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US, Israeli and Gulf Perspectives on the Threat from Iran

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CENTER FOR STRATEGIC &
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Burke Chair
in Strategy

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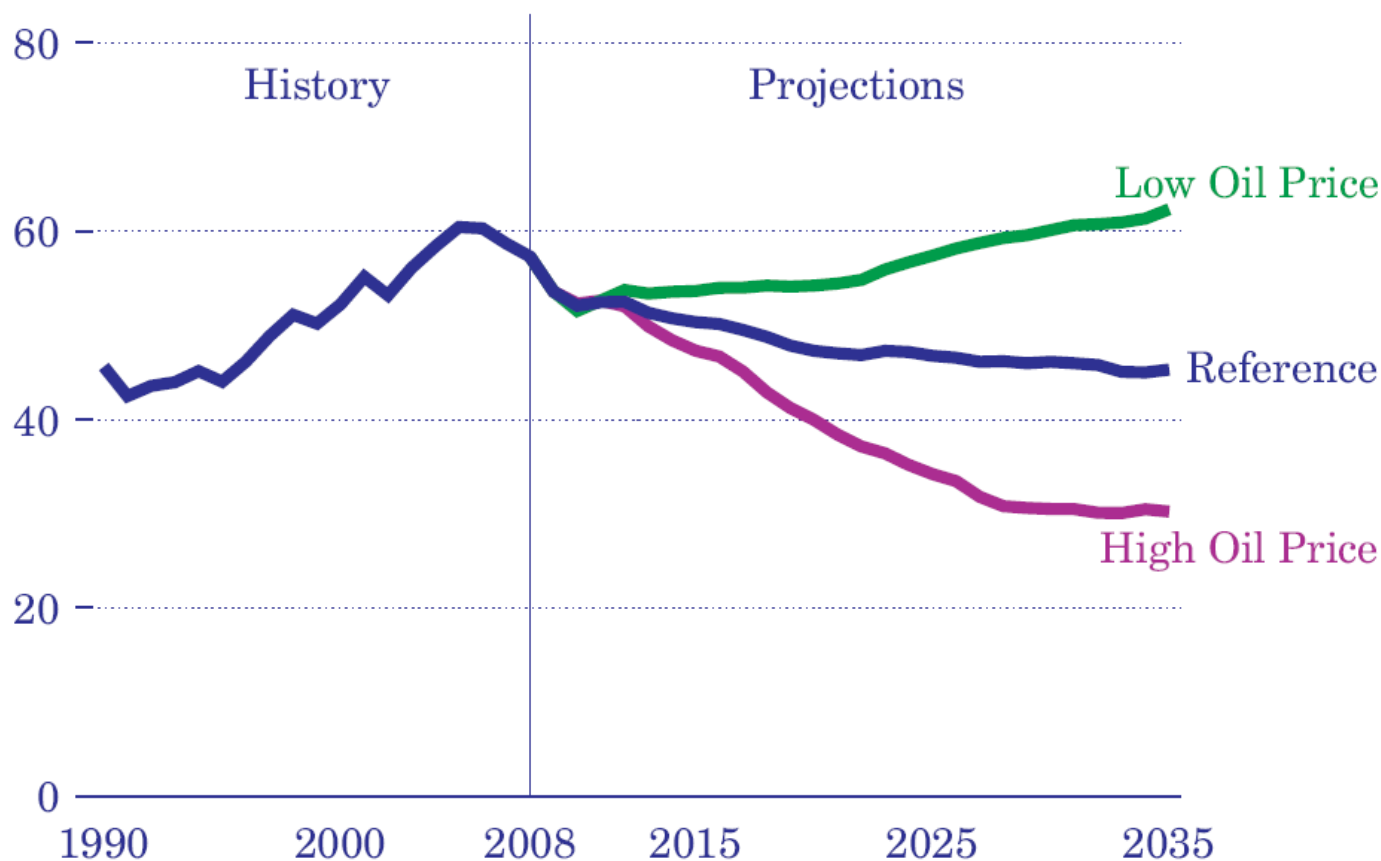
The US, Israeli, Gulf and Regional Perspective

US vs. Israel vs. Gulf

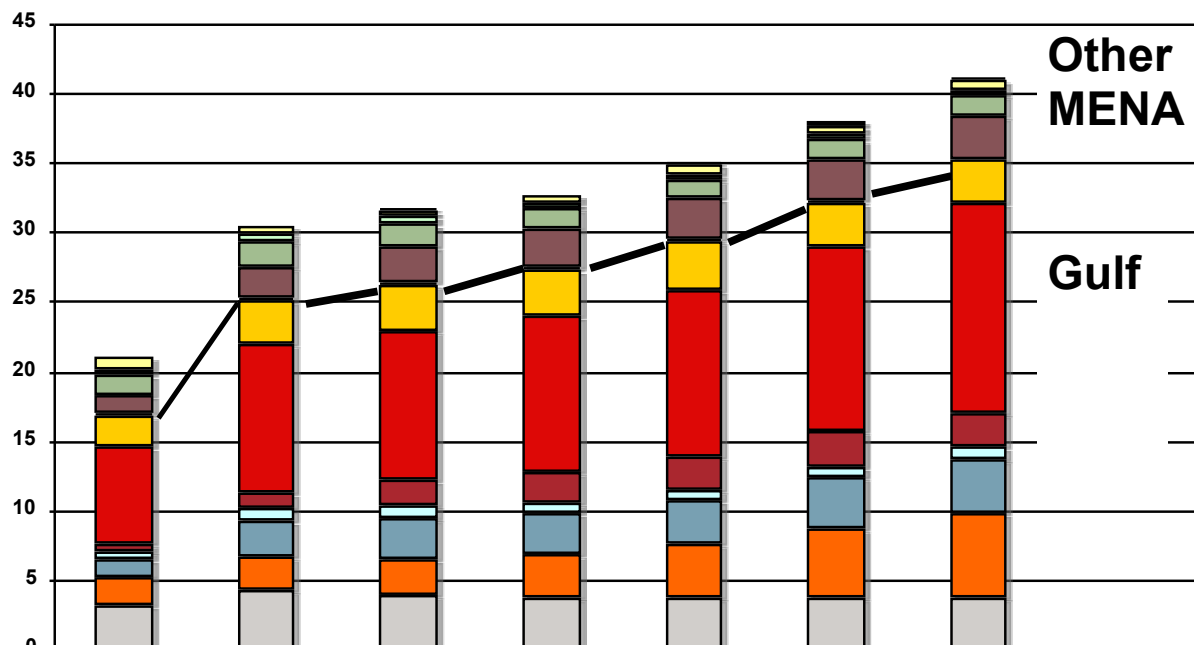
- **All:**
 - **Limit Iranian influence and military capability.**
- **US:**
 - **Nuclear as weapon of intimidation.**
 - **Energy security and security of both Israel and Arabs friends and allies.**
- **Israel:**
 - **Nuclear as existential threat.**
 - **Iran's role in Syria, Lebanon, Arab-Israeli conflict.**
- **Gulf:**
 - **Nuclear as weapon of intimidation.**
 - **Energy security and security of home territory.**

US, Western, and Global Concerns with Energy

Net Import Share of U.S. Liquid Fuels Consumption, 1990-2035 (2010 Estimate) in Percentages



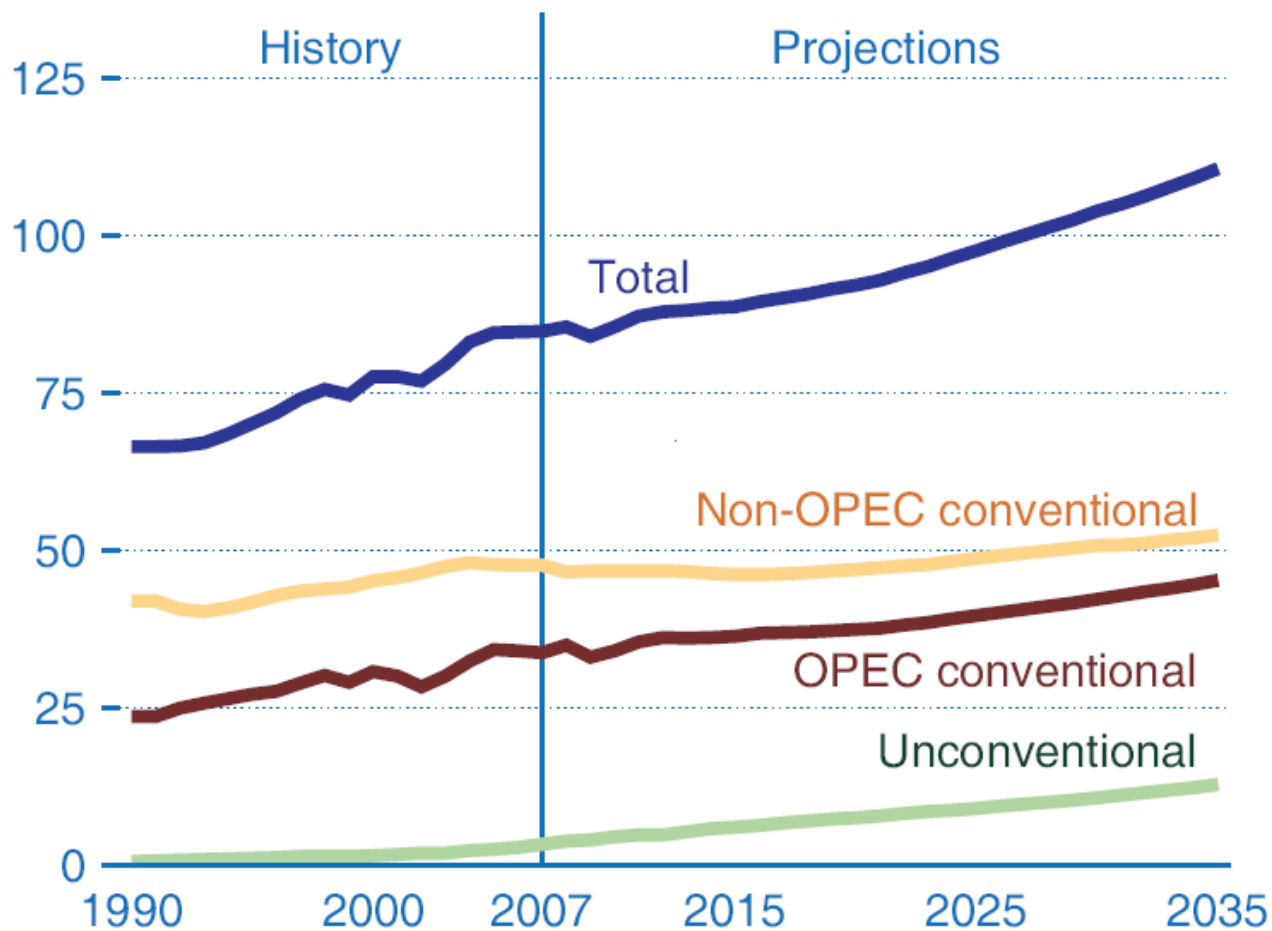
EIA Projections of Gulf/ME Liquids Production By Country, 1990-2035 (Millions of Barrels Per Day)



	1990	2008	2015	2020	2025	2030	2035	% Ave. Annual Change 07-35
□ Gulf Share of World	-	*28%	*28%	*29%	*29%	*30%	*31%*	-
□ Total World	-	*85.5	*88.7	*92.1	*97.6	*103.0	*110.5%	*1.0
□ Total MENA	-	*30.5	*31.6	*32.6	*35.0	*37.9	*41.0	
□ Other	-	0.1	0.1	0.1	0.2	0.2	0.2	*4.0
□ Egypt	0.9	0.6	0.5	0.6	0.7	0.7	0.7	*0.1
□ Syria	0.4	0.4	0.4	0.3	0.3	0.3	0.3	*-1.8
□ Libya	1.4	1.9	1.7	1.4	1.4	1.5	1.6	*-0.5
□ Algeria	1.3	2.2	2.6	2.8	2.9	3	3	*1.2
□ Yemen	0.2	0.3	0.2	0.2	0.2	0.1	0.1	*-2.9
□ Total Gulf	-	*25.0	*26.1	*27.2	*29.3	*32.1	*35.1	*1.4
□ UAE	2.3	3	3.4	3.4	3.4	3.2	3.1	*0.2
□ Saudi	7	10.7	10.7	11.2	12.1	13.3	15.1	*1.4
□ Qatar	0.4	1.2	1.8	2.1	2.3	2.5	2.5	*2.8
□ Oman	0.7	0.8	0.9	0.8	0.8	0.8	0.8	*0.2
□ Kuwait	1.2	2.7	2.9	3	3.2	3.6	3.9	*1.4
□ Iraq	2.1	2.4	2.6	3.1	3.9	5.1	6.1	*3.9
□ Iran	3.1	4.2	3.9	3.7	3.6	3.6	3.7	*1.4

Source: Adapted from EIA, *World Energy Outlook*, 2010, p. 225 and *World Energy Outlook*, 2010, p. 260

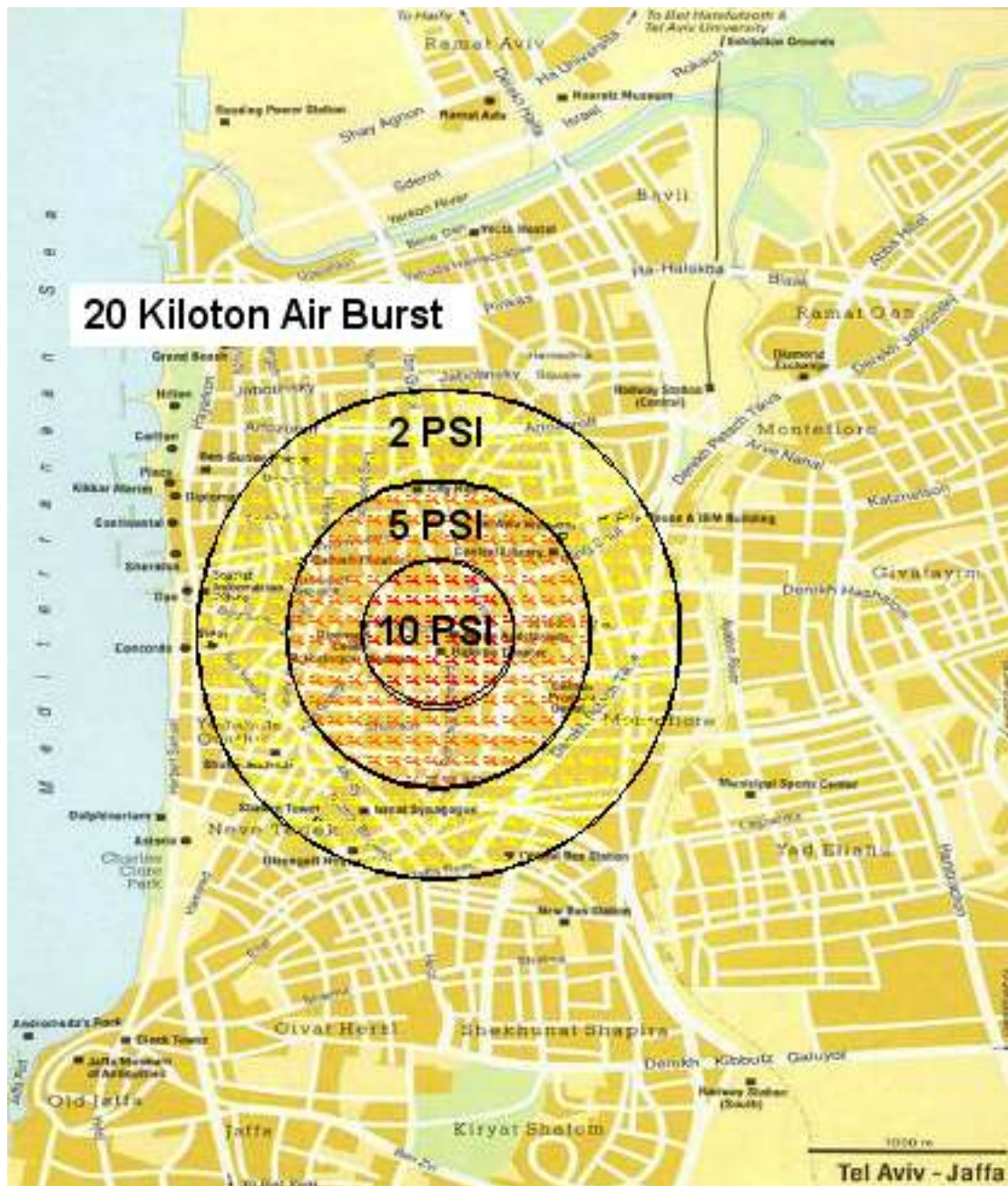
Global Dependence on Gulf oil is steadily rising



Israeli Existential Concerns

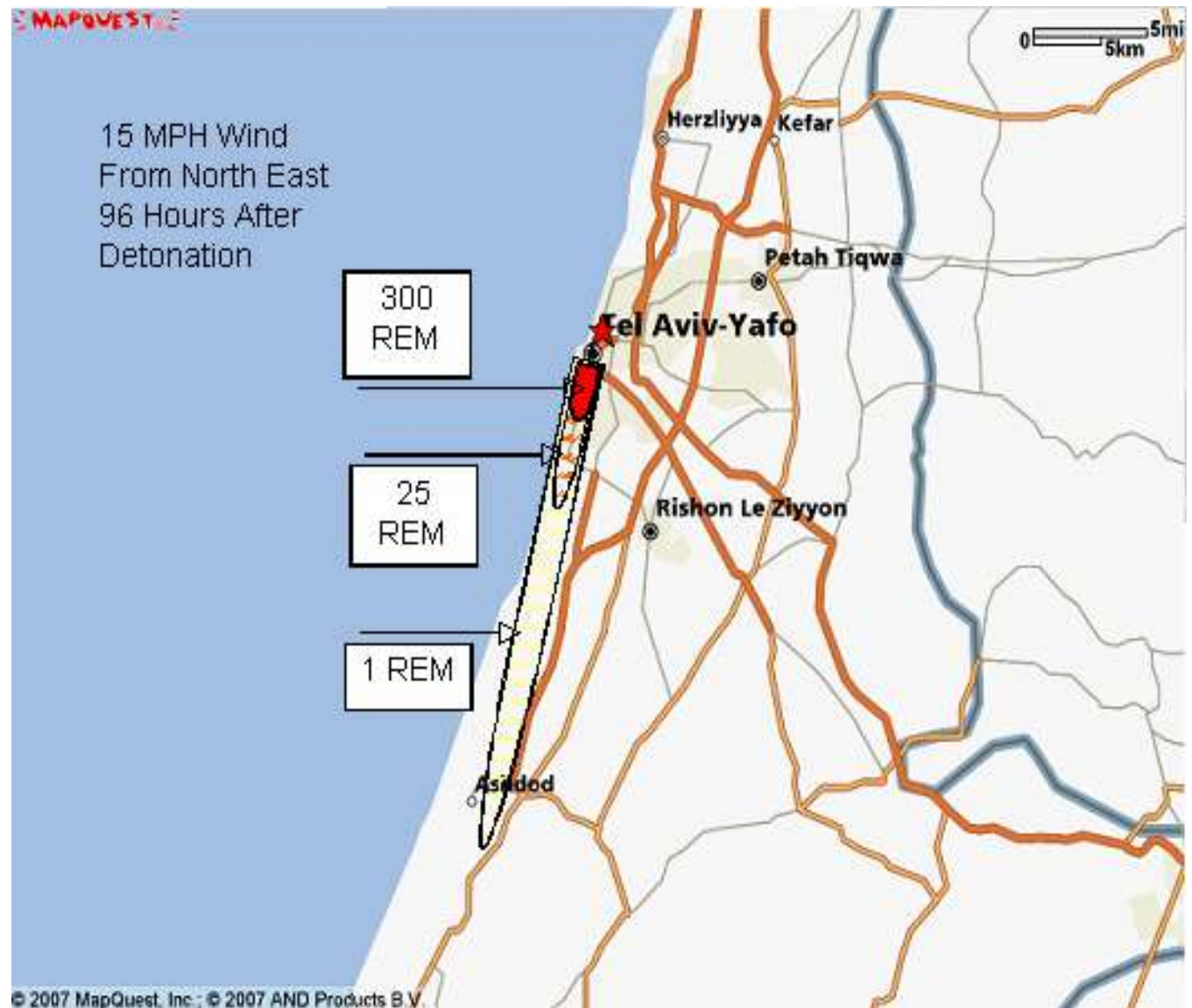
Israel:

**Blast
coverage
of 20KT
Iranian
Nuclear
Weapon**



Israel:

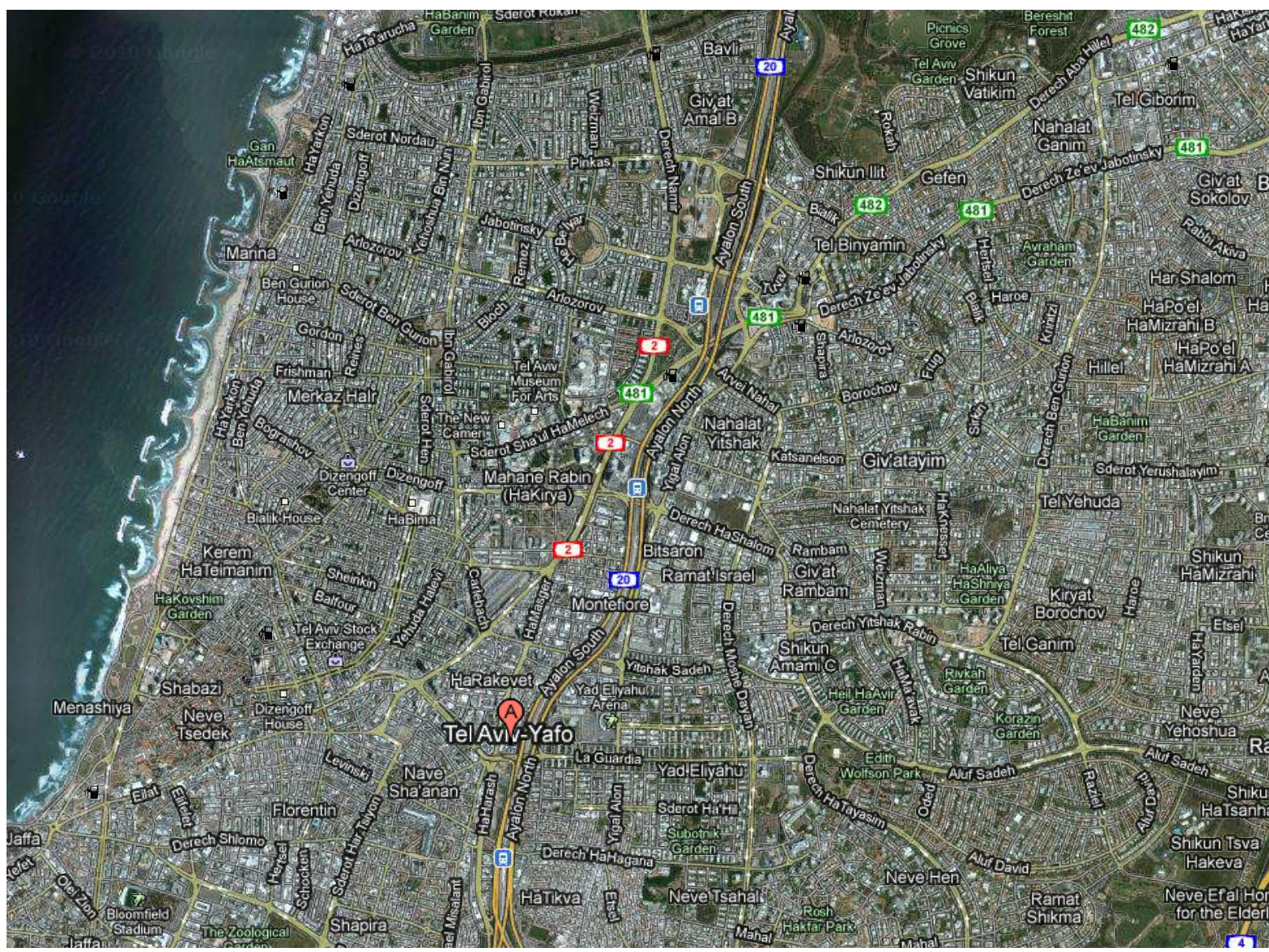
Nominal Worst Case 20KT Fall Out Coverage



