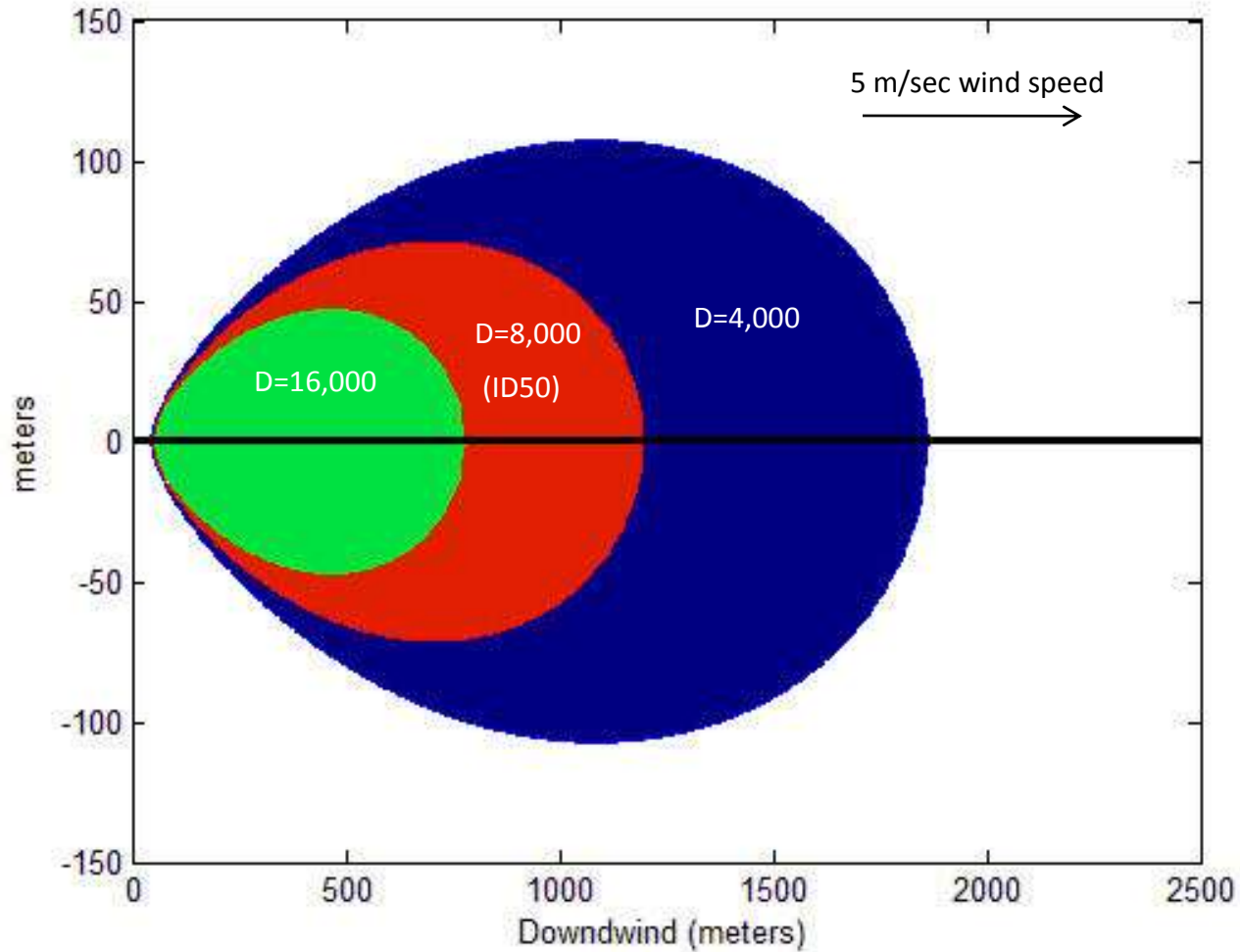
Briggs “E” ID50 Downwind Distance = 1,900 meters

(Reference: Applied Science and Analysis Inc. The ASA Newsletter. 2001: “Note Regarding Source Strength” Matthew Meselson.)