Fall Out

- **The closer to ground a bomb is detonated, the more dust and debris is thrown into the air, and the more local fallout.**
- **Impact with the ground severely limits the blast and radiation from a bomb. Ground bursts are not usually considered tactically advantageous, with the exception of hardened underground targets such as missile silos or command centers.**
- **Population kills can be different. For a 1 MT explosion, lethal ellipses can reach 40-80 miles against unsheltered populations after 18 hours**
- **For a 1 MT explosion, lethal ellipses will reach 40-80 miles against unsheltered populations after 18 hours. Area of extreme lethality (3000 rads) can easily reach 20+ miles.**
- **A dose of 5.3 Gy (Grays) to 8.3 Gy is considered lethal but not immediately incapacitating. Personnel will have their performance degraded within 2 to 3 hours, and will remain in this disabled state at least 2 days. However, at that point they will experience a recovery period and be effective at performing non-demanding tasks for about 6 days, after which they will relapse for about 4 weeks. At this time they will begin exhibiting symptoms of radiation poisoning of sufficient severity to render them totally ineffective. Death follows at approximately 6 weeks after exposure.**
- **Delayed effects may appear months to years following exposure. Most effects involve tissues or organs. Include life shortening, carcinogenesis, cataract formation, chronic radiodermatitis, decreased fertility, and genetic mutations.**

Downtown Tel Aviv: 3.2 of 7.4 million



Gulf, Regional, and US Perspective

The Problem of Vulnerability

- **Vulnerability extends throughout Gulf, into Gulf of Oman, and in nearby waters of Indian Ocean, Gulf of Aden, Horn, and Red Sea**
- **Increasing range of anti-ship missiles, and use of UAVs/UCAVs, smart mines, light guided weapons, fast small craft all changing the threat. .**
- **Key on and offshore oil and other facilities highly exposed, vulnerable and involve very long-lead repairs.**
- **Same is true of critical coast petroleum facilities, and desalination plants -- perhaps the most critical infrastructure facilities extent.**
- **Many key facilities have no grids, networks, or substitutes.**
- **Security often basic, poorly trained, and not realistically tested. Need active “red team” testing, and attention to sabotage as well as attack.**
- **Need passive defense plans, and repair and recovery plans and capability.**
- **Quick reaction forces to deal with infiltration, offshore, coastal attack critical.**

Iranian Assets for “Closing the Gulf”

- **3 Kilo (Type 877) and unknown number of midget (Qadr-SS-3) submarines; smart torpedoes, (anti-ship missiles?) and smart mine capability.**
- **Use of 5 minelayers, amphibious ships, small craft, commercial boats.**
- **Attacks on tankers, shipping, offshore facilities by naval guards.**
- **Raids with 8 P-3MP/P-3F Orion MPA and combat aircraft with anti-ship missiles:(C-801K (8-42 km), CSS-N-4, and others).**
- **Free-floating mines, smart and dumb mines, oil spills.**
- **Land-based, long-range anti-ship missiles based on land, islands (Seersucker HY-2, CSS-C-3), and ships (CSS-N-4, and others).**
- **IRGC raids on key export facility(ties).**
- **Iranian built Nasr-2 ship based SSM.**

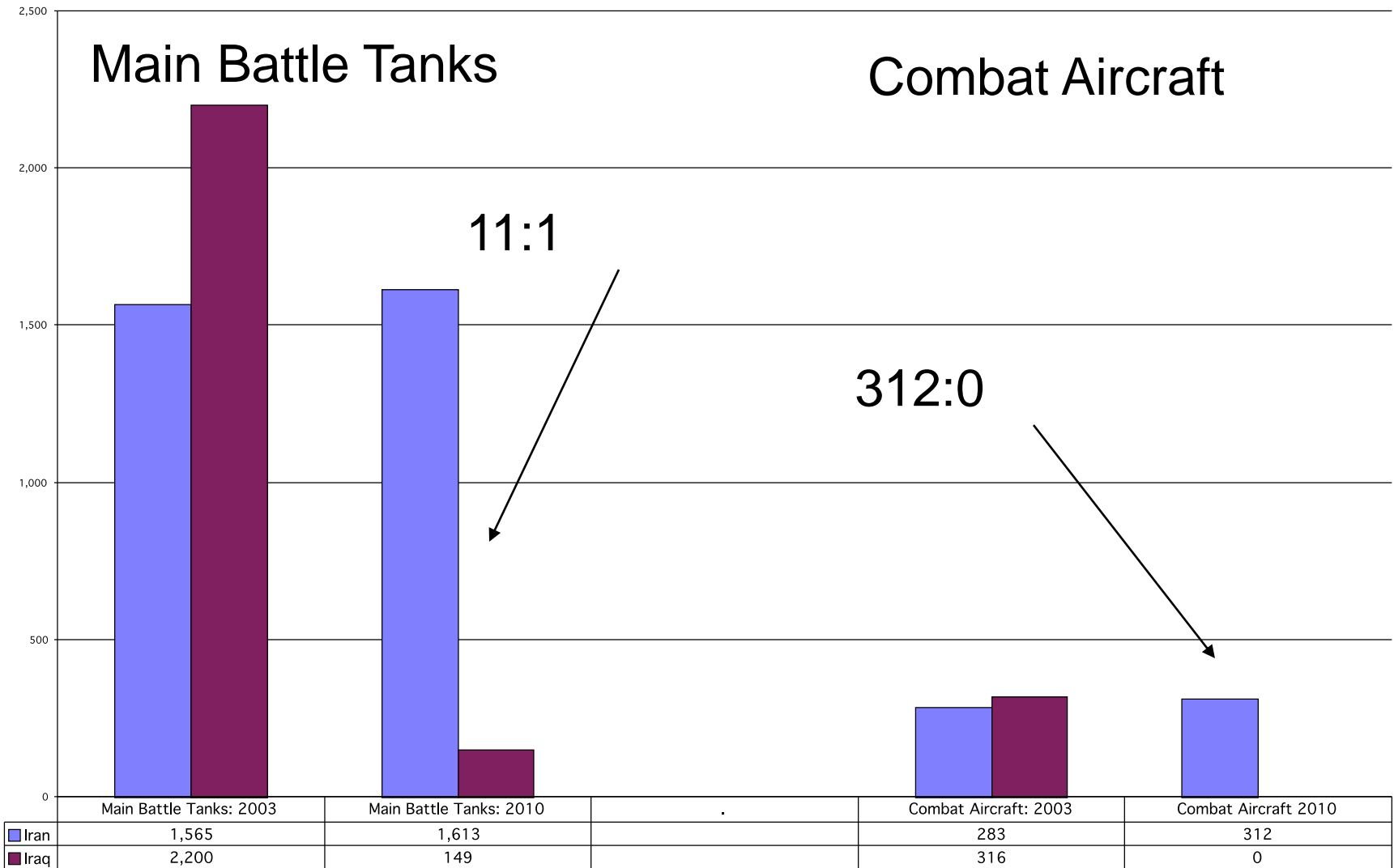
The Ongoing Changes in the Balance

- **Loss of Iraq as a Counterbalance to Iran; Risk of “Shi’ ite Crescent”**
- **Fragile structure of energy transport, and critical facility targets.**
- **GCC lead in military spending and arms imports.**
- **Impact of access to US technology; US as key partner.**
- **Potential GCC lead in conventional forces.**
- **Need to adapt to threat from Iranian asymmetric warfare capabilities.**
- **Emerging Iranian missile, chemical and potential nuclear threat.**
- **Steadily more sophisticated threat from extremists and terrorism.**
- ¹⁶ • **Instability in Yemen, the Horn, and Red Sea area.**

Iran, Iraq, and the Uncertain Power Vacuum to the Northwest

- **Loss of Iraq as Counterbalance to Iran; cannot be corrected before 2007-2010.**
- **US force posture in Kuwait and Upper Gulf uncertain after 2011.**
- **“Shi’ite crescent:” Future ties between Iran, Iraq, Syria, and Lebanon.**
- **Impact on Jordan and Israel; “spillover” from Arab-Israeli conflict into the Gulf.**

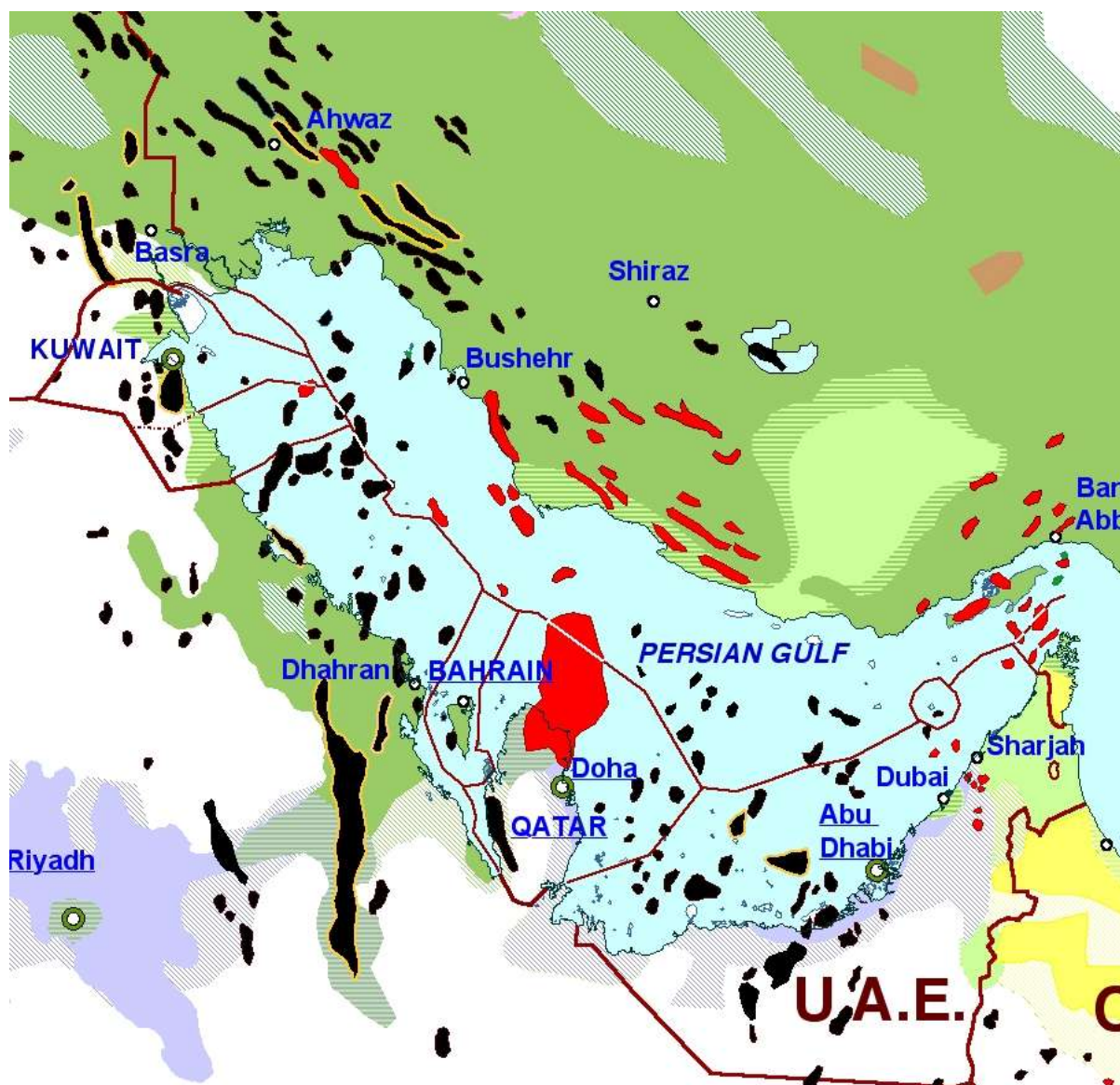
Iran vs. Iraq: 2003 vs. 2010



Details of Iraq's Loss of Deterrent and Defense Capability: 2003-2007

Category	2003			2010		
	Iraq	Iran	Force Ratio	Iraq	Iran	Force Ratio
Active Manpower	424,000	513,000	8:10	191,957	523,000	2:5
Reserve Manpower	650,000	350,000	19:10	0	350,000	NA
Main Battle Tanks	2,200	1,565	7:5	149	1,613	1:10
OAFVs	1,300	815	8:5	505	725	7:10
APCs	2,400	590	4:1	1,479	650	23:10
Towed Artillery	1,900	2,085	9:10	0	2,010	NA
SP Artillery	150	310	1:2	0	310	NA
MRLs	200	889	1:5	0	876	NA
Combat Aircraft	316	283	11:10	0	312	NA
Attack Helicopters	100	85	6:5	0	50	NA
Major SAM Launchers	225	205	11:10	0	234	NA

Vulnerability of Gulf Oil Fields



Primary Oil and Gas Deposits in the Middle East and the Shia Majority Areas.

- A Major Oil field
- A Super-Giant Oil field
- A Major Gas field

Islam:

- Shiism (to include Alevis/Alawis)
- Sunnism (Hanafi, Shafi'i, Maliki)

Hunbli

- Ibadism
- Christianity
- Judaism
- Other

- Mixed population areas
- Sparsely populated areas
- Uninhabited areas

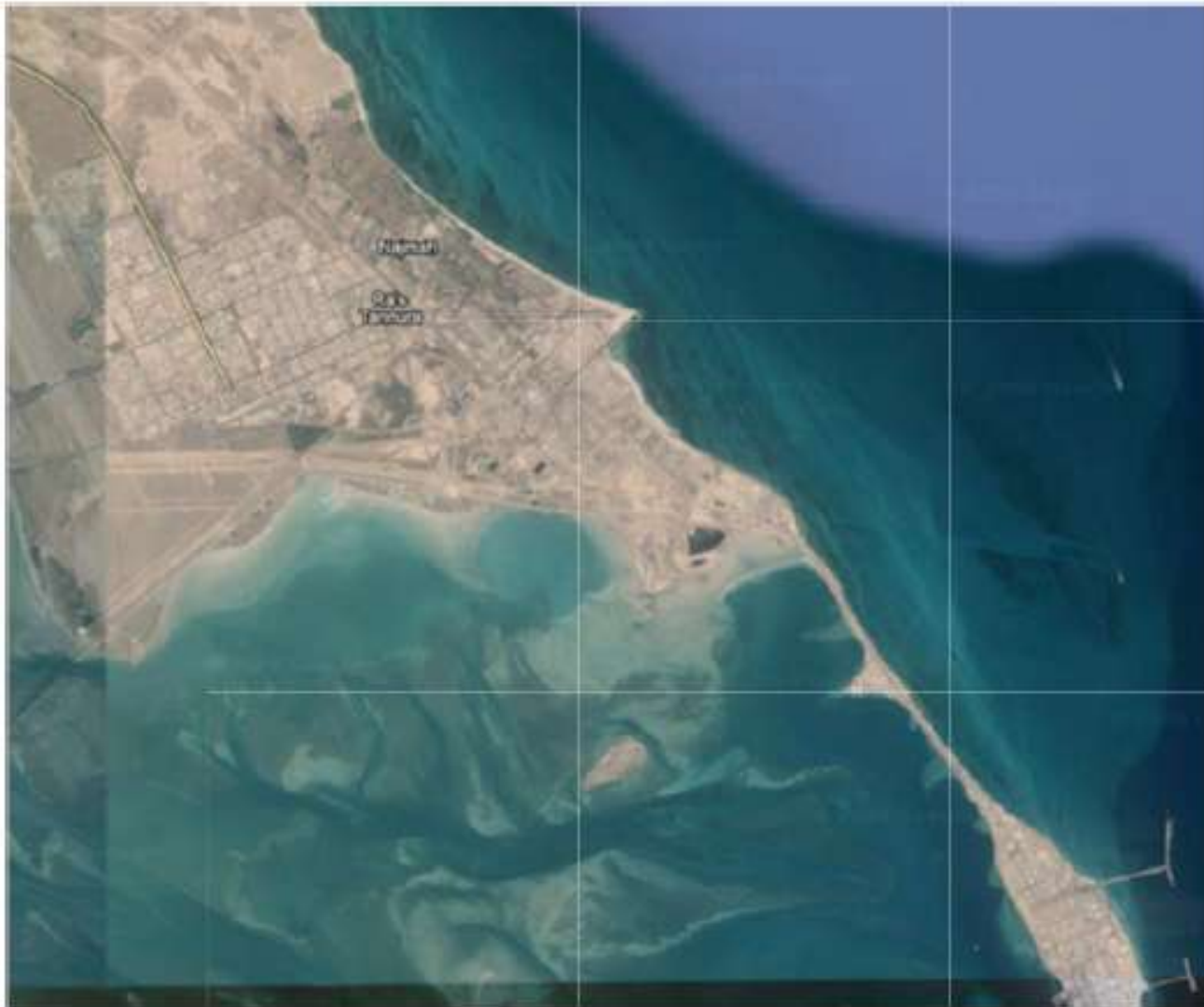
Saudi Arabian Oil Fields



- 267 billion barrels of oil reserves
- 9.7 MMBD production
- Capacity 10.5-11 MMBD growing to 12.5 MMBD.
- Exports 7/9-98.5 MBD, 52% to Asia
- 2.3 MMBD used domestically.
- Refinery throughput capacity of 2.1 MMBD
- 100 major oil and gas fields
- Ras Tanura complex has approximately 6 million bbl/d capacity; and the world's largest offshore oil loading facility. Includes the 2.5-million bbl/d port at Ras Tanura.
- More
- than 75 percent of exports are loaded at Ras Tanura Facility.
- 3 to 3.6-million bbl/d Ras al-Ju'aymah facility on the Persian Gulf.
- Yanbu' terminal on the Red Sea, has loading capacity of approximately 4.5 million bbl/d crude and 2 million bbl/d for NGL and products.

IA, Country Briefs, "Saudi Arabia," August 2008

Ras Tanura



Hormuz: Breaking the Bottle at the Neck



- 280 km long, 50 km wide at narrowest point.
- Traffic lane 9.6 km wide, including two 3.2 km wide traffic lanes, one inbound and one outbound, separated by a 3.2 km wide separation median
- Antiship missiles now have ranges up to 150 km.
- Smart mines, guided/smart torpedoes,
- Floating mines, small boat raids, harassment.
- Covert as well as overt sensors.

The Entire Gulf: Breaking the Bottle at Any Point



Severely Limited Alternative Routes



Iran's Petroleum Infrastructure



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

Iran Levan 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

Source: DOE/EIA

Energy Infrastructure is Critical, *But*

- **Steadily rising global demand for Gulf crude, product, and gas**
- **Rising Asian demand (much exported indirectly to the West)**
- *Heavy concentrations in facilities designed to economies of scale, not redundancy.*
- *Poor response planning, and long-lead time replacement for critical key components.*
- *Day-to-day use often near limits of capacity*
- *Lack of systems integration and bypass capability at national and GCC level*
- *Improving lethality and range of precision strike systems.*
- *Smarter saboteurs and terrorists.*

Desalination Plant



Iran's Perspective

Iran's Mixed Perceptions and Goals

- *Intimidation, leverage, status, deterrence rather than warfighting*
- Real ideological motives and drives: Export religious revolution.
- Traditional focus on regional influence and power.
- Iran-Iraq War, use of missile and chemical weapons, global guilt towards Iraq
- US: Shah's coup, desert raid, "Tanker War," Gulf War, Iraq 2003, US in Afghanistan
- Israel as real goal and way of building Arab public support, regional power, deflecting opposition to nuclear, missile, and asymmetric build-up.
- Nuclear and missile give global status, deter US, and give Iran added leverage in using asymmetric forces.