Anthrax Centerline Dose (Spores)

Downwind Distance (km)	Briggs "D" (Atmospheric Stability - Neutral)	Briggs "E" (Atmospheric Stability – Slightly Stable)
0.5	32,610	62,100
1	10,620	21,940
2	3,580	7,470
3	1,950	4,160
4	1,290	2,830
5	940	2,140
6	730	1,720
7	600	1,440
8	500	1,250
9	430	1,100
10	375	990
20	160	530
30	100	390
40	72	320
50	57	270

1 gram Anthrax dose in spores



Dose in Spores to cause effect in 50% of population exposed (ID50) = 8,000 spores

**Radiological Terrorism
(Radiological Dispersal Device RDD)**

“Dirty Bomb” Danger

- To date, the U.S. has not been attacked with a radiological weapon by terrorists. Nonetheless, theoretical case study examples illustrate the potential impacts of a radiological “dirty bomb.” Most injuries would probably occur from the heat, debris, radiological dust and force of the conventional explosion. A “dirty bomb” cannot create an atomic blast. Nonetheless, assumptions may appear too simple or too critical in stating the damage of a radiological event.
- Attack on a nuclear facility is another means to cause radiological contamination. Even with the redundant safeguards and security measures at nuclear facility locations, the possibility of terrorist assault and breach of these measures is not impossible. Considerable precautions and security measures are, in effect, to preclude successful attacks by vehicle borne explosive devices or aerial borne means.
- The simplest and the most primitive terrorist nuclear device would be a radiological weapon or radiological dispersal device, commonly called a "dirty bomb". It is not strictly speaking a nuclear weapon, as it does not involve a nuclear explosion. A dirty bomb would consist of a conventional high explosive—for example, Semtex, dynamite or TNT—and a quantity of a radioactive material.

Effects of a radiological weapon:

- The detonation of a dirty bomb is unlikely to cause a large number of casualties. Generally, any immediate deaths or serious injuries would most likely be caused by the detonation of the conventional explosive. The radioactive material in the bomb would be dispersed into the air but would soon be diluted to relatively low concentrations.
- If the bomb were exploded in a city, as it most likely would be, some people would probably be exposed to a dose of radiation. However, in most cases the dose would probably be relatively small. A low-level exposure to radiation would slightly increase the long term risk of cancer. The main potential impact of a dirty bomb is psychological—it would cause considerable fear, panic, and social disruption, exactly the effects' terrorists wish to achieve.

(Reference: US Army TRADOC Handbooks. A Military Guide to Terrorism in the 21st Century. 2007)

Radiological and Nuclear Devices

Device	Type of Weapon
Radiological Dispersal Device (RDD)	This is a conventional weapon designed to disperse radioactive material causing destruction and contamination as well as injury.
Improvised Nuclear Device (IND)	This is intended to cause a yield-producing nuclear explosion. Built from a modified nuclear weapon or components.

A Radiological Dispersal Device (RDD) is a conventional weapon designed to disperse radioactive material causing destruction and contamination as well as injury.

A Selected Sample of Radioactive Materials

Radioactive Material	Used In
Cobalt-60 (Co-60)	<ul style="list-style-type: none">• Cancer Therapy• Industrial Radiography• Industrial Gauges• Food Irradiation
Cesium – 137 (Cs-137)	<ul style="list-style-type: none">• (Same uses as Cobalt – 60)• Well Logging
Iridium – 192 (Ir – 192)	<ul style="list-style-type: none">• Industrial Radiography• Implants Cancer Therapy
Strontium – 90 (Sr – 90)	<ul style="list-style-type: none">• Radioisotope• Thermoelectric Generators
Plutonium – 238 (Pu – 238)	<ul style="list-style-type: none">• Research• Well Logging• Thermoelectric Generators
Americium – 241 (AM – 241)	<ul style="list-style-type: none">• Industrial Gauges• Well Logging

Non-Nuclear Uranium Explosion
Abu Dhabi - UAE

Inner	: 0.001 rem (0.003 square km)
Middle	: 0.0001 rem (0.016 square km)
Outer	: 0.00001 rem (2.9 square km)
Source Material	: Uranium (U)
Material at Risk	: 3 Kg
High Explosive	: 5 lbs TNT
Wind Velocity	: 2 meters/sec
Stability Class (City)	: Briggs "D"

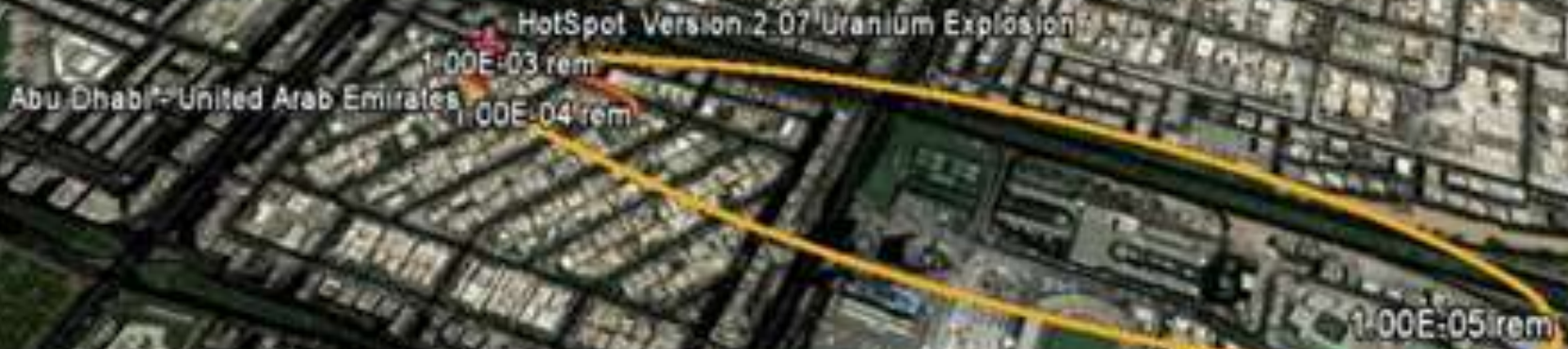


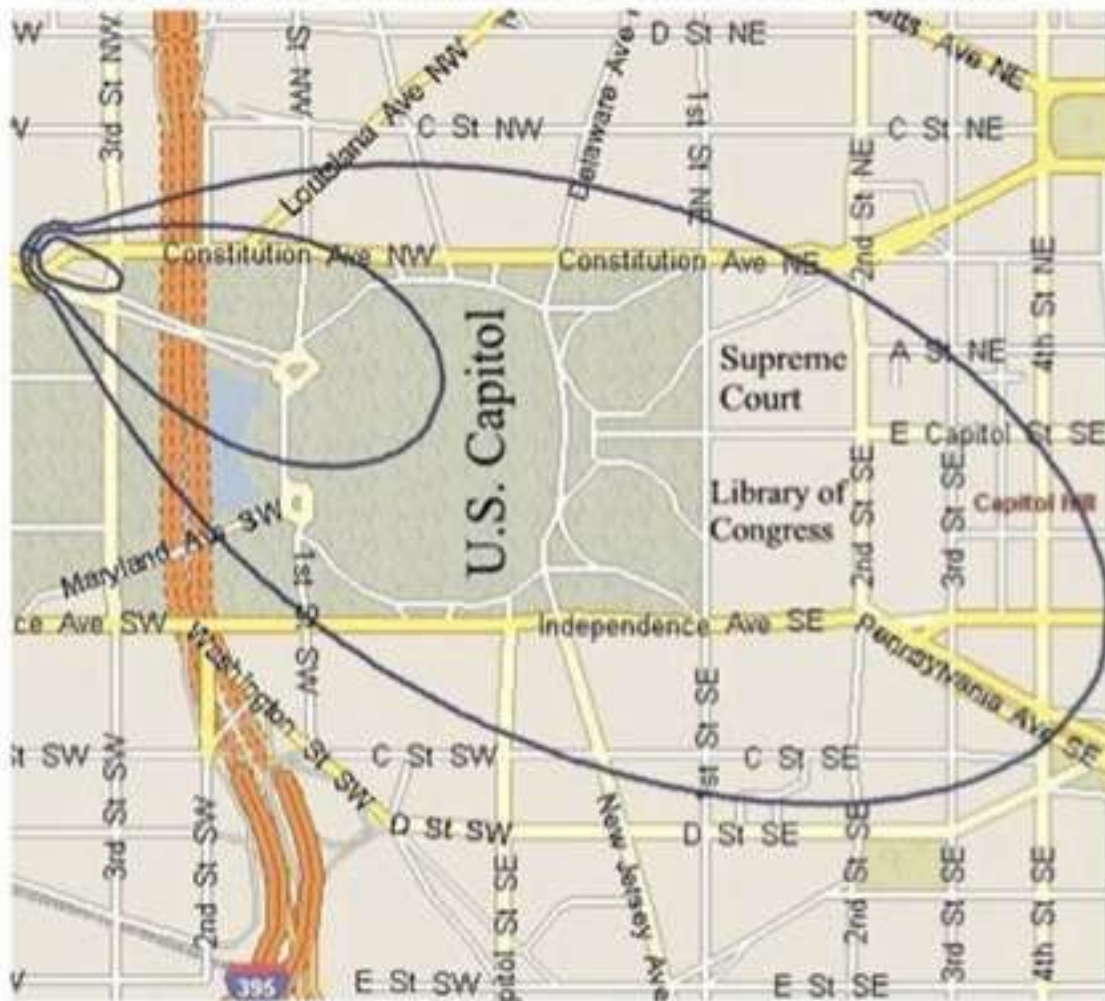
Figure 4: Immediate Effects Due to Americium Bomb in New York City