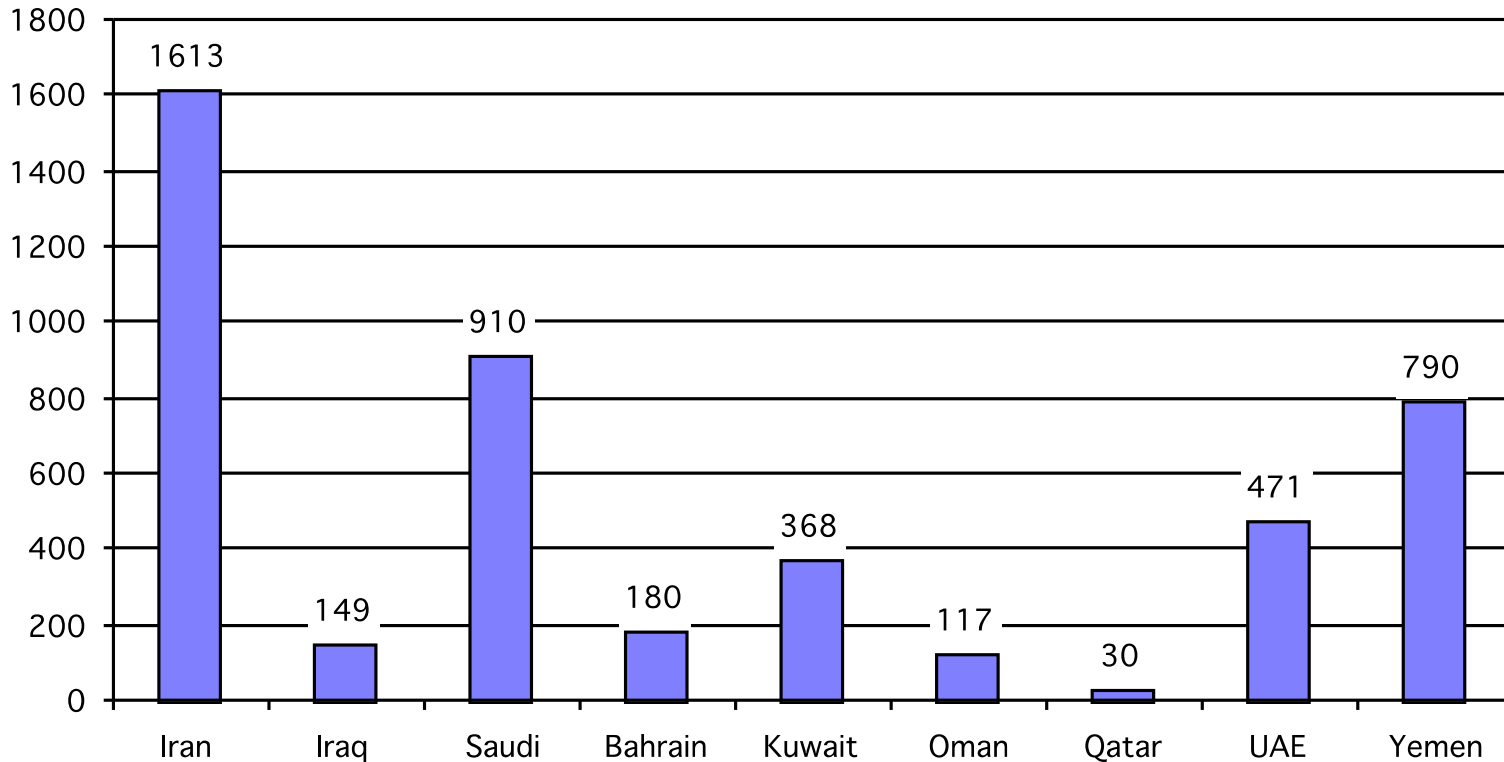
Key Iranian Options – With or Without Nukes

- **Direct and indirect threats of using force. (I.e. Iranian efforts at proliferation)**
- **Use of irregular forces and asymmetric attacks.**
- **Proxy conflicts using terrorist or extremist movements or exploiting internal sectarian, ethnic, tribal, dynastic, regional tensions.**
- **Arms transfers, training in host country, use of covert elements like Quds force.**
- **Harassment and attrition through low level attacks, clashes, incidents.**
- **Limited, demonstrative attacks to increase risk, intimidation.**
- **Strike at critical node or infrastructure.**

Some Tangible Examples

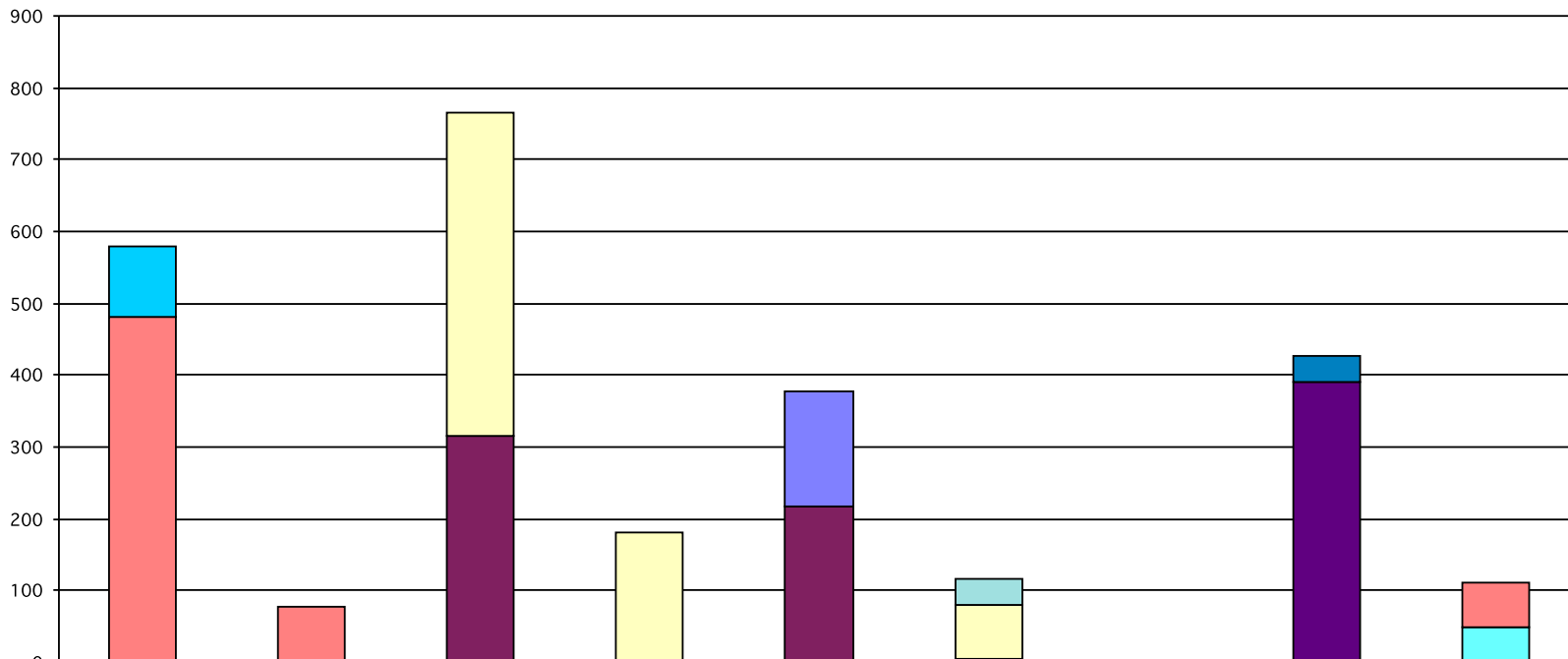
- **Iranian tanker war with Iraq**
- **Oil spills and floating mines in Gulf.**
- **Libyan “stealth” mining of Red Sea.**
- **Use of Quds force in Iraq.**
- **Iranian use of UAVs in Iraq.**
- **“Incidents” in pilgrimage in Makkah.**
- **Support of Shi’ite groups in Bahrain.**
- **Missile and space tests; expanding range of missile programs (future nuclear test?).**
- **Naval guards seizure of British boat, confrontation with US Navy, exercises in Gulf.**
- **Development of limited “close the Gulf” capability.**
- **Flow of illegal's and smuggling across Yemeni border.**

Comparative Main Battle Tank Inventory, Regardless of Age or Quality



Derived from IISS, Military Balance, various editions and Jane's

Comparative Modern Tank Strength, 2010



	Iran	Iraq	Saudi	Bahrain	Kuwait	Oman	Qatar	UAE	Yemen
Zulfiqar	100								
OF-40								36	
T-72	480	77							60
M-84					159				
Leclerc								390	
Challenger 2						38			
M-60A3			450	180		73			
M-60A1						6			50
M-1A2			315		218				

Source: Estimated by Anthony H. Cordesman using data from the IISS, The Military Balance, various editions.

Gulf Air Balance

Air Bases and Air Force Order of Battle (2009)



	Combat A/C	Attack Helo's
Iran	319	95
Iraq	-	37
Kuwait	50	45
Bahrain	33	16
Qatar	18	25
UAE	184	67
Oman	64	41
Saudi Arabia	278	67
Yemen	179	18

Iran Airbases

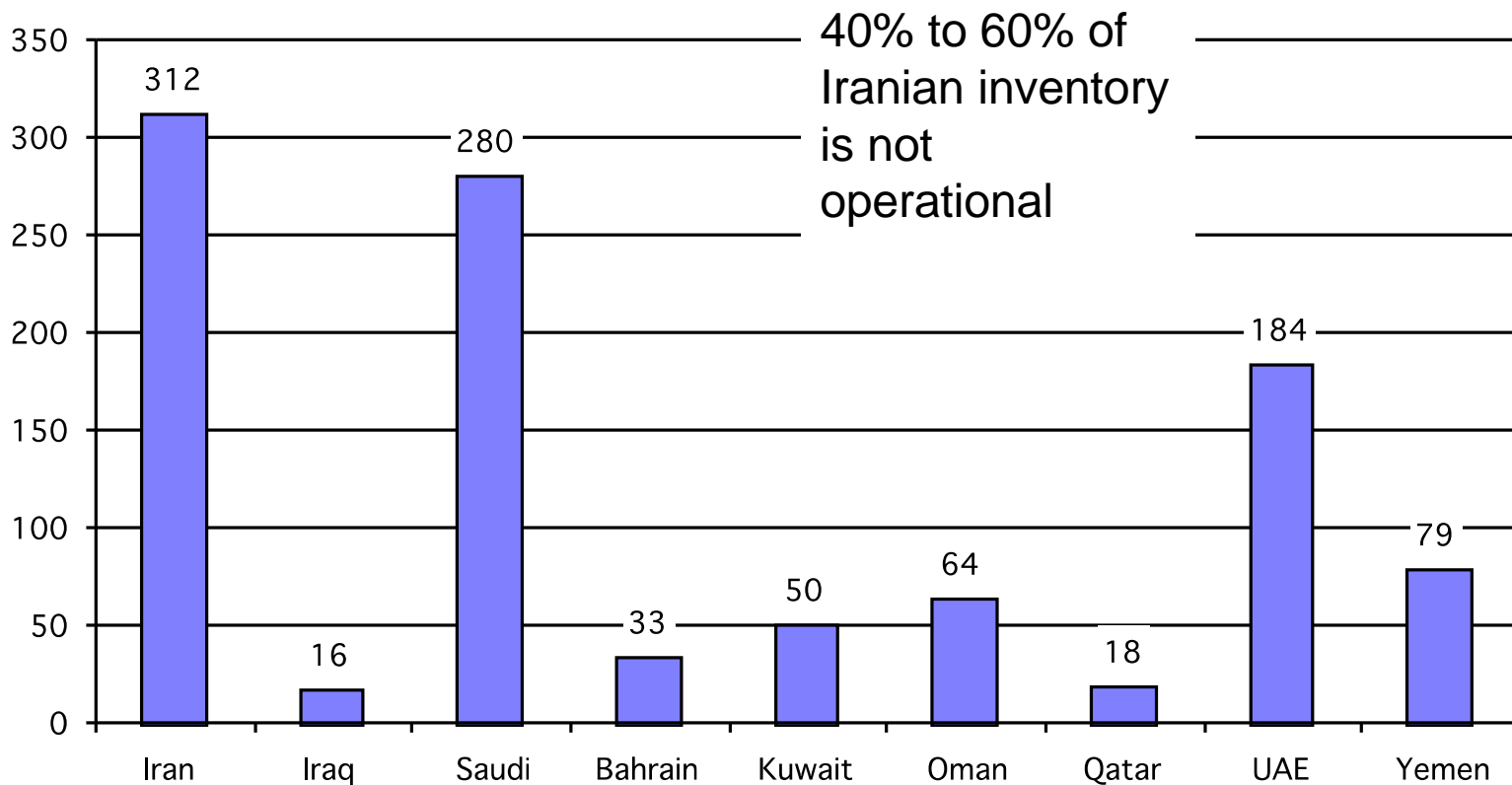
Tabriz	F-5E/F, MiG-29
Hamadan	F-4E/D Su-24
Dezful	F-5E/F
Bushehr	F-4E/D F-14
Bandar Abbas	2 Helicopter Wings
Shiraz	Su-25 Su-24
Esfahan	F-5E Su-24
Tehran	MiG-29 Su-24
Zahedan	F-7M
Kermanshah	F-5E/F

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)

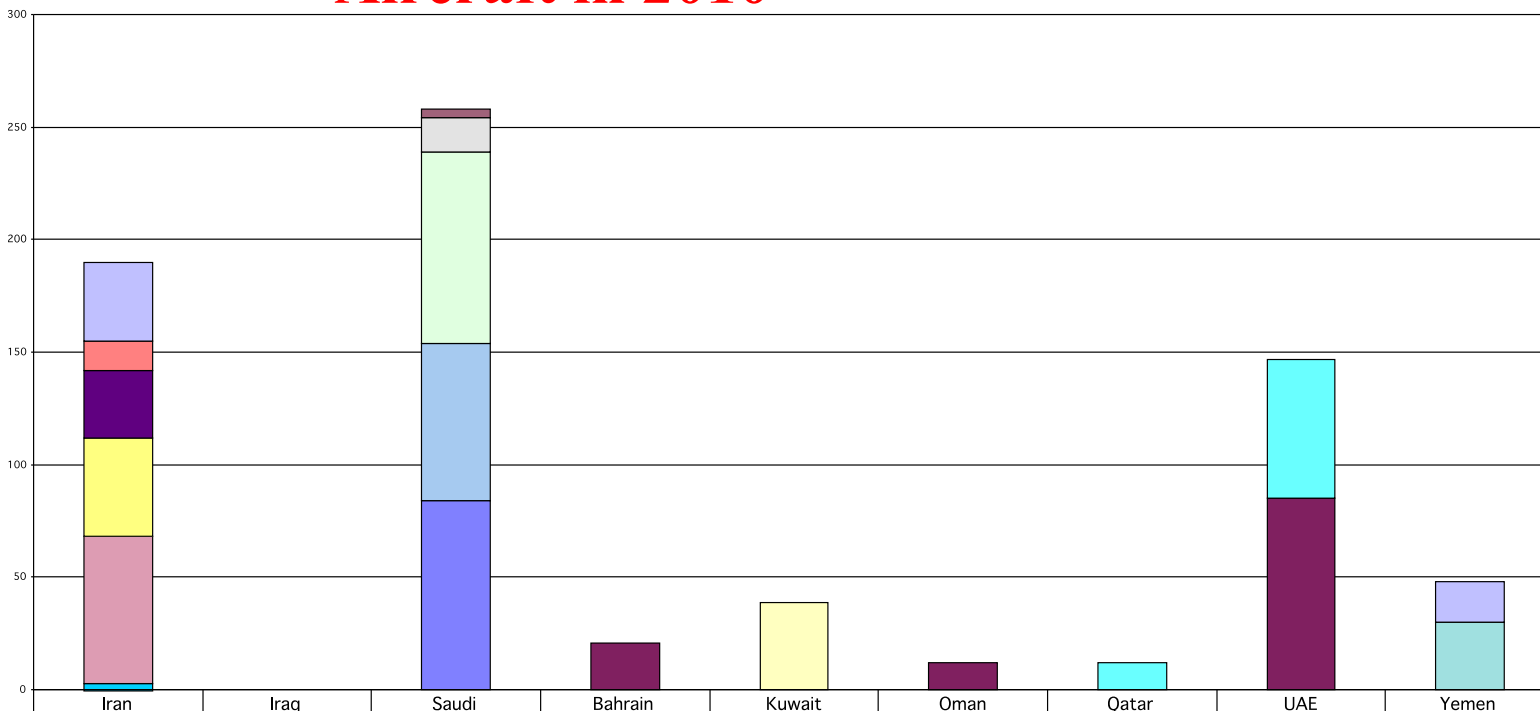
Air Bases Source: Global Security.org
Order of Battle Source: Anthony Cordesman CSIS

Comparative Combat Air Strength in 2010



Derived from IISS, Military Balance, and Jane's

Comparative High Quality Fighter/Attack Aircraft in 2010



■ Typhoon-2			4													
■ Tornado ADV			15													
■ Tornado IDS			85													
■ Mirage 2000												12				
■ MiG-29	35															18
■ MiG-25																
■ Su-25	13															
■ Su-24	30															
■ Su-20/22																
■ F-18																
■ F-16							21									
■ F-15S			70													
■ F-15C/D			84													
■ F-14	44															
■ F-4D/E	65															
■ Saegheh	3															

Source: Adapted by Anthony H. Cordesman from various sources and IISS, The Military Balance, various editions and Saudi experts.

Range of Iran's Air Power



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

Gulf Land-Based Air/Missile Defenses In 2010

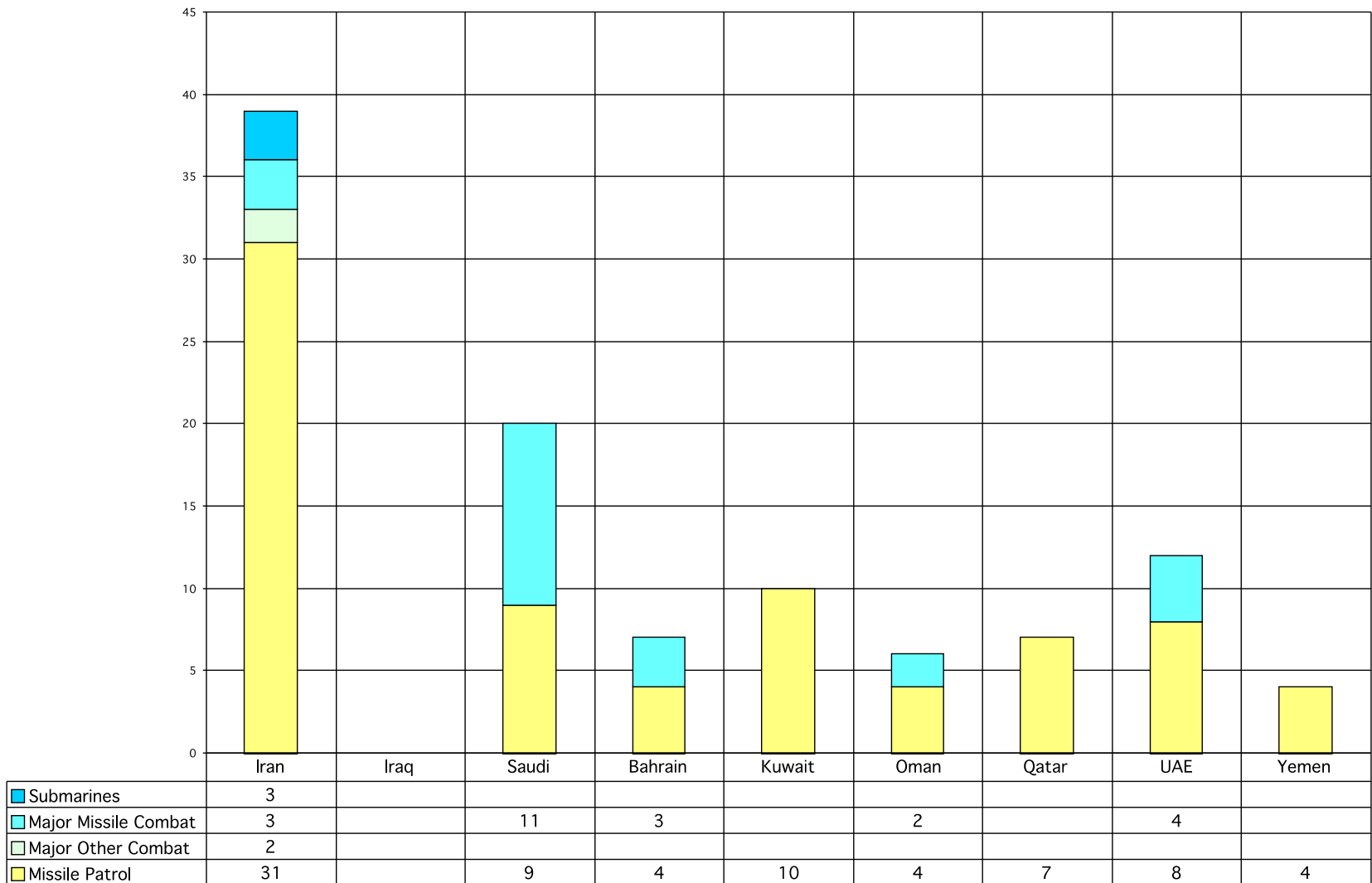
Country	Major SAM	Light SAM	AA Guns
Bahrain	8 Hawk MIM-23B	60 R BS-70 18 FIM-92A Stinger 7 Crotale	15 27 guns Oerlikon 35 mm 12 L/70 40 mm
Iran	16/150 Hawk 3/10 SA-5 45 SA-2 Guideline	SA-7/14/16, HQ-7 29 SA-15 Some QW-1 Misaq 29 TOR-M1 Some HN-5 5/30 Rapier 10 Pantsyr (SA-22) Some FM-80 (Ch Crotale)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

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

Iran Says Tests Its Own S-300 SAM/TMD 11/2010

- **State-run Press TV quoted a commander of Iran's elite Revolutionary Guards as saying Tehran had adapted another Russian-made missile system to perform like the more sophisticated S-300.**
- **"We have developed the system by upgrading systems like the S-200 and we have tested it successfully," Brigadier General Mohammad Hassan Mansourian said, according to Press TV's website.**
- **Some Western analysts doubt Iran's ability to replicate the S-300, a precision, mobile, long-range air defense system that can detect, track and destroy ballistic missiles, cruise missiles and low-flying aircraft.**
- **However, some Western officials suspect Iran's development of more sophisticated missiles could serve the goal of attaining a deliverable nuclear weapon.**
- **Russian President Dmitry Medvedev banned delivery of the S-300s in September, saying it would violate expanded U.N. sanctions over Iran's refusal to curb a nuclear programme many countries fear is aimed at making a bomb, a charge it denies..**

Major Combat Warships in 2010



Source: Adapted by Anthony H. Cordesman from IISS, *The Military Balance*, various editions and material provided by US and Saudi experts.

*Iran Has Strong Forces for
Asymmetric/Irregular Warfare,*

BUT

*Must Then Deter Outside
Conventional, Missile, and
WMD/WME Options*

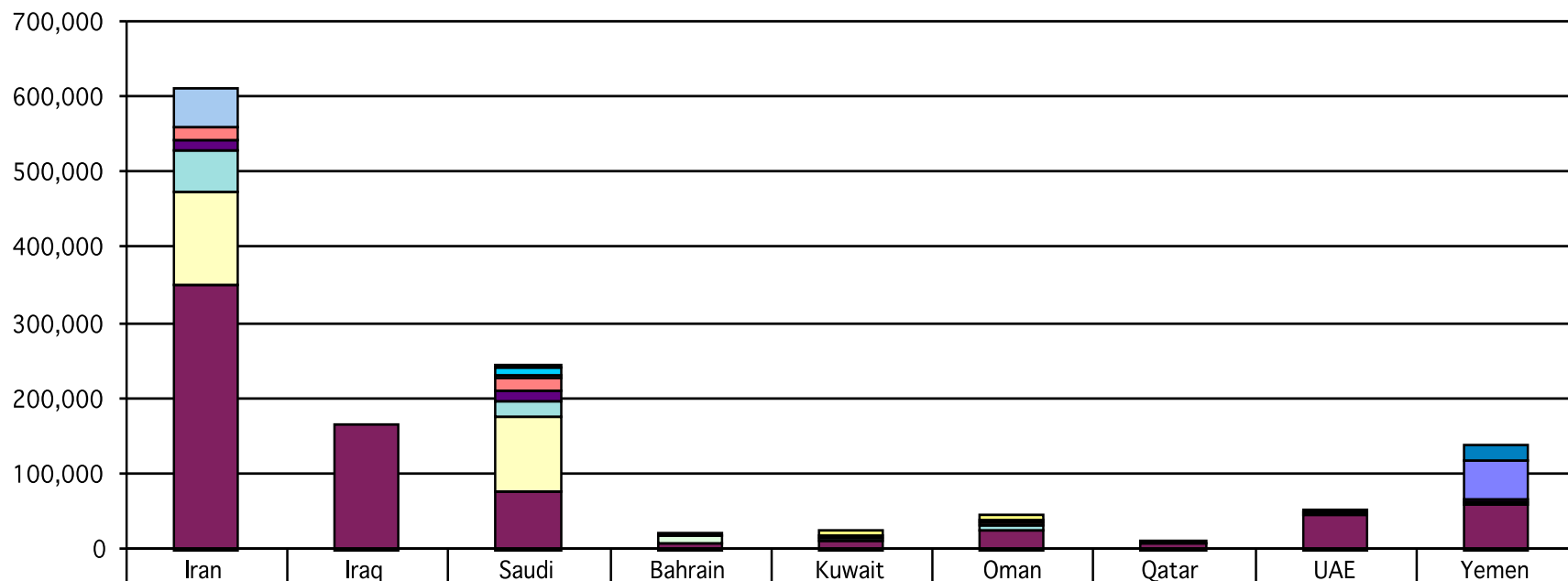
“Going Nuclear:” Intimidation as a Form of Terrorism and Asymmetric Warfare

- **Even the search for nuclear power is enough to have a major effect.**
- **Development of long range missiles add to credibility, and pressure.**
- **Crossing the nuclear threshold in terms of the bomb in the basement option.**
- **Threats to Israel legitimize the capability to tacitly threaten Arab states. Support of Hamas and Hezbollah increase legitimacy in Arab eyes -- at least Arab publics.**
- **Many future options: stockpile low enriched material and disperse centrifuges, plutonium reactor, underground test, actual production, arm missiles, breakout arming of missiles.**
- **Declared forces, undeclared forces, lever Israeli/US/Arab fears.**

“Going Asymmetric:” Substituting Asymmetric Forces for Weak Conventional Forces

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

Comparative Paramilitary Manpower: 2010



	Iran	Iraq	Saudi	Bahrain	Kuwait	Oman	Qatar	UAE	Yemen
Basij	*								
Other	50,000								
Guard				2,000	6,600	6,400			
Police				9,000					
Special Security			500						
Border Guard			10,500						
Coastguard			4,500	260	500	400		800	1,200
Tribal Levies						4,000			20,000
MOI Forces									50,000
Navy	18,000	1,100	15,500	700	2,000	4,200	1,800	2,500	1,700

Derived from IISS, Military Balance, 2010

The Broader Patterns in Iranian Activity

Iranian Actors	Related States/ Non-State Actors	Target/Operating Country
Revolutionary Guards	Iran	Iraq
Al Qaeda force	Syria	Israel
Vevak/other intelligence	Hezbollah	Egypt
Arms transfers	Hamas	Kuwait
Military and security advisors	Mahdi Army	Bahrain
Clerics, pilgrims, shrines	Yemeni Shi'ites	Yemen
Commercial training	Bahraini Shi'ites	Lebanon
Finance/investment	Saudi Shi'ites	Afghanistan
Investment/training companies		Venezuela
Education: scholarships, teachers		
Cultural exchanges		
Athletic visits		

IRGC Key Assets and Capabilities

- **The IRGC has a wide variety of assets at its disposal to threaten shipping lanes in the Gulf, Gulf of Oman, and the Caspian Sea.**
- **3 Kilo (Type 877) and unknown number of midget (Qadr-SS-3) submarines; smart torpedoes, (anti-ship missiles?) and smart mine capability.**
- **Use of 5 minelayers, amphibious ships, small craft, commercial boats.**
- **Attacks on tankers, shipping, offshore facilities by naval guards.**
- **Raids with 8 P-3MP/P-3F Orion MPA and combat aircraft with anti-ship missiles(C-801K (8-42 km), CSS-N-4, and others).**
- **Free-floating mines, smart and dumb mines, oil spills.**
- **Land-based, long-range anti-ship missiles based on land, islands (Seersucker HY-2, CSS-C-3), and ships (CSS-N-4, and others. Sunburn?).**
- **Forces whose exercises demonstrate the capability to raid or attack key export and infrastructure facilities.**

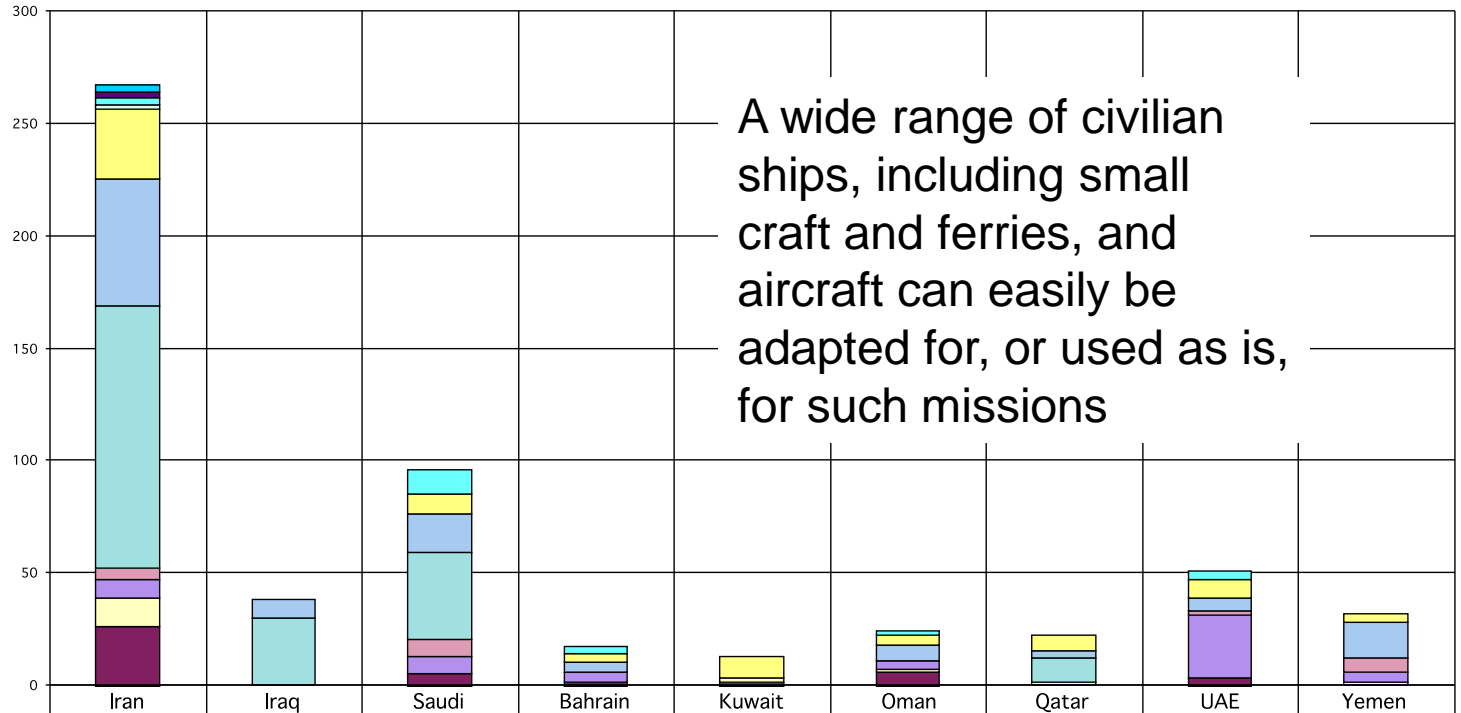
IRGC Naval Branch Modernization

- **Large numbers of anti-ship missiles on various types of launch platforms.**
- **Small fast-attack craft, heavily armed with rockets or anti-ship missiles.**
- **More fast mine-laying platforms.**
- **Enhanced subsurface warfare capability with various types of submarines and sensors.**
- **More small, mobile, hard-to-detect platforms, such as semi-submersibles and unmanned aerial vehicles.**
- **More specialized training.**
- **More customized or purpose-built high-tech equipment.**
- **Better communications and coordination between fighting units.**
- **More timely intelligence and effective counterintelligence/deception.**
- **Enhanced ability to disrupt the enemies command, control, communications, and intelligence capability.**
- **The importance of initiative, and the avoidance of frontal engagements with large U.S. naval surface warfare elements.**
- **Means to mitigate the vulnerability of even small naval units to air and missile attack.**

Steady Build-Up in Coastal and Island Basing and Facilities: Abu Musa



Key Ships for Asymmetric Warfare



	Iran	Iraq	Saudi	Bahrain	Kuwait	Oman	Qatar	UAE	Yemen
Submarines	3								
Midget Submarines	3								
Major Missile Combat	3		11	3		2		4	
Major Other Combat	2								
Missile Patrol	31		9	4	10	4	7	8	4
Other Patrol	56	8	17	4		7	3	6	16
Armed Boats	117	30	39				11		
Mine	5		7					2	6
Landing Craft	8		8	5		4		28	5
Amphibious Ships	13				2	1	1		1
Support	26		5	1	1	6		3	

A wide range of civilian ships, including small craft and ferries, and aircraft can easily be adapted for, or used as is, for such missions

Source: Adapted by Anthony H. Cordesman from IISS, *The Military Balance*, various editions; Jane's Sentinel series; Saudi experts

The Expanding Roles and Mission of the IRGC

- **Iran's Deputy Army Commander Brigadier General Abdolrahim Moussavi has announced that Iran is commitment to expanding its strategic reach, arguing that, "In the past, our military had to brace itself for countering regional enemies. This is while today we are faced with extra-regional threats."**
- **Iran upgraded a naval base at Assalouyeh in Iran's southern Bushehr province.**
 - **This base is the fourth in a string of IRGC bases along the waterway that will extend from Bandar Abbas to Pasa Bandar near the Pakistan border.**
 - **Part of, what IRGC's Navy Commander Rear Admiral Morteza Saffari describes as a new mission to establish an impenetrable line of defense at the entrance to the Sea of Oman.**

The Al Quds Force

- **Comprised of 5,000 - 15,000 members of the IRGC (Increased size of force in 2007)**
- **Equivalent of one Special Forces division, plus additional smaller units**
- **Special priority in terms of training and equipment**
- **Plays a major role in giving Iran the ability to conduct unconventional warfare overseas using various foreign movements as proxies**
- **Specialize in unconventional warfare mission**
- **Control many of Iran's training camps for unconventional warfare, extremists, and terrorists**
- **Has offices or "sections" in many Iranian embassies throughout the world**
- **Through its Quds Force, Iran provides aid to Palestinian terrorist groups such as Hamas, Lebanese Hizballah, Iraq-based militants, and Taliban fighters in Afghanistan.**
- **Despite its pledge to support the stabilization of Iraq, Iranian authorities continued to provide lethal support, including weapons, training, funding, and guidance through its Quds Force.**
- **General David H. Petraeus has stressed the growing role of the Quds force and IRGC in statements and testimony to Congress.**

Iran and Hamas

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

Source Multiple news outlets and Congressional reports and Intelligence assessments including: Kenneth Katzman, Iran: U.S. Concerns and Policy Responses, Congressional Research Service Report for Congress RL32048, April 14, 2009, available at: <http://www.fas.org/sgp/crs/mideast/RL32048.pdf>; Alon Ben-David, "Iranian influence looms as fragile Gaza ceasefire holds," Jane's Defence Weekly, 22 January 2009; Mike Shuster, "Iranian Support For Hamas Running High Post-Gaza," NPR, available at: 4 February 2009, available at: <http://www.npr.org/templates/rundowns/rundown.php?prgId=3>; The Israel Project, "Hezbollah, Hamas Rearm as Israel Works to Resume Peace Process," press release, February 22, 2007, available at: www.theisraelproject.org/site/apps/nl/content2.asp?c=hsJPK0PIJpH&b=689705&ct=3601455; etc.

Key Issues in Assessing Iran's Future Capabilities

How Far Has the Iranian Nuclear Threat Evolved?

- **Still at Threshold Level.**
- **Have all key elements of technology: Machining, implosion, triggers, initiators, possible Chinese design through North Korea/AQ Khan.**
- **Unlikely beyond basic fission gun/implosion technology.**
- **20% enrichment at R&D scale.**
- **P-1 centrifuges operational in chains, and 4 more types shown or being tested.**
- **Heavy water reactor at Arak, possible plutonium production.**
- **Level of simulation analysis unknown.**
- **Need for testing unknown, as are problems in going from device to bomb/warhead.**

How Far Has the Iranian Missile Threat Evolved?

- **Limited capability for Intimidation and Deterrence?**
- **Test, development, or deployed future threat?**
 - **Unitary Warhead, Uncertain Reliability, Poor CEP/Accuracy?**
 - **High accuracy/derrived aimpoint/TERCOM,**
 - **Countermeasures/maneuvering capability?**
 - **Cluster Warhead, Chemical Warhead? Biological warhead?**
 - **Possible nuclear warhead?**
 - **Tested Nuclear warhead?**
- **Ballistic + cruise + UCAV + strike fighter threat?**
- **Volley or limited rate missile firing numbers?**
- **Sheltered and/or mobile basing?**
- **Advanced Iranian TMD and terminal defense (TOR-M+) capability?**

What Range of) Scenario(s)?

- **Intimidation vs. deterrence?**
- **Single Gulf country targeted? US target oriented? All of Gulf? Turkey? Israel? Europe? Russia? US (ICBM wild card?)**
- **Limited demonstrative strike evolving out of symmetric conflict?**
- **Major terror attack on area targets?**
 - **Conventional? CW?, BW?**
- **Effective strike against critical infrastructure and/or military targets?**
- **Caught in Iranian-Israeli missile exchange?**
- **Nuclear Threat?**
- **Actual Nuclear escalation?**
- **Missile only or mix of Ballistic + cruise + UCAV + strike fighter threats?**
- **TMD on one or both sides?**
- **Single or extended series of missile attacks?**

Key Strategy & Force Posture Decisions

- **US and/or Israel**
 - **Prevent, preempt**, contain, deter, retaliate, mutual assured destruction.
- **Iran and Israel:**
 - In reserve (secure storage), launch on warning (LOW), launch under attack (LOA), ride out and retaliate
 - Continuous alert, dispersal
 - Point, wide area defense goals
- **Israel:**
 - Basing mode: sea basing, sheltered missiles.
 - Limited strike, existential national, multinational survivable.
- **US:**
 - Level of defensive aid.
 - Ambiguous response
 - Clear deployment of nuclear response capability.
 - Extended deterrence. Assured retaliation.
- **Gulf:**
 - Passive (wait out), defensive, or go nuclear.
 - Ballistic, cruise missile, air defense.
 - Seek extended deterrence from US

Key Force Posture Decisions - II

- **Syria:**
 - **Link or decouple from Iran.**
 - **Passive (tacit threat) or active (clear, combat ready deployment).**
- **Non-State Actor:**
 - **Tacit or covert capability.**
 - **Proven capability.**
 - **Deployment mode: Hidden, dispersed, pre-emplaced**

BMD Deployment Issues? Trade-offs

- **Value of given levels of missile defense capability?**
 - **Tradeoffs between given missile defense options by weapons type/mix?**
 - **Costs?**
 - **Value of integrated architecture?**
- **Value of defense/deterrence/containment vs. preventive/preemptive strike?**
- **Best mix of ballistic missile, cruise missile, air, UCAV defenses?**
- **Requirements for integrated and interoperable defenses – particularly in Gulf.**
- **Trade-offs in battle management, sensor, and IS&R capabilities?**
- **Command and control decision requirement trade-offs?**
- **Value of US power projection, TMD “surge capabilities?”**
- **How much does Iranian WMD or WME capability change the defensive requirement?**

Iran's Long Range Missile Program

Iran's Ballistic Missiles: DNI Assessment - March 2010

Iran has continued to develop its ballistic missile program, which it views as its primary deterrent. Iran is fielding increased numbers of short-and medium-range ballistic missiles (SRBMs, MRBMs) and we judge that producing more capable MRBMs remains one of its highest priorities. Iran's ballistic missile inventory is one of the largest in the Middle East.

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

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

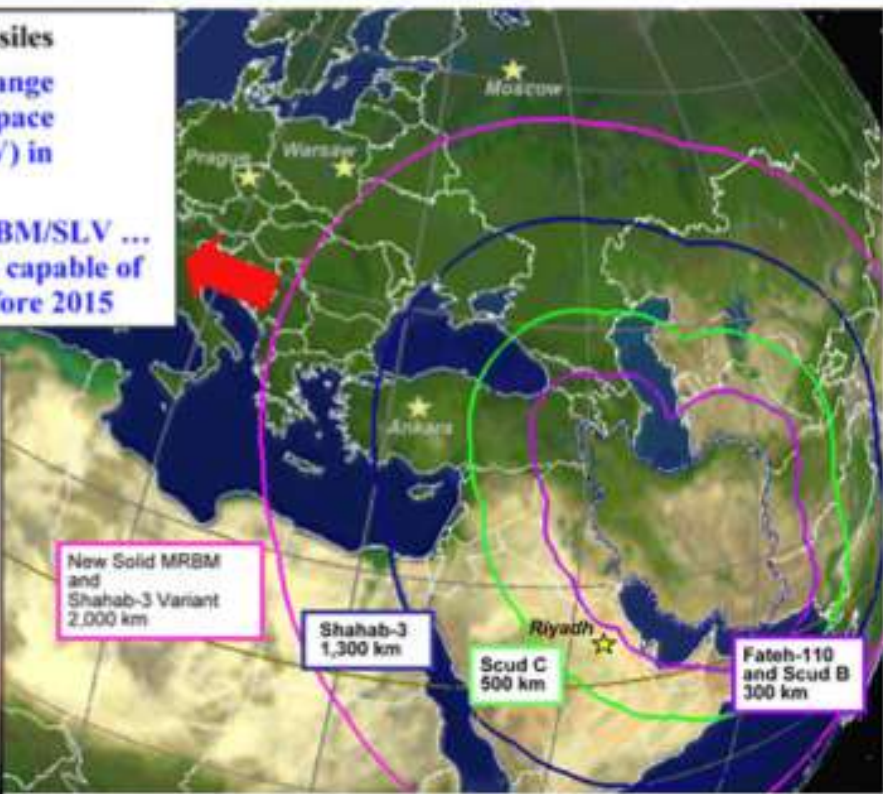
Iran's President Ahmadi Nejad also announced Tehran would launch a home-produced satellite into orbit in 2008, and several Iranian news websites released photos of a new rocket called "Safi."

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

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

Iranian Missile "Range"

- 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



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	-

ms-1096738 / 061437

(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)

Iran's Ballistic Missiles - I

Liquid Propellant Missiles

- Has approximately 200-300 Shahab-1 and -2 missiles capable of hitting targets in neighboring countries
- Imported/assembled between 12 and 18 Shahab-1&-2 TELs. This number is growing to 24+
- Iran can hitting targets up to 900km from its borders using the Shahab-3 and Ghadr-1
 - Ghadr-1 began flight tests in 2004 – theoretically extends Iran's reach to about 1600km, but seems to have a smaller warhead – 750kg
- Iran has at least six Shahab-3/Ghadr-1 Transporter-Erector-Launcher (TEL) vehicles, and probably more. Silo option may be in development.