- Inner Ring:** All people must receive medical supervision
- Middle Ring:** Maximum annual dose for radiation workers exceeded
- Outer Ring:** Area should be evacuated before radiation cloud passes

(Reference: Testimony of Dr. Henry Kelly, President Federation of American Scientists before the Senate Committee on Foreign Relations. March 6, 2002)

Figure 1: Long-term Contamination Due to Cesium Bomb in Washington, DC



- Inner Ring:** One cancer death per 100 people due to remaining radiation
 - Middle Ring:** One cancer death per 1,000 people due to remaining radiation
 - Outer Ring:** One cancer death per 10,000 people due to remaining radiation
- EPA recommends decontamination or destruction

(Reference: Testimony of Dr. Henry Kelly, President Federation of American Scientists before the Senate Committee on Foreign Relations. March 6, 2002)

Figure 2: Long-term Contamination Due to Cobalt Bomb in NYC – EPA Standards



Inner Ring: One cancer death per 100 people due to remaining radiation
Middle Ring: One cancer death per 1,000 people due to remaining radiation
Outer Ring: One cancer death per 10,000 people due to remaining radiation
 EPA recommends decontamination or destruction

Figure 3: Contamination Due to Cobalt Bomb in NYC – Chernobyl Comparison



Inner Ring: Same radiation level as *permanently closed zone* around Chernobyl
Middle Ring: Same radiation level as *permanently controlled zone* around Chernobyl
Outer Ring: Same radiation level as *periodically controlled zone* around Chernobyl

(Reference: Testimony of Dr. Henry Kelly, President Federation of American Scientists before the Senate Committee on Foreign Relations. March 6, 2002)

Appendix

Iranian Nuclear Facilities: Target Analysis Force Allocation

Esfahan

Facility not buried, and area some 100,000 sq ft.

psi	Peak Overpressure Distance (ft)	Number of GBU-27 required to cover 100,000 sq ft.
10	59	9
5	89	4
3	118	2

- We assume that a 5 psi blast is required.
- Assume a 90% system reliability, then 5 GBU-27 would be required.
- This would require 5 F-16s if each carries 1 GBU-27 PG Bombs.