•Solid Propellant Missiles

- Sajjil-2 – potentially capable of delivering a 750kg warhead to a range of 2200km
- The only country to have developed this missile without first having nuclear weapons
 - Solid fuelled systems provide certain advantages
 - Less prone to pre-emptive attacks given shorter launch prep times
 - Successfully tested in November of 2008
 - Still AT LEAST 2 years away from being fully operational

Iran's Ballistic Missiles - II

• Impact

- Estimated Casualties would still be low
- Iran must unleash its full missile arsenal and that the majority of the warheads penetrated missile defenses
- Due to the low accuracy of these warheads.
- The confident destruction of a fixed-point military would require a significant percentage at least of its missile inventory to be specific mission
- Currently able to conduct harassment attacks towards large airport bases however, nothing capable of shutting down military activities.
- Lacking high number of TELs and the delays occurring during reload procedures

• Potential exists for chemical and biological warheads

- Missiles still however could not reliably carry out and deliver enough agent over a wide enough area to stop an adversary's military capabilities indefinitely

• Tehran's ballistic missile are capable of loading nuclear warheads

- Challenge is making a small enough bomb
- Most common delivery platforms would be Ghadr-1 and the Shahab-3
- Once the solid propellant Sajjil-2 becomes operational, this would be an option as well.
 - Offers greater flexibility and superior range-payload capacity

Iran's Ballistic Missiles - III

•Ballistic Missile Industries

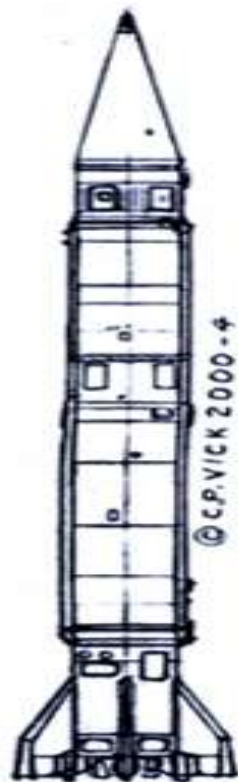
- Turning away from foreign aid/design, Iran redesigns of Shahab-3 resulted in longer-range Ghadr-1
- Continued efforts resulted in a modified Ghadr-1 which created the Safir space-launch vehicle – orbiting a small satellite in space.
- Unveiling of the two-stage Simorgh launch vehicle – comprised of 4 No-dong engines suggests that Iran plans to develop more powerful satellite carriers
- Iran has proven to have the capacity to successfully modify existing missiles and outfit them with the necessary components to become effective
- These efforts have strong political support given the financial services that have been allocated to the research and development efforts of these missiles
- However, this support still depends significantly on foreign aid, and availability and access to key materials

Images of Iranian Missile Program

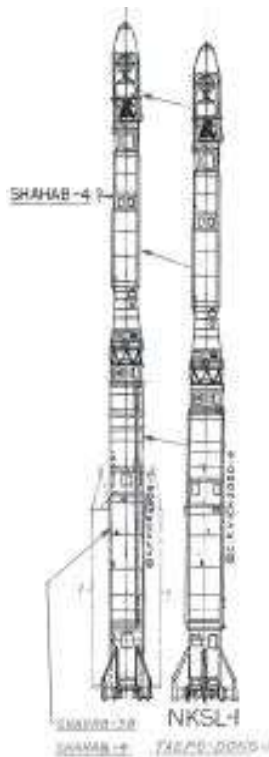
Shahab-3



No Dong



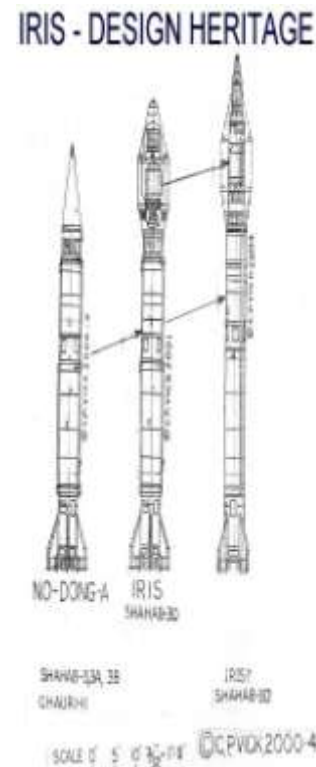
Shahab-4



Variant



IRIS



Range	1,300	1,300	2,000	2,000	3,000
Payload	~1,000	700-1000	?	700	~1,000
IOC	2002	?	?	?	2005

Ballistic and Cruise Missile Updates

- **Dec 16, 2009**
 - Iranian reporting shows an upgraded version of the Sejil-2 missile test was successful.
 - Defense Minister General Ahmad Vahidi stated that “it is impossible to destroy [Sejil-2] by anti-missile rockets”
 - He also stated that the launch prep time necessary is shorter than previous versions, for this missile. While further referring to the upgraded missile as a “great development in Iran’s defense industry increasing the country’s technical and tactical powers”
- **Jan 10, 2010**
 - General Ahmad Vahidi stated “Iran’s missile deterrent power is highly above the enemies’ imagination”
- **March 7, 2010**
 - Iranian reporting shows that Iran has started production on the Nasr-1 cruise missile.
 - Minister of Defense, General Ahmad Vahidi reports that the Nasr-1 cruise missile is “capable of destroying 3,000 ton targets”
 - According to the minister, the Nasr-1, “the short-range surface-to-surface missile will be capable of being fired from the air and underwater in the near future”
- **June 19, 2010**
 - General Ahmad Vahidi reports that “Iran’s missile capability is of a deterrent nature and poses no threats to others”
 - In response to Sec. Gates’ statement: “Iran could, if it wanted, launch scores, even hundreds of missiles into Europe”

Uzi Rubin on BM-25/RS-27/KH55

Iran acquired eighteen BM25 land-mobile missiles with launchers from North Korea which can strike targets in Europe. In the past, the BM25 has been produced in two models: one with a range of 2,500 km and the second with a range of 3,500 km. Obviously, they threaten not just Iran's immediate neighbors, and it seems that the Iranians are looking to project power beyond their own region.

Once Iran set up a missile industry, it tried to cover expenses by exporting. The Iranians attempted to sell Scud-Bs to Zaire. They signed a \$12 billion deal with Khaddafi to set up an entire missile industry in Libya and were very upset when Khaddafi changed and became one of the good guys. Iran has also provided heavy rockets to Hizballah: the Fadjir 3 with a range of 45 km and the Fadjir 5 with a 75 km range.

Iran is also developing a whole line of big, solid propellant, two-stage ballistic missiles - the Ghader 110. Well-substantiated reports indicate that the Iranians managed to steal and smuggle out of Ukraine several strategic cruise missiles, probably not to be deployed but to be emulated and copied. Thus, we can expect an Iranian cruise missile program too, based on cloning the Russian Kh 55, the Soviet equivalent of the U.S. "Tomahawk."

Speculation on BM-25/RS-27

The **BM25 Musudan**,^[2] also known under the names **Nodong / Rodong-B**, **Mirim** and **Taepodong-X** is a mobile [intermediate-range ballistic missile](#) developed by the [Democratic People's Republic of Korea](#), based on Soviet Union's [R-27 Zyb](#). The missile probably makes up the 2nd stage of [Taepodong-2](#), a fixed-launcher platform [ICBM](#). The Musudan was first revealed to the international community in a military parade on 10 October 2010 celebrating the [Korean Worker's Party's](#)



65th anniversary.

In the mid-1990s, after the collapse of the [Soviet Union](#), North Korea invited the [Makeyev Design Bureau's](#) ballistic missile designers and engineers to develop this missile, based on the [R-27 Zyb](#). It was [decided that](#), as the [Korean People's Army's](#) MAZ-547A/MAZ-7916 [Transporter erector launcher](#) could carry 20 tonnes, and the [R-27 Zyb](#) was only 14.2 tonnes, the [R-27 Zyb's](#) fuel/oxidizer tank could be extended by approximately 1.7 m.^[1] Additionally, the warhead was reduced from a [three-warhead MIRV](#) to a single warhead.

It was estimated that, as a result of the tank extension and warhead replacement, the missile's range was approximately 3,200-4,000 km, an improvement on the R-27U's 3,000 km.^[3]

The actual rocket design is a [liquid fuel rocket](#) using a [hypergolic](#) combination of [unsymmetrical dimethylhydrazine](#) as fuel, and inhibited [red fuming nitric acid](#) as oxidizer; this fuel/oxidizer combination does not vaporise like liquified [hydrogen/oxygen](#) gas at 35°C. As a result, once the fuel/oxidizer combination were fed into the missile, it could maintain a 'ready to launch' condition for several days, or even weeks, like the R-27 SLBM; however it could not be kept longer that this, because of tank corrosion caused by the red fuming nitric acid. Musudan's rocket motors originally made up either the [1st or 2nd stage](#) of the [Taepodong-2](#), which North Korea test fired in 2006. However, this launch was not successful. The TD-2 first demonstrated a successful test launch on July 5, 2009, proving the reliability of the Musudan missile.^[4]

According to other sources though, the Taepodong-X missile, with a range of up to 4,000 kilometers, is a solid-fuel missile, not a liquid-fuel one, and is still in development as of 2009.^[5] However, 16 launchers with missiles were displayed in the 10 October 2010 military parade, the largest in the country's history.

Speculation on KH-55

The **Kh-55** ([Russian: X-55](#); [NATO:AS-15 'Kent'](#); [RKV-500](#);) is a [Soviet/Russian](#) air-launched [cruise missile](#), designed by [MKB Raduga](#). It has a range of up to 3,000 km (1,620 nmi) and can carry conventional or [nuclear](#) warheads. Kh-55 is launched exclusively from bomber aircraft and has spawned a number of conventionally armed variants mainly for tactical use, such as the **Kh-65SE** and **Kh-SD**, but only the **Kh-101** and **Kh-555** appear to have made it into service. Contrary to popular belief, the Kh-55 was not the basis of the submarine- and ground-launched [RK-55 Granat](#) (SS-N-21 'Sampson' and SSC-X-4 'Slingshot').

A Kh-55 production unit was delivered to Shanghai in 1995 and appears to have been used to produce a similar weapon for China.

It is powered by a single R95-300 [turbofan](#) engine, with pop-out wings for cruising efficiency. It can be launched from both high and low altitudes, and flies at subsonic speeds at low levels (under 110 m/300 ft altitude). After launch, the missile's folded wings, tail surfaces and engine deploy. It is guided through a combination of an [inertial guidance system](#) plus a terrain contour-matching guidance system which uses [radar](#) and images stored in the memory of an onboard computer to find its target. This allows the missile to guide itself to the target with a high degree of accuracy, with a reported ^{[[citation needed](#)]} [CEP](#) of 15 meters.

in March 2005 Ukraine's prosecutor-general Svyatoslav Piskun said that in 2001, 12 Kh-55's had been exported to Iran in a deal allegedly worth US\$49.5 million^{[[12](#)]} and six to China.^{[[11](#)]} It has also been reported that Iran has started producing the missiles locally and is working on a longer range version.^{[[13](#)][[14](#)]}



New Qiam-1 Missile Test: 2010

- **Defence Minister Brigadier General Ahmad Vahidi says Iran is unveiling a series of missiles and rockets to mark the national ‘Day of Defence Industry’ on August 22. These include two new surface-to-surface missiles.**
- **A new Qiam missile is launched on 20 August. Iran claims it is a liquid fueled missile entirely designed and built in Iran. It is described as a short-range missile but no details are provided on range or guidance.**
 - **The minister tells Fars news agency that, “The missile has new technical aspects and has a unique tactical capacity.” It has a "smart navigation system" and is of a “new class...Since the surface-to-surface missile has no wings, it has lot of tactical power, which also reduces the chances of it being intercepted. This missile is capable of hitting the target with high precision.”**
 - **“Ya Mahdi” is written on the side of the missile. The Imam Mahdi is one of the 12 imams of Shiite Islam, who disappeared as a boy and whom the faithful believe will return one day to bring redemption to mankind.**
- **A third generation Fateh 110 (Conqueror) missile is also test fired. Iran has previously shown a version claimed to have range of 150 to 200 kilometers (90 to 125 miles).**
- **The Minister formally inaugurates production lines for two missile-carrying speedboats, Seraj (Lamp) and Zolfaqar (named after Shiite Imam Ali’s sword).**

Qiam-1 Missile Performance

- **Jane's reports that the missile appears to be similar to the Shahab 2: which is similar to a modified Russian SS-1 Scud C and derived from the or North Korean R-1**
- **The exhaust plume shape indicates the missile has had a liquid propellant. Jane's report is has had no rear fins and appeared to have four small motors at the rear to control the ascent phase.**
- **The nose of the missile has the 'baby bottle' shape on the later Shahab 3 missiles. Jane's indicates this suggests that the warhead section would separate from the rest of the missile during its flight.**
- **Jane's also reports a single external strake goes from the rear of the warhead section midway down the missile's body, possibly carrying cables from the warhead section to the motor section.**
- **No details are provided on the launcher. Jane's indicates it may have been from a mobile transporter-erector-launcher (TEL) vehicle.**
- **Jane's estimates that the Qiam-1 missile is an upgraded Shahab 2, with a length of 11.5 m, a diameter of 0.88 m and a launch weight of 6,000-6,200 kg.**
- **It notes that could have a maximum range of 500 km. Improvements over the earlier Shahab 2 be in both accuracy and increased range, but the Iranian Defence Ministry and other military sources do not provide details.**

New Fateh 110 Missile Tests: 9/2010

Commander of the IRGC Aerospace Force Brigadier General Amir Ali Hajizadeh declared that Iran's Defense Ministry has equipped his units with Fateh-1 said his force is due to be equipped with more modern missiles on a monthly basis.

"We have received the third generation of Fateh-110 missile with a range of 300 kilometers from the Defense Ministry and they were displayed at the parades today," Hajiza

The Iranian Armed Forces staged military parades all throughout the country on Wednesday to mark the start of the Week of Sacred Defense, commemorating Iranian sacri 1980s.

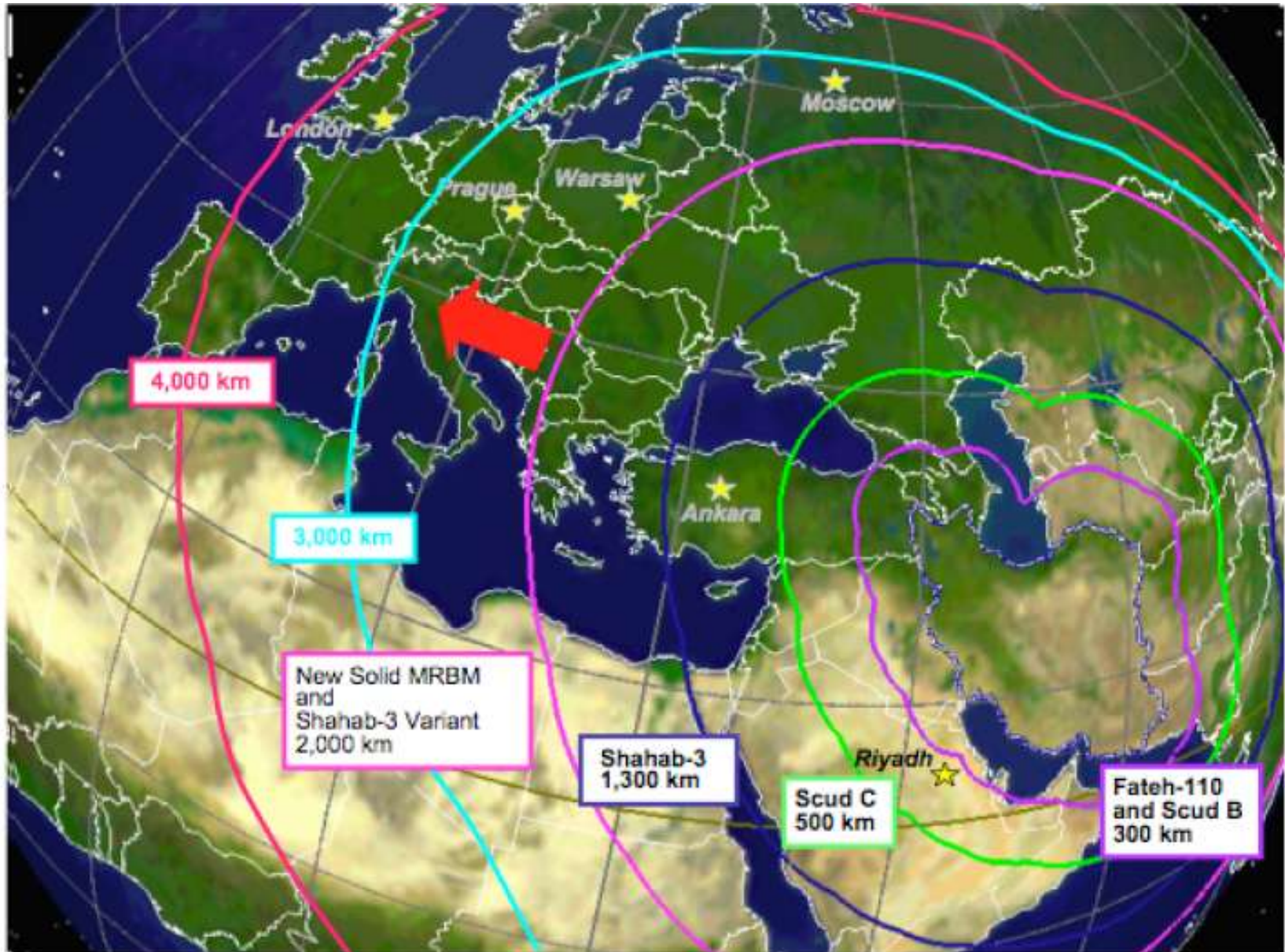
In the capital, various units of the Islamic Republic Army, Islamic Revolution Guards Corps (IRGC) and Basij (volunteer) forces took part in the parades in southern Tehran. Hajizadeh further noted that the Iranian Armed Forces have displayed only a small part of their capabilities in the parades today.

The commander also announced that the Defense Ministry is slated to equip his force with new missiles and military equipment and systems each month based on a contra Force.

The Iranian Defense Ministry announced yesterday that it had delivered the third generation of home-made Fateh-110 high-precision ballistic missiles to the IRGC Aerospac The new missiles were handed out in a ceremony attended by Iranian Defense Minister Brigadier General Ahmad Vahidi, Brigadier General Amir Ali Hajizadeh and Comma "The operational movement of the missile unit of the IRGC Aerospace Force will be remarkably boosted by these missiles," Vahidi said during the ceremony. Last month, Iran announced that the country has successfully test-fired the third generation of Fateh-110 missiles.

The Fateh-110 is a short-range, road-mobile, solid-propellant, high-precision ballistic missile with advanced navigation and control systems.

“Guesstimated” Iranian Missile Ranges



Future Capabilities : Progress and Obstacles

Liquid Propellant

- **Some future advances will be governed by the fact that Iran will have to produce liquid propellant engines “in house”**
- **Fully functional Shahab-3 and Ghadr-1 require at least 3 to 5 years of prep and testing**
- **Performance analysis in the Shahab missiles compared to the Scuds previously acquired from the Soviet Union show a continued dependence on design and implementation with the Soviet framework.**
- **Speculation of foreign support in the form of technical assistance suggests that Iran may be able to establish a stand alone liquid-propellant engine production line of its own in the near future**

Solid Propellant

- **Iran has established a series of licensed solid-propellant production lines**
- **2 years or more for a functional Solid- propellant rocket**
- **These facilities have demonstrated the ability to develop rocket motors to be used potentially on the Sajjil-2 missile**
- **However much of the Iranian knowledge in dealing with design and implementation of these solid-propellant missiles depends much on the technical aid of Chinese experts, Iran is still between 2 to 3 years away from developing a stand-alone program**

Guidance Systems

- **While Iran still must import complete guidance units for its missiles, evidence indicates Iran has the knowhow to assemble basic units and modify them successfully to outfit custom missiles**
- **Minor improvements such as more robust GPS receivers to enhance accuracy**
- **Ability to incorporate Iranian created guidance packages (excluding actual units) improving inertial navigation units**
- **Provides short term advantages**
- **However, needs precise thrust terminations. Post Boost control systems**
- **Without these, Iranian missile accuracy will still fail to improve significantly**

Future Capabilities : Potential Outcomes

Iran still has to rely heavily on Foreign technical assistance (Russia and China) in developing Liquid-Propellant engines, and both of these countries are starting to adhere more closely to Missile Technology Control Regime guidelines. This will force Iran to rely more on its own technology and industrial base and/or less capable North Korean technology..

•As Iran seeks to develop missiles with a longer range, quicker set up and reaction times, and more reliability it will probably shift to solid fuel. It may develop and strengthen the Sajjil-2 or modify the Safir satellite launcher for military use. Iran has the ability, availability of resources, and expertise to implement this process.

•Implementing some TBM countermeasures seems likely.

•Effective cluster and CBW warheads are possible.

•Improved accuracy is uncertain without new technologies.

•Would require a far more intensive testing program to have credible reliability for longer range systems.

•Reports of terminal guidance capabilities seem doubtful through mid-term.

•Important caveats

- Still necessary to engage in multiple testing phases
- Acquisition of tracking and telemetry systems that can be deployed on sea-based platforms
- Tehran would have to develop and implement reliable technologies for all forms of advanced warheads that could withstand shock and re-enter the atmosphere

The Challenge of Missile Warfare

A Gulf Missile War



Regional Operational Challenges in TMD

Interception during Boost Phase should keep the missile WMD debris from falling over friendly territory and actually making it fall in the aggressors territory.

However, to conduct a Boost Phase Intercept, an airborne platform will have to be close to the target to launch its weapons as the timelines associated with the Boost Phase are in seconds.



This would entail getting to the target area by flying over a neighbors airspace and maybe other countries as well.

If there is no prior authorization and coordination this action could be considered as violating the sovereignty of the country and possibly bringing the region into conflict.

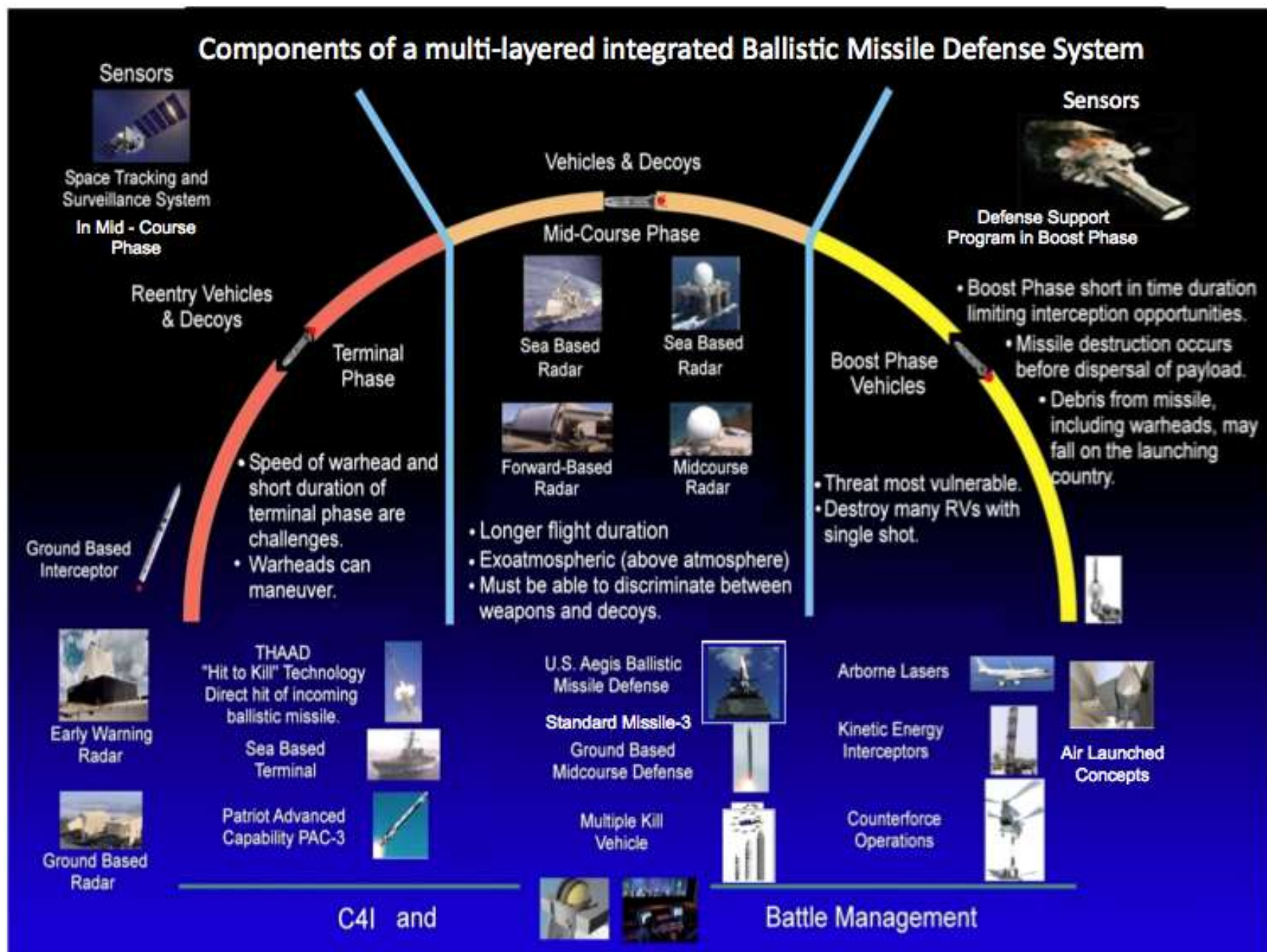
In the Terminal Phase due to the very high closing velocity and short time duration, Ballistic Missiles will have to be engaged automatically.

This then requires intercept authorization in advance and rules of engagement between neighboring countries will have to be agreed upon.

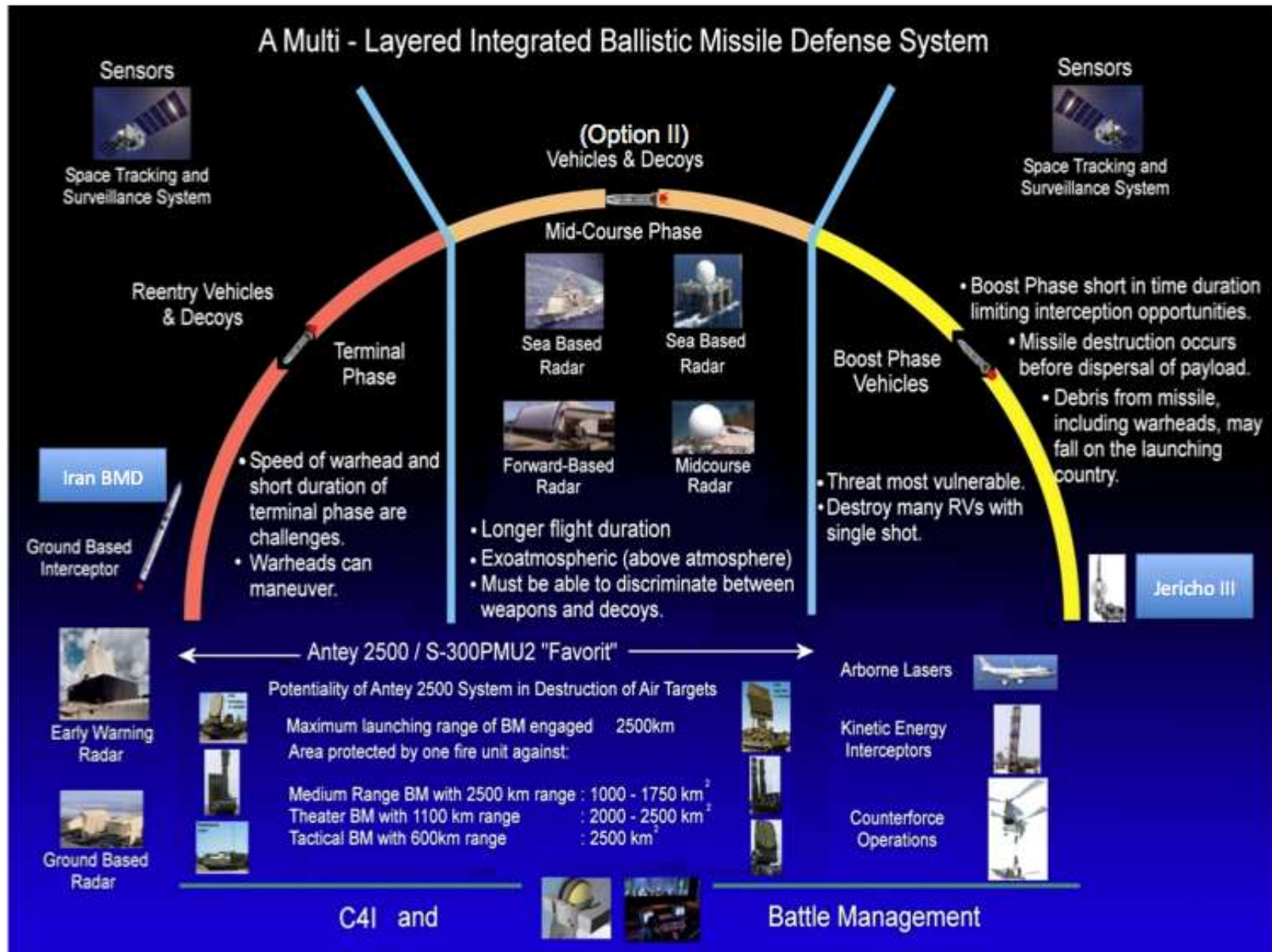


If no Rules of Engagement are agreed upon then WMD debris from the intercept could fall on the territory of a neighboring country, causing losses in human life and economic productivity.

Gulf Integrated Missile Defenses



Iranian Integrated Missile Defenses



The Challenge of Nuclear Forces and Weapons of Mass Destruction

Current & Potential Nuclear Powers

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			



Iran's Nuclear Programs: DNI Assessment - February 2010

The Iranian regime continues to flout UN Security Council restrictions on its nuclear program. There is a real risk that its nuclear program will prompt other countries in the Middle East to pursue nuclear options. We continue to assess Iran is keeping open the option to develop nuclear weapons in part by developing various nuclear capabilities that bring it closer to being able to produce such weapons, should it choose to do so. We do not know, however, if Iran will eventually decide to build nuclear weapons.

I would like to draw your attention to two examples over the past year that illustrate some of the capabilities Iran is developing.

First, published information from the International Atomic Energy Agency indicates that the number of centrifuges installed at Iran's enrichment plant at Natanz has grown significantly from about 3,000 centrifuges in late 2007 to over 8,000 currently installed. Iran has also stockpiled in that same time period approximately 1,800 kilograms of low-enriched uranium. However, according to the IAEA information, Iran also appears to be experiencing some problems at Natanz and is only operating about half of the installed centrifuges, constraining its overall ability to produce larger quantities of low-enriched uranium.

Second, Iran has been constructing—in secret until last September—a second uranium enrichment plant deep under a mountain near the city of Qom. It is unclear to us whether Iran's motivations for building this facility go beyond its publicly claimed intent to preserve enrichment know-how if attacked, but the existence of the facility and some of its design features raise our concerns. The facility is too small to produce regular fuel reloads for civilian nuclear power plants, but is large enough for weapons purposes if Iran opts configure it for highly enriched uranium production. It is worth noting that the small size of the facility and the security afforded the site by its construction under a mountain fit nicely with a strategy of keeping the option open to build a nuclear weapon at some future date, if Tehran ever decides to do so.

Iran's technical advancement, particularly in uranium enrichment, strengthens our 2007 NIE assessment that Iran has the scientific, technical and industrial capacity to eventually produce nuclear weapons, making the central issue its political will to do so. These advancements lead us to reaffirm our judgment from the 2007 NIE that Iran is technically capable of producing enough HEU for a weapon in the next few years, if it chooses to do so.

We judge Iran would likely choose missile delivery as its preferred method of delivering a nuclear weapon. Iran already has the largest inventory of ballistic missiles in the Middle East and it continues to expand the scale, reach and sophistication of its ballistic missile forces— many of which are inherently capable of carrying a nuclear payload.

We continue to judge Iran's nuclear decisionmaking is guided by a cost-benefit approach, which offers the international community opportunities to influence Tehran. Iranian leaders undoubtedly consider Iran's security, prestige and influence, as well as the international political and security environment, when making decisions about its nuclear program.

Iran's growing inventory of ballistic missiles and its acquisition and indigenous production of anti-ship cruise missiles (ASCMs) provide capabilities to enhance its power projection. Tehran views its conventionally armed missiles as an integral part of its strategy to deter—and if necessary retaliate against—forces in the region, including US forces. Its ballistic missiles are inherently capable of delivering WMD, and if so armed, would fit into this same strategy.

Iran's Nuclear Programs: DDNI Assessment - March 2010

We continue to assess Iran is keeping open the option to develop nuclear weapons though we do not know whether Tehran eventually will decide to produce nuclear weapons. Iran continues to develop a range of capabilities that could be applied to producing nuclear weapons, if a decision is made to do so.

During the reporting period, Iran continued to expand its nuclear infrastructure and continued uranium enrichment and activities related to its heavy water research reactor, despite multiple United Nations Security Council Resolutions since late 2006 calling for the suspension of those activities. Although Iran made progress in expanding its nuclear infrastructure during 200[1, some obstacles slowed progress during this period.

In 2009, Iran continued to make progress enriching uranium at the underground cascade halls at Natanz with first-generation centrifuges, and in testing and operating advanced centrifuges at the pilot plant there.

As of mid-November, Iran had produced about 1,800 kilograms of low-enriched uranium hexafluoride (LEUF6) gas product at Natanz, compared to 555 kilograms of LEUF6 in November 2008. Between January and November 2009, Iran increased the number of installed centrifuges from about 5,000 to about 8,700, but the number reported to be operating remains at about 3,~100.

In September, Iran disclosed that it was constructing a second gas-centrifuge uranium enrichment plant near the city of Qom that is designed to house approximately 3,000 centrifuges.

Iran in 2009 continued construction of the IR-40 Heavy Water Research Reactor. Iran during National Nuclear Day inaugurated its fuel manufacturing plant and claimed to have manufactured a fuel assembly for the IR-40.

What Does Iran Mean by “100% Enrichment”

On July 31, according to Iran's semiofficial Mehr News Agency, presidential chief of staff Esfandiar Rahim Mashai claimed that the West had raised no objections to President Mahmoud Ahmadinezhad's open proclamation that the Islamic Republic could build a nuclear bomb...Mashai's statement reportedly came as he was addressing the assembly of young advisors to the Ministry of Education. Rooz Online, a Britain-based website detested by the regime, analyzed reports on the speech from various semiofficial Iranian news outlets, such as Fars, the Iranian Students News Agency, and the Islamic Republic News Agency. Rooz noted that while other agencies reported rather bland comments, Mehr News Agency -- connected to the Supreme Leader's Islamic Propagation Organization -- gave a much blunter account.

According to Mehr's website, Mashai discussed Ahmadinezhad's February 7, 2010, speech at the National Center for Laser Science and Technology. Mashai reportedly said, "One of the points Dr. Ahmadinezhad announced during his visit to this center was the possibility of enriching to 100 percent, which means building an atom bomb [ke maani an sakht-e bomb-e atomi ast]. But it was interesting that not even one foreign media made a hullabaloo or an uproar. And this shows that they are not worried about an atom bomb. And essentially Dr. Ahmadinezhad had said this to test them in order to see what degree of worry they have about Iranian production of an atom bomb" (translation by the author).

...Interestingly, the week after Ahmadinezhad's February 7 speech, another important Iranian official publicly referred to 100 percent enrichment. On February 15, a government-connected website (dolat.ir) posted a long interview with Ali Akbar Salehi, director of the Atomic Energy Organization of Iran and former ambassador to the International Atomic Energy Agency. Near the end of the interview, Salehi repeatedly claimed that Iran has the legal right to enrich to 100 percent....

Iran's CBW Programs: DDNI Assessment - March 2010

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

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

Nuclear Uncertainty

- **Must plan to deal with possible Iranian force with unknown weapons characteristics, delivery systems, basing, and timelines.**
 - **Technology base now exists, enrichment to fissile levels is only limiting factor.**
- **Already a key factor in Iranian capability to conduct “wars of intimidation.”**
- **Clear Iran proceeding with extensive ballistic missile program regardless of whether it pursues the nuclear option.**
- **Cannot predict timeframe for nuclear threat. Worst case is 2009, but could well be 2015.**
 - **Break out, bomb in basement, tested, deployed, serious numbers, mobile, sheltered, LUA/LOW? Fission, boosted, thermonuclear?**
- **Chemical and biological options as well.**

IAEA Report of May 31, 2010

Iran's total LEU production at the Natanz fuel enrichment plant (FEP): to date is reported to be 2,427 kg of low enriched uranium, including 362 kg estimated by Iran to have been produced from January 30, 2010 to May 1, 2010. The average monthly production of LEU at the FEP has increased slightly to 120 kg per month (for the last reporting period we noted it was 117 kg of LEU).

Activity at the Pilot Fuel Enrichment Plant: Iran has designated two cascades at the smaller, above-ground pilot fuel enrichment plant (PFEP) for the production of LEU enriched to 20 percent U235 for the Tehran Research Reactor.

Enhanced safeguards at the PFEP: enhanced safeguards were installed in late April 2010. The Agency noted however, that the modification of the PFEP to produce 20 percent enriched uranium “was not notified to the Agency by Iran with sufficient time for the Agency to adjust its safeguards procedures” as required by Iran’s existing safeguards agreement.

Continued R&D of advanced centrifuges, but no indication of timing of deployment: Between February 3, 2010 and May 21, 2010, Iran introduced 74 kg of UF6 into a 20-machine cascade of IR-4 centrifuges, a 20-machine cascade of IR2 centrifuges and into single IR-1, IR-2 and IR-4 machines. These quantities of UF6 feed and the number of centrifuges involved indicate that this effort is still at the R&D stage.

No progress on IAEA requests for Fordow design information: Iran “referred to its earlier answers on this subject and indicated that ‘the Agency is not mandated to raise any question beyond the Safeguards Agreement.’”

No cooperation on centrifuge production, R&D, uranium mining and milling: Iran replied only that it was “continuing to cooperate with the Agency in accordance with its Safeguards Agreement” but did not provide the requested information.

Bushehr fuel loading set: Iran informed the IAEA that it will perform a “technical examination of the fuel assemblies” for the Bushehr reactor prior to loading them into the reactor’s core in June 2010. No specific date for the loading or official start of the reactor was provided.

Pyroprocessing R&D underway; equipment moved: Iran informed the IAEA in January 2010, during a design inspection of the Jabr Ibn Hayan Multipurpose Research Laboratory (JHL) in Tehran, that “pyroprocessing R&D activities had been initiated at JHL to study the electrochemical production of uranium metal.” Iran subsequently informed that IAEA that such work was purely research related and aimed at studying the “electrochemical behavior of uranyl ion in ionic liquid.” It is not clear in the report whether and to what extent this work is related to Iran’s weaponization research. During the IAEA’s second visit to JHL which sought to clarify the nature of the work, inspectors found that the electrochemical cell had been moved.

No progress on weaponization issues: No progress made on resolving what the IAEA terms “possible military dimensions” to Iran’s nuclear program. Iran continues to refuse IAEA requests to discuss such issues and insists that the documentation on which such allegations are based are forgeries. The Agency reports that it “remains concerned about the possible existence in Iran of past or current undisclosed nuclear related activities, involving military related organizations, including activities related to the development of a nuclear payload for a missile. There are indications that certain of these activities may have continued beyond 2004.”

Why the US Did Not Accept the Turkish-Brazilian Proposal

- The proposed agreement did not take into account the major changes on the ground related to the Iranian nuclear program because of the Iranian actions in October 2009, at the forefront of which is the fact that Iran enriched uranium to the level of 20 percent. However, this is not the only reason.
 - Iran is ignoring its commitments to the nuclear non-proliferation agreement, and over the last six months:
 - It concealed the Qom facility;
 - Did not fully respond to questions by the IAEA regarding the possibility of there being a military side to the Iranian nuclear program.
- Iran has also almost doubled the amount of enriched uranium it has from Natanz [nuclear enrichment facility].
- When former IAEA chief Muhammad ElBaradei moved diagonally last autumn to lead negotiations in Vienna and came up with an excellent proposal that states that Iran should send uranium abroad in order to transform it into nuclear energy to use in its research facilities in Tehran to produce isotopes for medical uses. This took place and Iran possessed 1,600 kg of low-enriched uranium. However, from that point until now Iran speeded up the level of its nuclear program and produced, although it is hard to accurately determine the amount, around a further 1,000 kg of uranium.
- This is a change in circumstances on the ground. With Iran returning to the October 2009 agreement, the question was raised: What is the problem with the agreement now one year after agreeing to it? This does not take into consideration many of the changes on the ground. Also there are a number of points in the Tehran declaration that did not take into account the details that came in the agreement supervised by ElBaradei last October; for example details about protecting the stockpiles of Iranian fuel and the conditions for returning the uranium. Practically, all the details.

The Challenge of the Iranian Targeting Base

300 miles
500 km

TURKEY

TURKMENISTAN

CASPIAN SEA

Lashkar A'bad

Tehran

Sites circled in red
unknown pre-mid 2002

IRAQ

Arak

Natanz

Isfahan

IRAN

Saghand

Ardekan

AFGHANISTAN

MIDDLE EAST

MW Megawatts

Uranium processing facility

Uranium mines

Heavy-water facility

Research reactors / research facilities

Uranium enrichment facility

Light-water reactor (under construction)

KUWAIT

Bushehr

1000 MW

PAKISTAN

Gachin

SAUDI ARABIA

BAHRAIN

QATAR

Gulf of Oman

Vehicle Entrance Ramp
(after burial)

Bunkered underground
Centrifuge cascade halls

Helicopter
pads

New security
wall

Dummy building
concealing tunnel
entrance ramp

Admin/engineering
office area

DigitalGlobe Quickbird commercial satellite image

21 JUL 04

Vehicle Entrance Ramp
(before burial)

Bunkered underground
production halls

Admin/engineering
office area

DigitalGlobe Quickbird commercial satellite image

20 SEP 02

Seeking Effective Concealment



IAEA on Natanz: 11/2010

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

On 5 November 2010, 54 cascades had been installed in three of the eight units in Production Hall A, 29 of which were being fed with UF₆.^{3,4} Initially, each installed cascade comprised 164 centrifuges. Iran recently modified six of the cascades to contain 174 centrifuges each. To date, all the centrifuges installed are IR-1 machines. Installation work in the remaining five units was ongoing but no centrifuges had been installed. As of 5 November 2010, there had been no installation work in Production Hall B.

Contrary to the relevant resolutions of the Board of Governors and the Security Council, Iran has not suspended its enrichment related activities. Iran has continued with the operation of FEP and PFEP at Natanz, and has continued to produce UF₆ enriched up to 20% U-235 at PFEP.

...Iran has continued the construction of FFEP. In order to verify the chronology and original purpose of FFEP, Iran still needs to provide the Agency with access to relevant design documents and to companies involved in the design and construction of the plant.

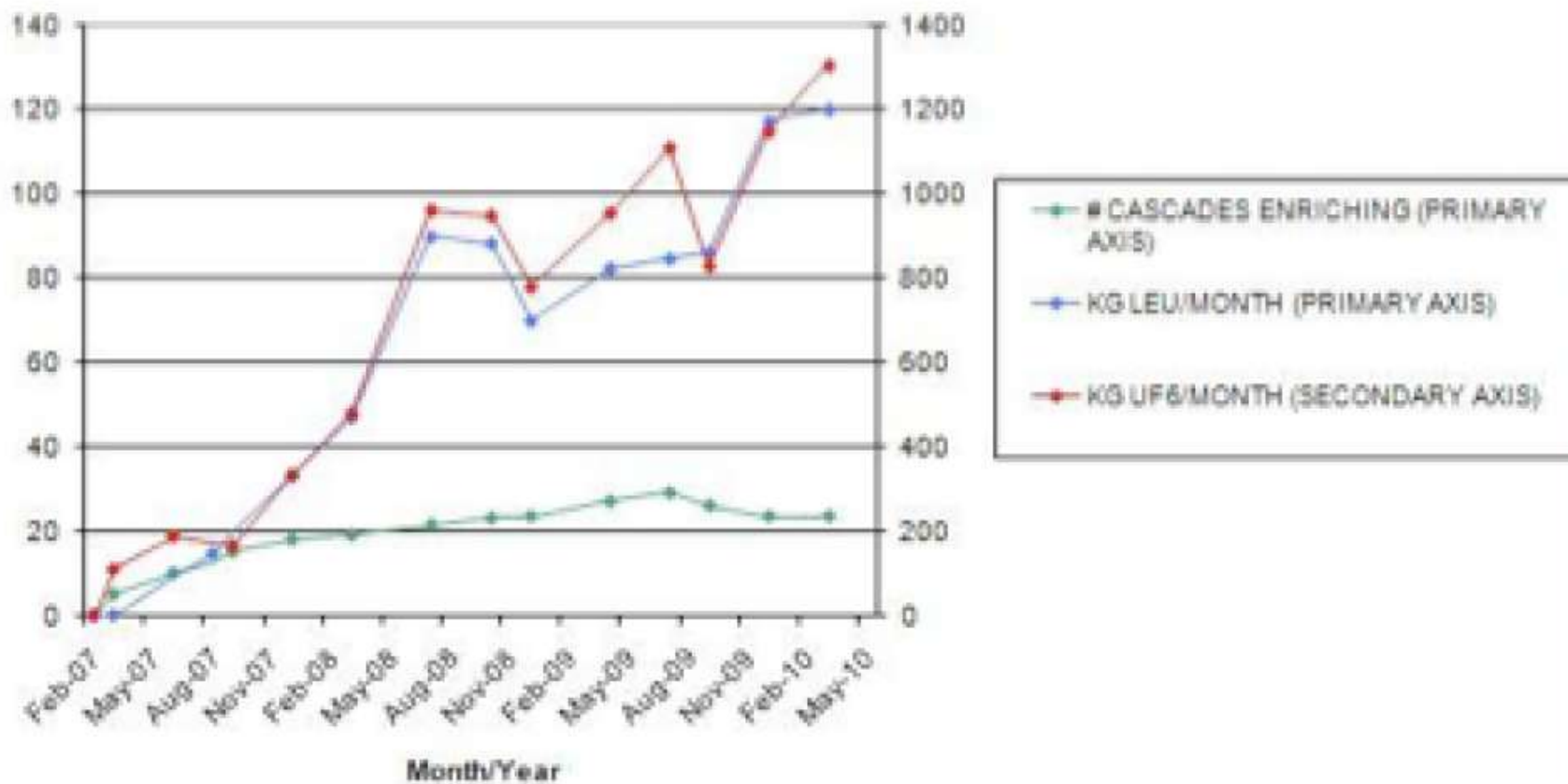
...PFEP is a research and development (R&D) facility and a pilot, low enriched uranium (LEU) production facility which was first brought into operation in October 2003. It has a cascade hall that can accommodate six cascades. Cascades 1 and 6, each of which comprises 164 centrifuges, are designated for the production of LEU enriched up to 20% U-235. The other part of the cascade hall is designated as an "R&D area".