Natanz Facility

psi	Distance of Peak Overpressure (ft)	Underground Facilities (646,000 sq ft) Number of GBU-28s required	Uranium Separation Plant 6 Buildings (95,500 sq ft) Number of GBU-28s required
10	62	48	7
5	92	22	3
3	125	12	2

- We assume a required psi of 5psi, as a 10psi requirement could be an overkill.
- We find that 22 GBU-28 are needed to cover the underground facilities of 585,000 sq ft in area.
- This would imply that on the average each GBU-28 covers an area of 26,600 sq ft.
- Since we also assumed a 50% penetration for each GBU-28 pair, we would then require some 44 GBU-28 PG Bombs.
- For the Uranium Separation Buildings, we can assume that the requirement would also be 5 psi, therefore the number of GBU-28 comes out to be 3 that would cover the 85,500 sq ft area.
- A force of either 50 F-15Es have to be allocated if 1 GBU-28 is mounted on the Centerline.
- Or a force of 25 F-15E have to be allocated if 2 GBU-28 are carried.

(We assume that 90% of the surface area of each target site is covered, $0.9 \text{ of } 646,000 = 585,500$)

Arak

psi	Distance of Peak Overpressure (ft)	Heavy Water Production Plant some 55,000sq ft. Number of GBU-10s required	Nuclear Reactor Construction Site Number of GBU-10s required
10	69	4	4

- The main elements of the Production Plant to manufacture Heavy Water are the set of towers that cover an area of some 55,000 sq ft.
- 4 GBU-10 would be required to cover the whole area and collapse the towers.
- We shall assume that 4 GBU-10s would be required to destroy the Reactor if the Construction has been completed if and when Israel decides to go ahead with the Mission to Strike Iran's Nuclear facilities.
- Force allocation required would then be 4 to 8 F-16Is if each F-16I carries 1 GBU-10.

Mission Planning Payloads

GBU-27	<p>BLU-109 2000lb class penetrating warhead. Penetrates 1.8 to 2.4 meters of concrete/hard targets depending on angle of attach. It carries 550 lbs of high explosives, and can penetrate more than 6 feet of reinforced concrete.</p>	<p>This 2000lb weapon would be most likely used against the Esfahan Uranium Conversion Facility. In addition the GBU-10 can also be used.</p>
GBU-28	<p>BLU-113 5000 lb class penetrating warhead. Penetrates at least 6 meters (20 feet) of concrete, presumably reinforced concrete and 30 meters(100 ft) of earth.</p> <p>It is a 5,000 lb laser guided conventional munitions that uses a 4,000 lb penetrating warhead blast/fragmentation, which contains 630 pounds of explosive.</p>	<p>The GBU-28/BLU-113 5000lb penetrator would be the most likely weapon of choice against the Natanz Centrifuge Facility as well as the Esfahan Uranium Conversion Facility.</p> <p>Used as a Bunker Buster. 2 properly sequenced GBU's would most certainly penetrate the 30 meters of earth and up to 6m of concrete.</p> <p>The Probability of Hit (PH) of 2 GBU's aimed at the same point essentially one following the other is 50%.</p>

Peak Overpressure Distance

Weapon	Warhead (kg)	10 psi (ft)	5 psi (ft)	3 psi (ft)
GBU-28	306	62	92	125
GBU-27	240	59	89	118
GB-10	428	69	105	144

Aircraft Fuel Load

	F-15E	F-16
Internal Fuel	1,987 Gal = 12,916 lbs	1,072 Gal = 6,972 lbs
External Tanks (Left & Right)	2 x 610 Gal = 2 x 3,965 lbs	2 x 370 Gal = 4,810 lbs 2 x 600 Gal = 7,800 lbs
External CL Tanks	610 Gal = 3,965 lbs	300 Gal = 1,950 lbs
Conformal Fuel Tanks (CFTs)	2 x 720 Gal = 2 x 4,680 lbs	-
Max Fuel Load	5,263 Gal = 34,213 lbs	2,572 Gal = 16,722 lbs
Weight Empty (lbs)	32,618 lbs	15,870 lb
Ferry Range- External Tanks Dropped (nmi)	2,500 nmi	2,275 nmi
Take off Gross Weight (TOGW)	81,000 lbs	37,500 lbs