In the R&D area, between 21 August 2010 and 19 November 2010, a total of approximately 138 kg of natural UF₆ was fed into a 20-centrifuge IR-4 cascade, a 20-centrifuge IR-2m cascade and single IR-1, IR-2m and IR-4 centrifuges. In this area, no LEU is withdrawn because the product and the tails of this R&D activity are recombined at the end of the process.

ISIS,

IAEA Iran Report: Enrichment increases slightly; lack of adequate safeguards, David Albright and Jacqueline Shire, Charts prepared by Christina Walrond, May 31, 2010, <http://www.isisnucleariran.org/reports/>

ISIS Estimate of Trends at Natanz



ISIS, *IAEA Iran Report: Enrichment increases slightly; lack of adequate safeguards*, David Albright and Jacqueline Shire, Charts prepared by Christina Walrond, May 31, 2010, <http://www.isisnucleariran.org/reports/>

20% Enrichment & Weapons Production

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

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

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

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

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

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

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

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

Images of Qom (Fordow)



ISIS on Qom

ISIS has obtained commercial satellite imagery from DigitalGlobe that narrows the time frame during which Iran would have begun construction of the gas centrifuge uranium enrichment plant near Qom. The satellite imagery indicates that Iran began construction of the enrichment facility after January 2006 but before June 2007. This time frame is consistent with a Reuters report that construction began in 2006.

ISIS previously assessed that the June 2004 and March 2005 satellite imagery seen on GoogleEarth (which depict the future site of the enrichment plant construction, but at the time show tunnel entrances that were likely not yet associated with the uranium enrichment construction project). The Atomic Energy Organization of Iran could have chosen among existing tunnel facilities throughout the country, and settled on this one near Qom, to site the covert enrichment plant. The January 2006 DigitalGlobe image of the site is very similar to the 2004 and 2005 imagery, which indicates that construction of the uranium enrichment plant had still not yet commenced as of that date.

The June 2007 image shows notable differences from the three previous images. A large amount of construction materials is visible next to the two tunnel entrances and at one of the adjacent construction staging areas, and possible cement storage is visible at another nearby construction staging area. ISIS assesses that construction associated with the covert gas centrifuge uranium enrichment facility had begun by this June 2007 image and that the construction materials seen in the image were then used in the transformation from what was likely a smaller tunnel facility into a much larger industrial facility, the gas centrifuge hall, built inside the mountain.

The January 2009 image shows a large amount of construction and excavation activity, and the September 27, 2009 still shows a large amount of construction activity, though the tunnel entrances and another excavation have been covered. A February 2000 image from GeoEye shows that the initial tunnel entrances were not yet present at that date.

DNI on Qom (Fordow)

...Iran has been constructing -- in secret until last September -- a second uranium enrichment plant deep under a mountain near the city of Qom. It is unclear to us whether Iran's motivations for building this facility go beyond its publicly claimed intent to preserve enrichment know-how if attacked, but the existence of the facility and some of its design features raise our concerns.

The facility is too small to produce regular fuel reloads for civilian nuclear power plants, but is large enough for weapons purposes if Iran opts configure it for highly enriched uranium production.

It is worth noting that the small size of the facility and the security afforded the site by its construction under a mountain fit nicely with a strategy of keeping the option open to build a nuclear weapon at some future date, if Tehran ever decides to do so.

IAEA on Qom (Fordow) as of 11/2010

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

in Iran's initial declaration regarding the purpose of FFEP, contained in a letter dated 2 December 2009, Iran stated that, "The location [near Qom] originally was considered as a general area for passive defence contingency shelters for various utilizations. Then this location was selected for the construction of [the] Fuel Enrichment Plant in the second half of 2007".¹¹ The Agency has asked Iran on a number of occasions, most recently in the aforementioned letter of 10 November 2010, to provide additional information regarding the chronology of the design and construction of FFEP, as well as its original purpose.¹² The Agency has, on several occasions, also requested access to companies involved in the design and construction of FFEP. The Agency informed Iran that it had received extensive information from a number of sources alleging that design work on the facility had started in 2006.¹³ Iran has stated that there are "no legal bases" upon which the Agency can request information on the chronology and purpose of FFEP, and that the Agency is "not mandated to raise any question beyond the Safeguards Agreement".

In a letter of 16 November 2010, Iran said that its statements concerning the chronology and purpose of FFEP should be considered "as a fact" by the Agency, and that the Agency's request to have access to companies involved in the design of the facility and to further design documents was not only not in accordance with the Safeguards Agreement but was also "beyond the Additional Protocol". The Agency considers that the questions it has raised are within the terms of the Safeguards Agreement, and that the information requested is essential for the Agency to verify the chronology and original purpose of FFEP to ensure that the declarations of Iran are correct and complete.¹⁵

18. The Agency has verified that the construction of the facility is ongoing. As of 14 November 2010, no centrifuges had been introduced into the facility. The results of the environmental samples taken at FFEP up to February 2010 did not indicate the presence of enriched uranium... 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 HWPP. While the Agency can report that Iran has made statements to the effect that it has not suspended those activities, without full access to the heavy water at UCF and the HWPP, the Agency is unable to verify such statements and therefore to report fully on this matter.

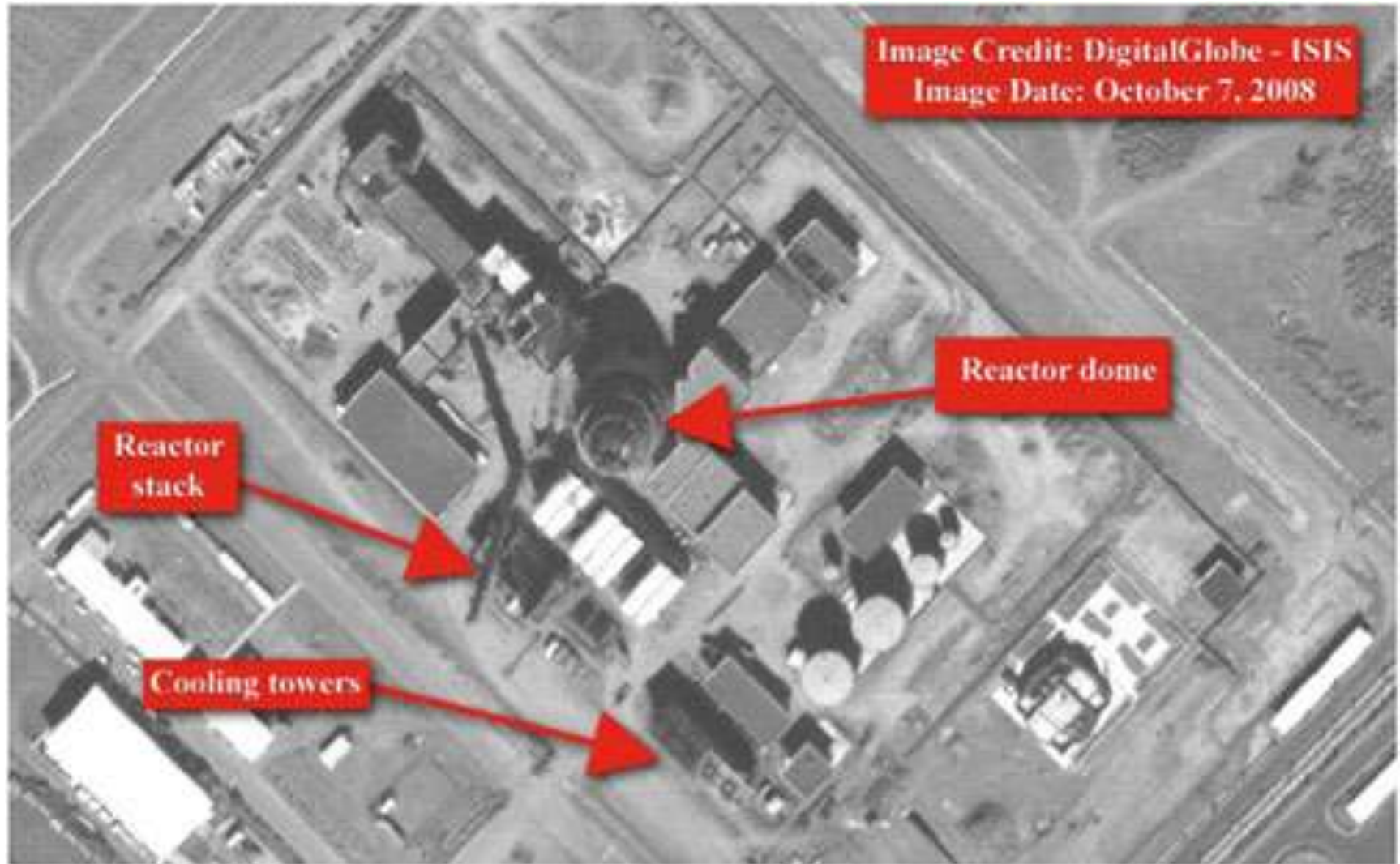
IEA on Plutonium/ Heavy Water Facilities as of 11/2010

The Agency has requested that Iran make the necessary arrangements to provide the Agency, at the earliest possible date, with access to: the Heavy Water Production Plant (HWPP); the heavy water stored at the Uranium Conversion Facility (UCF) for the taking of samples;²⁴ and any other location in Iran where projects related to heavy water are being carried out. The Agency, in a letter to Iran dated 2 November 2010, has again reiterated this request for access. In its reply dated 7 November 2010, Iran repeated its previous assertions that the Agency's requests had "no legal basis since they are not falling within Iran's Safeguards Agreement" and that the Agency's requests went beyond the relevant Security Council resolutions that "request only verification of suspension". Iran also stated that it had not suspended work on heavy water related projects. To date, Iran has not provided the requested access.

On 8 November 2010, the Agency carried out a DIV at the IR-40 reactor at Arak and observed no significant change since the Director General's last report. The Agency verified that construction of the facility was ongoing, with the civil construction of the buildings almost complete and some major equipment having been installed. This equipment includes the main crane in the reactor building and the pressurizer for the reactor cooling system. According to Iran, the operation of the IR-40 reactor is planned to commence in 2013. In the radiochemistry building, the concrete structure for the hot cells was ready, but no hot cell windows or manipulators were present.

Based on satellite imagery, the HWPP appears to be in operation.²⁵ However, without access to the HWPP, the Agency is unable to verify Iran's statement that it has not suspended work on heavy water related projects, contrary to relevant Security Council resolutions,²⁶ and therefore cannot report fully on this matter.

The Heavy Water Reactor at Arak



Source: ISIS Report. David Albright, Paul Brannan. November 13, 2008.

Iran's announces in June 2010 that it wants to build four new nuclear research reactors. Such announcements can shroud other intentions, in this case an attempt by Iran to lay the basis for continued or even increased enrichment of 20 percent enriched uranium at the Natanz centrifuge plant.

On June 16, Ali Akbar Salehi, the head of Iran's Atomic Energy Organization announced that Iran would begin work on four new research reactors for the production of medical isotopes.

The reactors' planned locations were not announced, but Salehi stated that they would be constructed in different parts of the country to serve medical centers. According to Salehi, the first reactor would replace the aging 5-megawatt Tehran Research Reactor (TRR), which has an estimated life span of fifteen more years.

He said the new reactor would be more powerful, operating at 20 megawatts-thermal, and that design work would start immediately and the reactor would start in five years.

Given that Iran has not built a reactor, and the Arak heavy water reactor construction project is delayed, this schedule is highly optimistic. This plan also raises questions about Iran's ability to meet minimal safety and environmental concerns about a new reactor and its fuel.

Given the unrealistic nature of Iran's announcement, the question is whether it is a pretext for a claim that it must continue producing 20 percent enrichment to fuel these new research reactors. Iran could also use its latest announcement as justification for employing additional cascades for the production of 20 percent enriched uranium at Natanz, thereby further entrenching its enrichment capability by creating additional "facts on the ground" and exacerbating tensions with the UN Security Council.

IEA on Other Uranium Enrichment Facilities as of 11/2010

The Agency is still awaiting a substantive response from Iran to Agency requests for further information in relation to announcements made by Iran concerning the construction of ten new uranium enrichment facilities, the sites for five of which, according to Iran, have been decided, and the construction of one of which will begin by the end of the current Iranian year (20 March 2011) or the start of the next year.

Iran has not provided further information, as requested by the Agency, in connection with its announcement on 7 February 2010 that it possessed laser enrichment technology, and its announcement on 9 April 2010 regarding the development of third generation centrifuges.

...Iran has also announced that it has selected the venues for new enrichment facilities and that construction of one of these facilities will start around March 2011, but has not provided the Agency with the necessary design information and access in accordance with Iran's Safeguards Agreement and Subsidiary Arrangements.

IEA on Possible Military Dimensions as of 11/2010

Previous reports by the Director General have detailed the outstanding issues related to possible military dimensions to Iran's nuclear programme and the actions required of Iran necessary to resolve those issues.³³ Since August 2008, however, Iran has declined to discuss the outstanding issues with the Agency or to provide any further information or access to locations and people necessary to address the Agency's 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 forged documents.

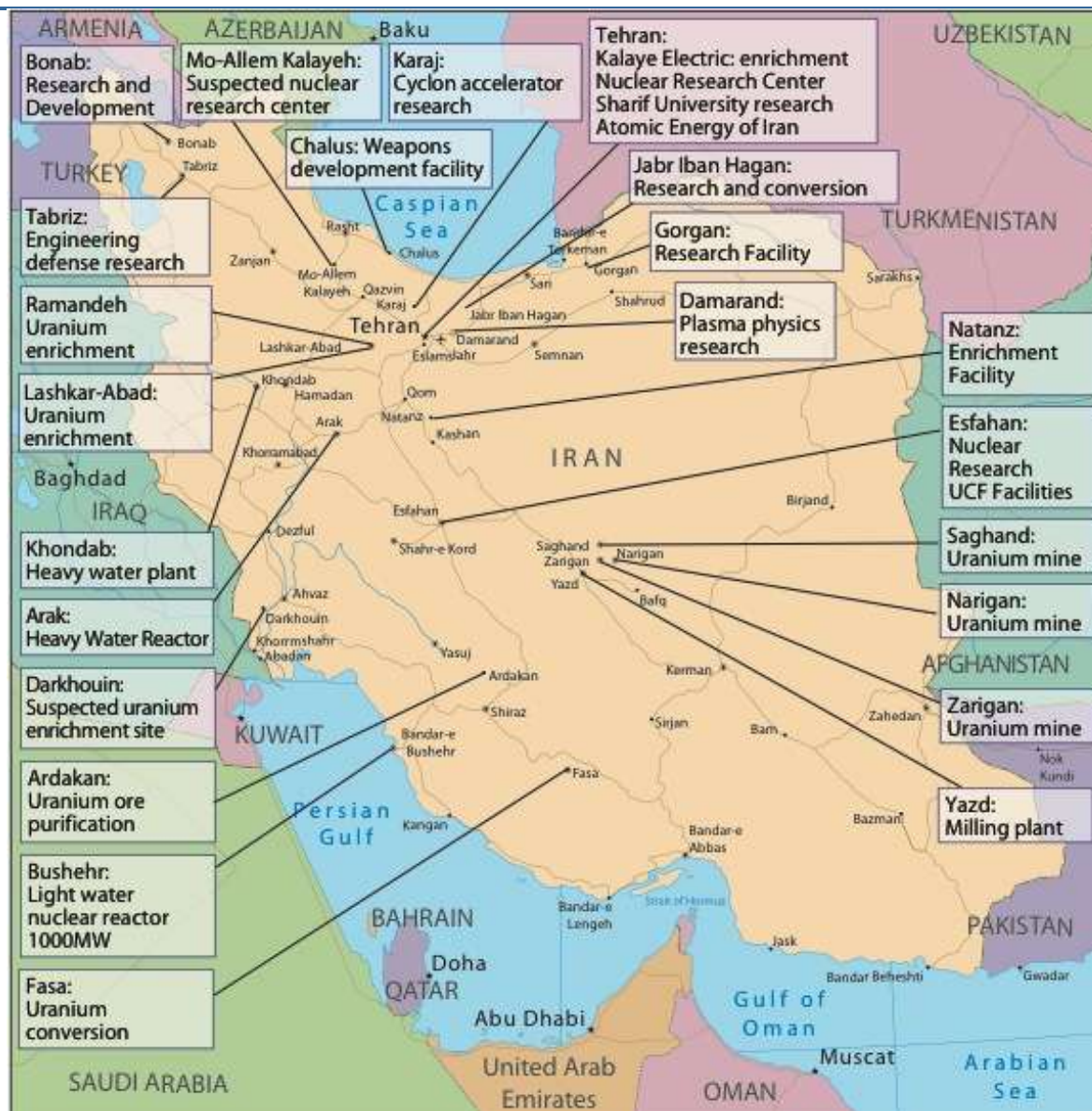
Based on the Agency's analysis of all the information available to it, the Agency remains concerned about the possible existence in Iran of past or current undisclosed nuclear related activities involving military related organizations, including activities related to the development of a nuclear payload for a missile. There are indications that certain of these activities may have continued beyond 2004.³⁴

As Iran has been informed previously, although most of the actions identified in the 2007 work plan agreed between Iran and the Agency (INFCIRC/711) have been completed, there remain issues that still need to be addressed.³⁵ According to the work plan, Iran was required to provide the Agency with its assessment of the documentation related to the alleged studies to which the Agency had provided Iran access. The Agency acknowledges receipt of Iran's 117-page assessment of May 2008, in which Iran asserted that the documentation was forged and fabricated. However, as the Agency considers this assessment to be focused on form rather than substance, it has on several subsequent occasions requested Iran to provide a substantive response. Iran has not yet done so. Moreover, based on the Agency's analysis of additional information which has come to its attention since August 2008,³⁶ there are further concerns which the Agency also needs to clarify with Iran. For these reasons the Agency is unable to consider the issue of the alleged studies as referred to in the work plan as being closed.

In a letter dated 29 October 2010, the Agency provided Iran with a list of matters that remain to be addressed, including, inter alia: the project management structure of the alleged studies related to nuclear explosives; nuclear related safety arrangements for a number of the alleged projects; details of the manufacture of components for high explosives initiation systems; and experiments concerning the generation and detection of neutrons. As was pointed out to Iran in that letter, it is important to resolve all of the issues which have given rise to concerns about the possible military dimensions of Iran's nuclear programme.

It is essential 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 all relevant persons, without further delay. The passage of time and the possible deterioration in the availability of some relevant information increase the urgency of this matter. Iran's substantive and proactive engagement is essential to enable the Agency to make progress in its verification of the correctness and completeness of Iran's declarations.

NTI Estimate of Iranian Nuclear Sites



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

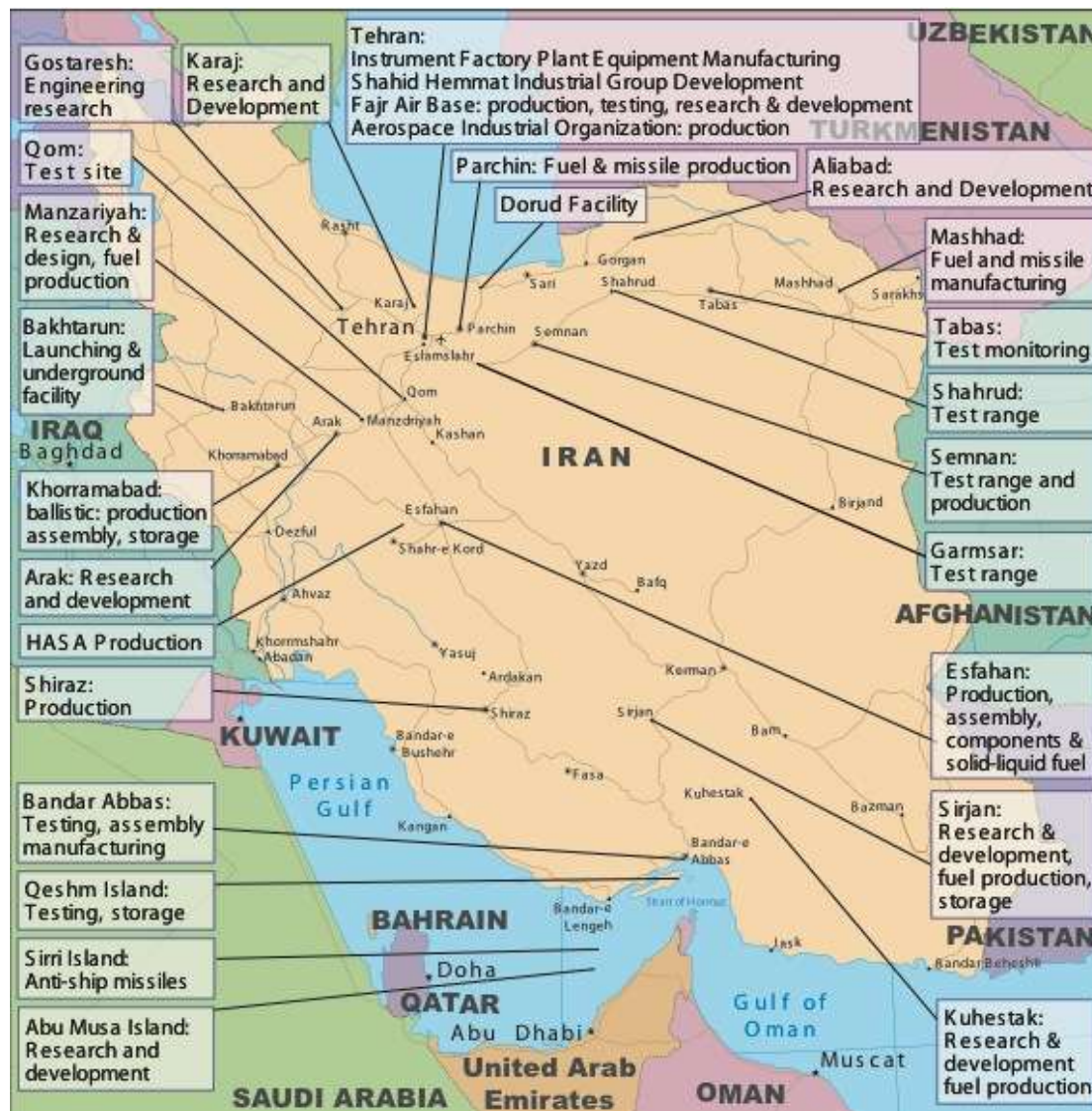
NTI Estimate of Iranian Enrichment Sites