F-16C

Mission	Hi-Lo-Lo-Hi	Hi-Lo-Lo-Hi	Hi-Lo-Lo-Hi	Hi-Lo-Lo-Hi	Air Superiority Hi-Hi	Air Superiority Hi-Hi
AIM-9	2	2	2	2	2	2
MK 82 (500 lbs)	4	4	8	8	-	-
600 Gal Tank	-	2	-	2	-	2
370 Gal Tank	2	-	2	-	2	-
300 Gal Tank	1	1	-	-	1	1
Fuel Quantity (Gallons)	2,113	2,573	1,813	2,273	2,113	2,573
Range nmi – Tanks Dropped	900	1,030	731	877	• 1026 • 1,162 without combat	• 1,125 • 1,365 without combat

Internal Fuel : 6,972 lbs = 1,072 Gal

F-15E

- The F-15E is a two place, high performance, supersonic, all weather, day/night, dual fighter.
- The F-15E carries BVR air-to-air missiles while configured for air-to-ground missions, enabling the aircraft to engage enemy aircraft while enroute to the target area on air-to-ground missions, giving the F-15E a Self-Escort capability.

Mission	Hi-Lo-Lo-Hi	Hi-Lo-Lo-Hi	Hi-Lo-Lo-Hi	Hi-Lo-Lo-Hi	Hi-Lo-Lo-Hi
Air to Air Missiles	4	4	4	4	4
Payload	2 x MK 84	1 x MK 84	2 x GBU-10 PGM	1 x GBU-10 PGM	6 x MK 82
External 600 Gal Tanks	1	2	1	2	2
Range (nmi)	•600 Tanks Dropped •560 Tanks Retained	•750 Tanks Dropped •700 Tanks Retained	•595 Tanks Dropped •540 Tanks Retained	•745 Tanks Dropped •680 Tanks Retained	•650 Tanks Dropped •615 Tanks Retained

F100-PW-229 Engines

LANTIRN Pods

Internal Fuel: 12,916 lbs

2 CFTs Installed : 9,400 lbs

3 x 610 Gallons : 11,895 lbs

MK 84 : 2000 lb Bomb

MK 82 : 500 lb Bomb

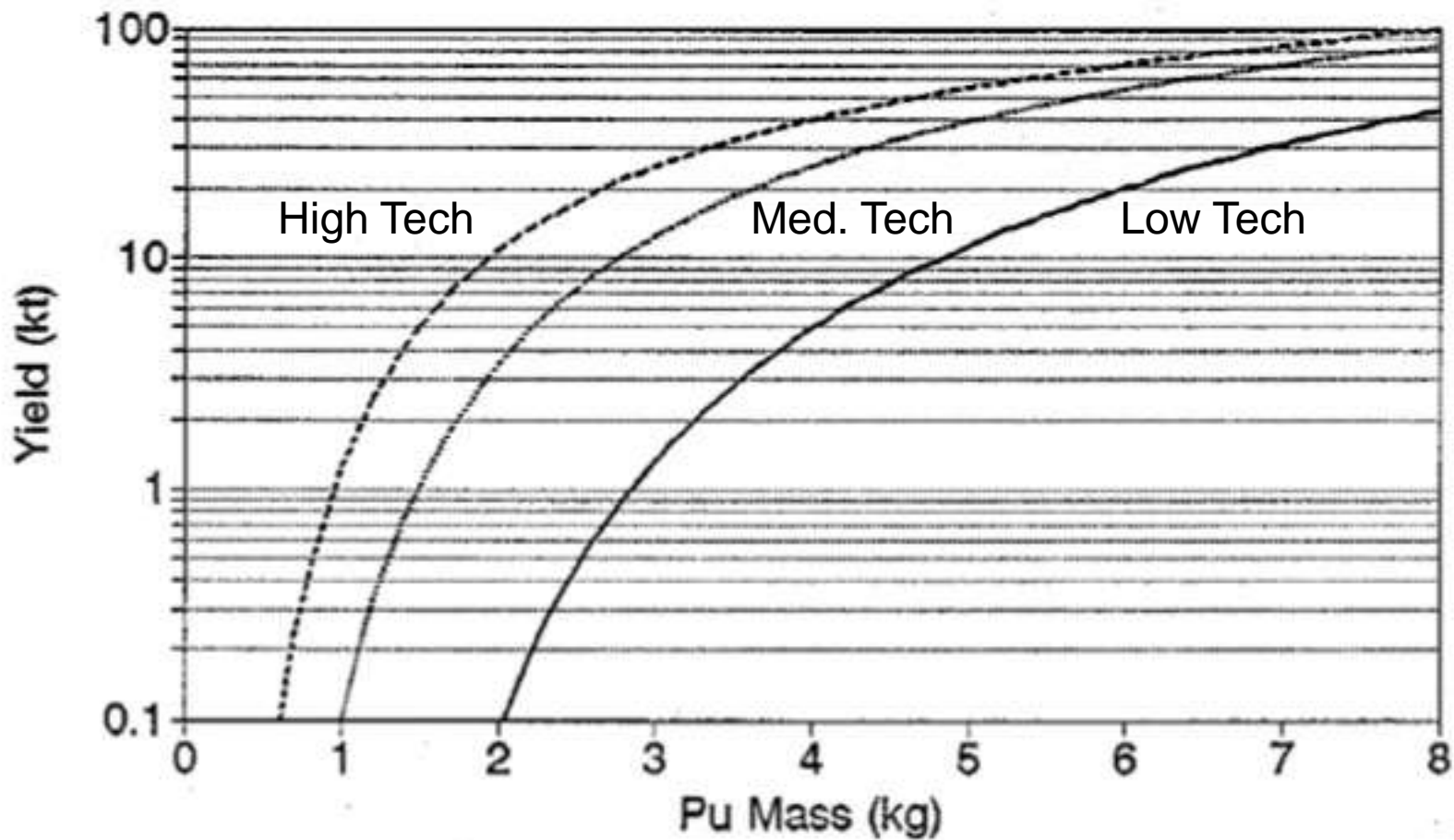
GBU-10 2000 lb class PG Bomb

lb = 6.5 lb/gal

Aerial Refueling

- The F-15E and F-16C refueling system is compatible with the refueling boom from KC-135A and KC-10 tankers.
- Some Future Options to Extend the Range of the F-15E:
 - An in flight refueling (IFR) probe could be incorporated into the F-15E to give the aircraft the capability to refuel from drogue configured tankers.
 - Studies have also taken place regarding Buddy Refueling between F-15Es that can be packaged in an external tank or CFT. This would be useful in an emergency situation when Strike Missions are in Egress from the target area.
 - Larger External Tanks (Dropped Tanks). These tanks would have a fuel capacity of 800 gallons compared to the standard 610 gallons. The F-15E's mission radius would then be increased by about 10%.
 - Additional Internal Fuel added to the outer wing of the F-15E. This would increase the mission radius by 2%
 - Larger Conformal Fuel Tanks (CFTs). The F-15E could still carry the air-to-air and air-to-ground weapons and external pods as well as the fuel tanks. This would increase the mission radius by 5%.

Yield vs Plutonium Mass
(As a function of Technical Capability)



Source: The Amount of Plutonium and HEU Needed for Pure Fission Nuclear Weapons
Thomas B. Cochran and Christopher E. Paine. 13 April 1995
National Resources Defense Council, Inc. (NRDC)

The curve in Fig. 3.72 shows the variation of peak overpressure with distance for a 1 KT free air burst in a standard sea-level atmosphere.

Scaling. For targets below 5,000 feet and for burst altitudes below 40,000 feet, the range to which a given peak overpressure extends for yields other than 1 KT scales as the cube root of the yield, i.e.,

$$D = D_1 \times W^{1/3},$$

where, for a given peak overpressure, D_1 is the distance (slant range) from the explosion for 1 KT, and D is the distance from the explosion for W KT.

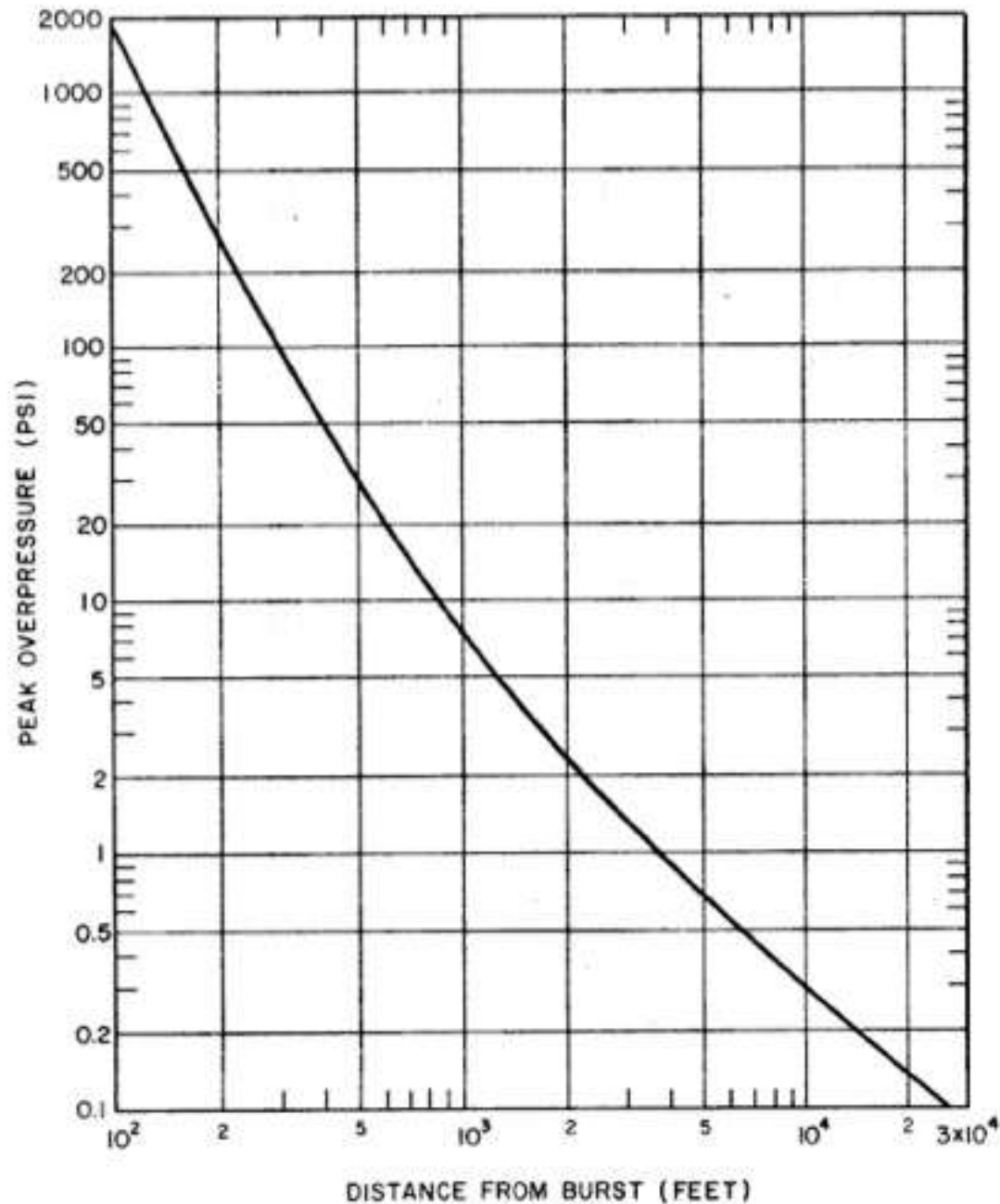


Figure 3.72. Peak overpressure from a 1-kiloton free air burst for sea-level ambient conditions.