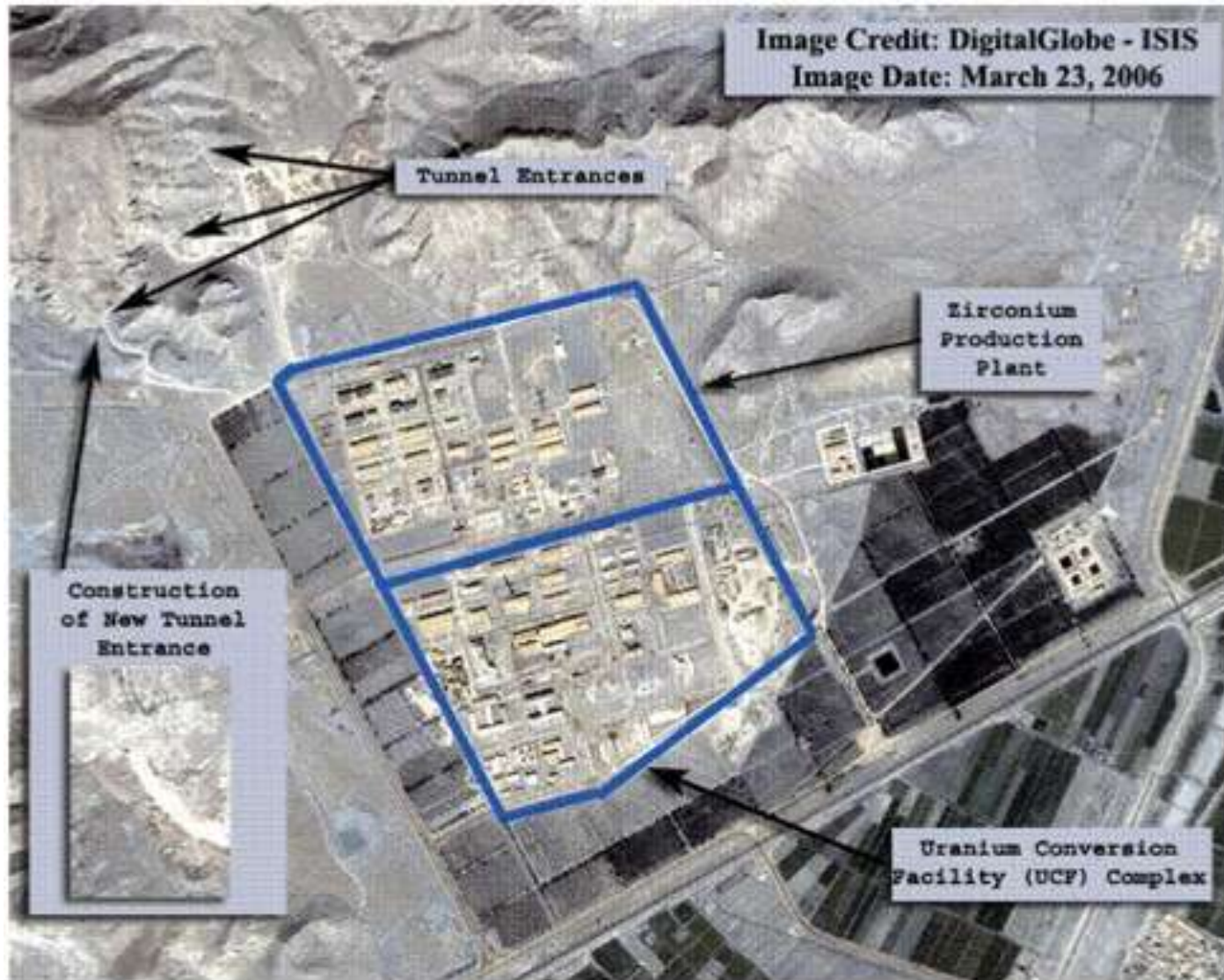
NTI Estimate of Iranian Nuclear Reactors



NTI Estimate of Iranian Missile Sites

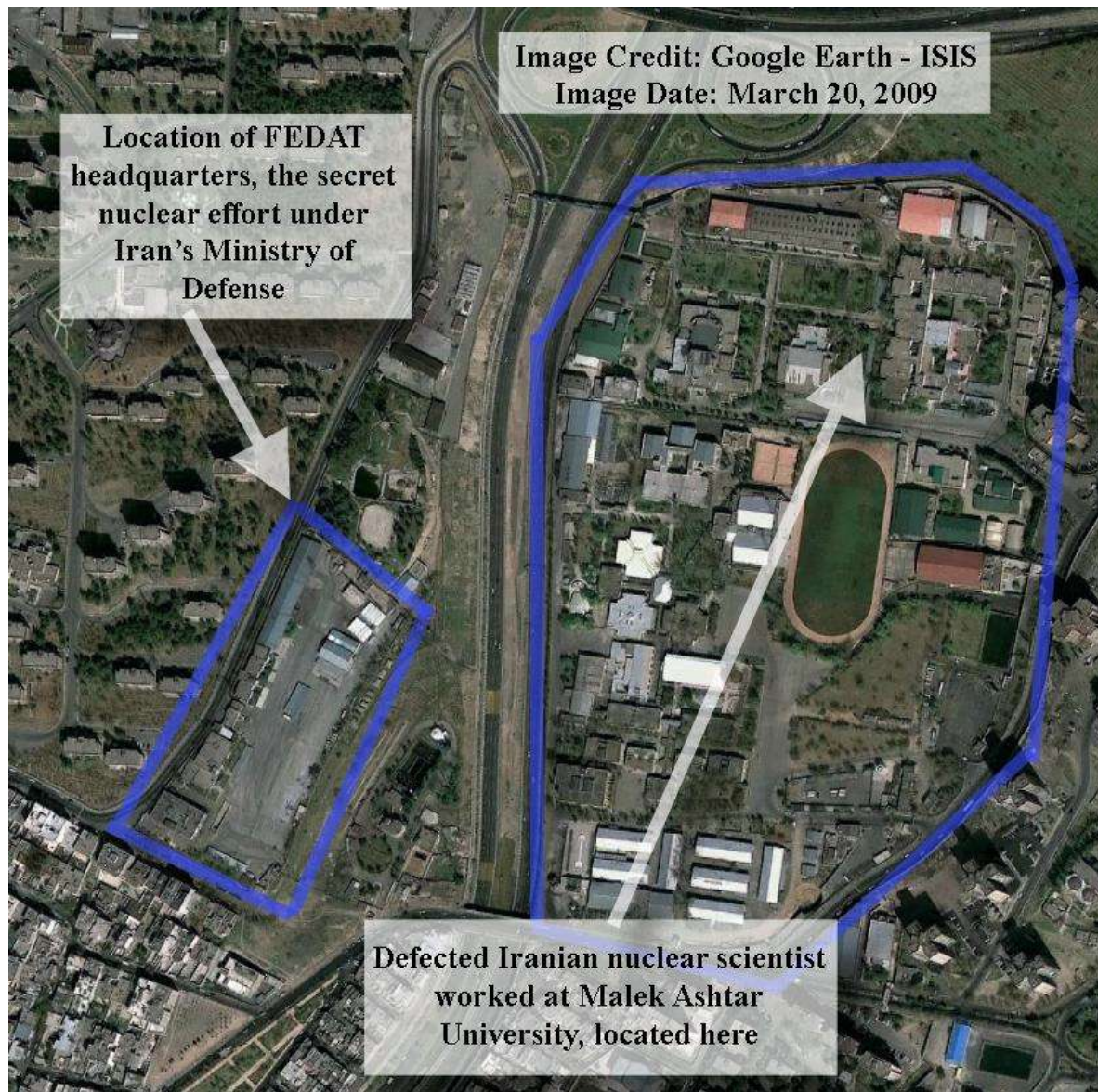


Nuclear Research Complex at Esfahan



ISIS Report. David Albright, Paul Brannan, and Jacqueline Shire. August 7, 2008

Nuclear Complex in Tehran



Iran: Getting Enough Material?

Ali Akbar Salehi, head of the Atomic Energy Organization of Iran, has reportedly stated that Iran has a new centrifuge with an enrichment output of 10 separative work units (swu) per machine per year.¹ He said that the P1 centrifuge has an output of 1.8 swu per year per machine.

Ali Akbar Salehi, head of the Atomic Energy Organization of Iran announced July 12, 2010 that Iran intends on producing 120 kilograms of 19.75 percent uranium by September 2011, purportedly for use in the Tehran Research Reactor (TRR). Salehi also announced that Iran is working on producing fuel plates. .

If Iran stockpiles this amount of 19.75 percent enriched uranium, it could have nearly the amount needed to produce subsequently enough weapon-grade uranium for a bomb. Once it has enough 19.75 percent LEU, it is 90 percent of the way to weapon-grade uranium, meaning Iran could go from 19.75 percent to 90 percent in as little as one-tenth the time needed to go from natural uranium to weapon-grade uranium...Iran could continue producing more 19.75 percent LEU once it reaches that initial September 2011 target of 120 kilograms. Iran could also cite this goal as the basis for enriching up to 19.75 percent in an increasing number of cascades and eventually surpass its target quantity.

Based on its own statements, Iran appears to be implementing a way to more efficiently use the tails and reduce the amount of 3.5 percent LEU feed it requires. Instead of storing the 2 percent enriched tails, it has stated it will further enrich them in a second cascade, in a recycling process. The final tails would be 0.7 percent and reusable in the cascades that make 3.5 percent LEU. By doing so, Iran could significantly reduce the amount of 3.5 percent LEU feed needed to make 19.75 percent material.

Such recycling would be particularly useful to a state attempting breakout with limited amounts of enriched uranium. For example, without recycling, Iran might need about 2,000 kilograms of 3.5 percent LEU to produce 25 kilograms of weapon-grade uranium, where weapon-grade is achieved in three steps. But by simultaneously enriching the tails in other cascades (and reducing the tails in those parallel cascades), Iran could reduce by half the amount of 3.5 percent LEU it would need to produce 25 kilograms of weapon-grade uranium. Although this recycling would require Iran to dedicate more centrifuge cascades to a breakout, it would allow for a smaller initial stock of 3.5 percent enriched LEU.

ISIS on the “Neutron Initiator”

ISIS’ s assessment...is that the document describes a plan to develop a very specialized neutron initiator likely for use in a nuclear explosion. There has been considerable analysis of this document. ISIS encourages discussion and scrutiny of this document, including over the issue of its authenticity, and wants to add some additional information to its earlier assessment of this document.

ISIS understood at the time it received the English translation of the Farsi document that the Times’ source removed headings from the original Farsi-language document and retyped the text in order to protect intelligence-sensitive information. The source made it clear that it had taken these steps to protect its sources and methods and made no attempt to conceal such steps from the Times. The Times’ subsequent publication of both the Farsi document and its translation was not opposed by the source. ISIS understood that the source provided the document to relevant governments and the International Atomic Energy Agency (IAEA) in a different form. Nevertheless, the lack of an original document obviously complicates public assessments of the authenticity of the document. It also calls for the IAEA and governments to share their analysis of this document and how it fits into the other information they possess about Iran’ s nuclear efforts.

If the document is forged or otherwise tampered with, the source risks a severe blow to its credibility in both the short and medium term. Likewise, if the documents had been forged and subsequently obtained by the Times’ source, the source’ s credibility would still be considerably damaged. In discussions with officials from several governments prior to the publication of the Times article, ISIS found that these officials unanimously believed that the source was unlikely to take such a risk. But because of the seriousness of the implications of the document, thorough vetting of the document should continue. What does this document describe?

If the document is genuine, it concerns the design of an experiment to develop a neutron initiator set off by high explosives. The document describes an experiment to calibrate neutron detectors to measure pulsed neutrons from an experiment. The document is not, as some have suggested, about developing ordinary pulsed neutron sources called “neutron generators” (NG) or “dense plasma focus” (PF) devices. The document acknowledges that Iran already has these devices and that they will be used for calibration in an experiment to detect pulsed neutrons from a “hot” source. The paper states that there are existing sources, namely NG and PF that will be used to calibrate the experiment and that there will then be a new experiment using a “hot source”, which is a hydrodynamic device. The hot source is assessed to be an implosion device that generates neutrons via D-D reactions (see figure 1).

The next few lines in the excerpt from the document ...tell us the purpose is to do a calibration experiment for the “hot source” using conventional NG and PF devices. The purpose of the project outlined in the document is making pulsed neutrons and preparing an experiment to prove that the hot source will work as planned, using a hydrodynamic device at a location that requires mobile labs.

That the experiment is hydrodynamic in nature, a reference to shock compression which has nothing to do with NG and PF devices and the need for mobile laboratories, implies that the hot experiments involve tens of kilograms of high explosives.

This paper is not about developing pulsed laboratory sources such as neutron generators and dense plasma focus devices. It describes using those devices to calibrate a hot experiment to see if a nuclear weapon will work using a technology developed by the United States and China to produce neutrons for initiation of a fission nuclear explosive.

How Much is Enough?

Amount of Fissile Material Need to Build a Basic Fission (Non-Boosted) Weapon

Highly Enriched Uranium

HEU (90% U-235)

Simple gun-type weapon **90-110 lbs/40-50 kg**

Simple implosion weapon **33lbs/15 kg**

Sophisticated implosion weapon **20-26lbs/9-12kg**

Weapons Grade Plutonium

Simple implosion weapon **14lbs/6 kg**

Sophisticated implosion weapon **4.5-9lbs/2-4 kg**

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

*Preventive/Preemptive
Strike on Iran*

Strike on Iran?

- **Timelines: Acquisition? Deployment? Modernization?**
- **Targeting intelligence?**
- **Dispersal, hardening, concealment?**
- **Hardening vs. Attack Lethality**
- **SEAD: Penetration? Suppression? Kill?**
- **Range-payload, refuel, recovery**
- **Restrike? Penetration corridor enforcement?**
- **LOW? LUA? Covert?**

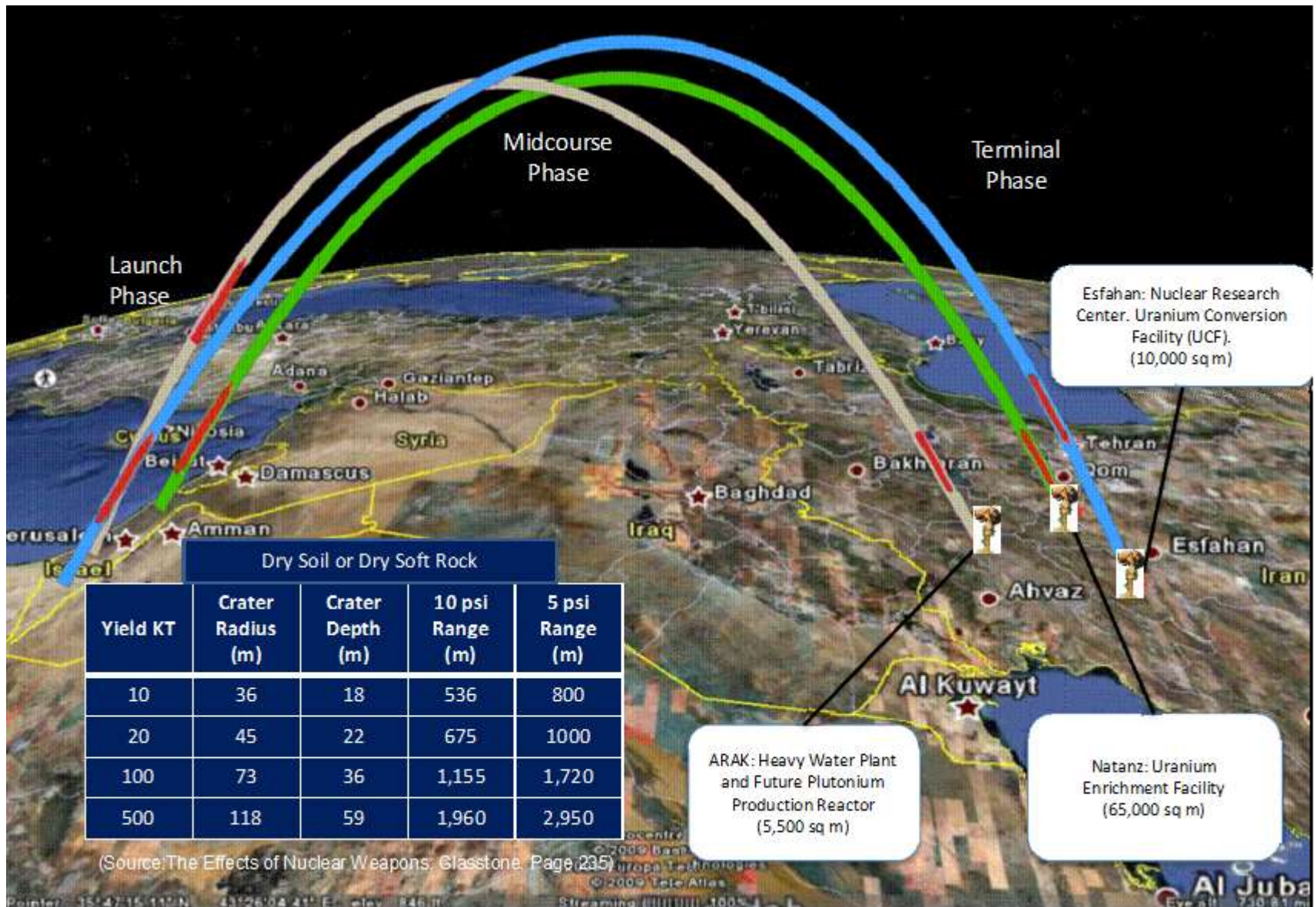
Key Force Posture Decisions

- **US and/or Israel**
 - **Prevent, preempt, contain, deter, retaliate, mutual assured destruction.**
- **Iran and Israel:**
 - **In reserve (secure storage), launch on warning (LOW), launch under attack (LOA), ride out and retaliate**
 - **Continuous alert, dispersal**
 - **Point, wide area defense goals**
- **Israel:**
 - **Basing mode: sea basing, sheltered missiles.**
 - **Limited strike, existential national, multinational survivable.**
- **US:**
 - **Level of defensive aid.**
 - **Ambiguous response**
 - **Clear deployment of nuclear response capability.**
 - **Extended deterrence. Assured retaliation.**
- **Gulf:**
 - **Passive (wait out), defensive, or go nuclear.**
 - **Ballistic, cruise missile, air defense.**
 - **Seek extended deterrence from US**

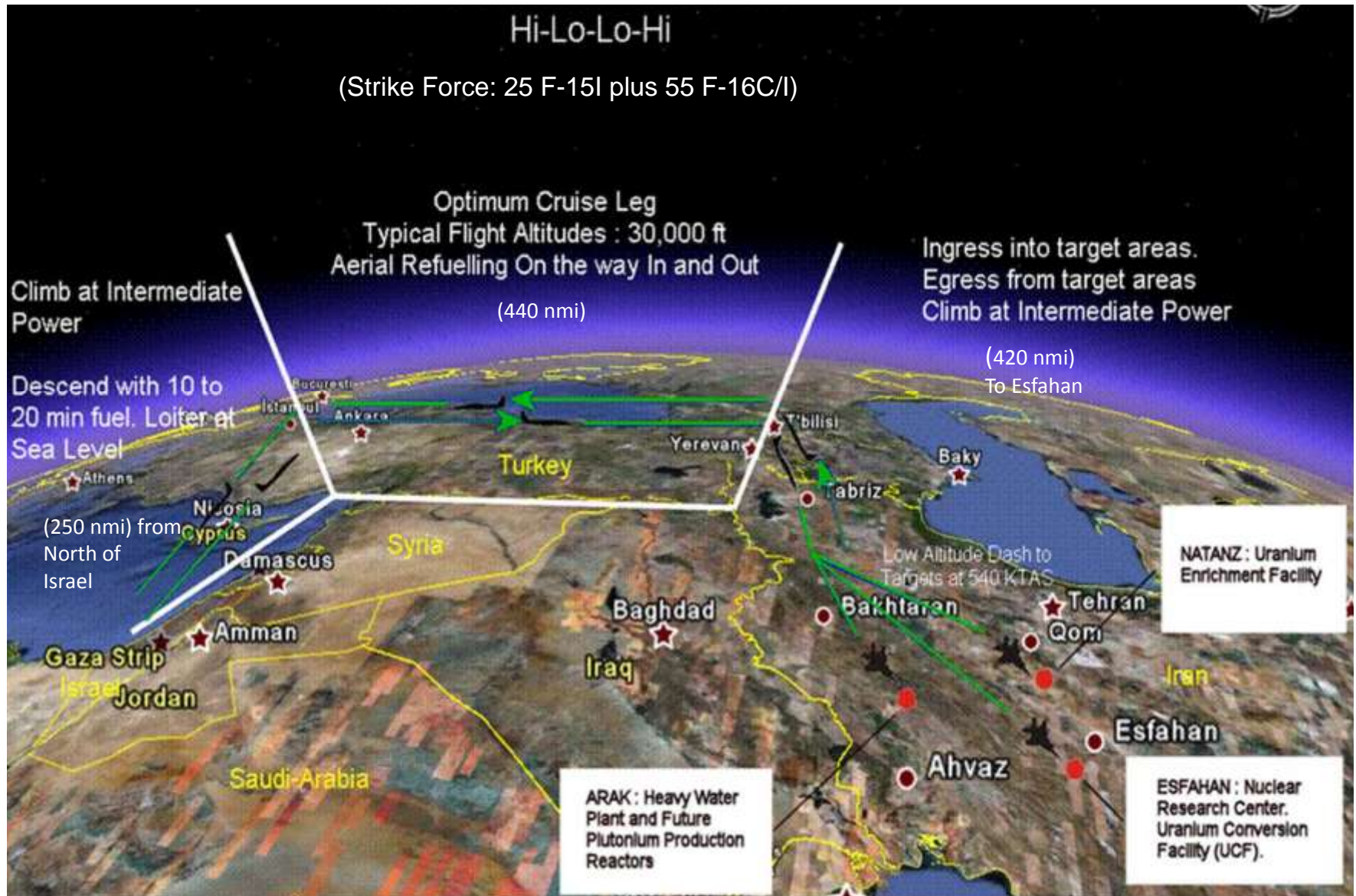
Key Force Posture Decisions - II

- **Syria:**
 - **Link or decouple from Iran.**
 - **Passive (tacit threat) or active (clear, combat ready deployment).**
- **Non-State Actor:**
 - **Tacit or covert capability.**
 - **Proven capability.**
 - **Deployment mode: Hidden, dispersed, pre-emplaced**

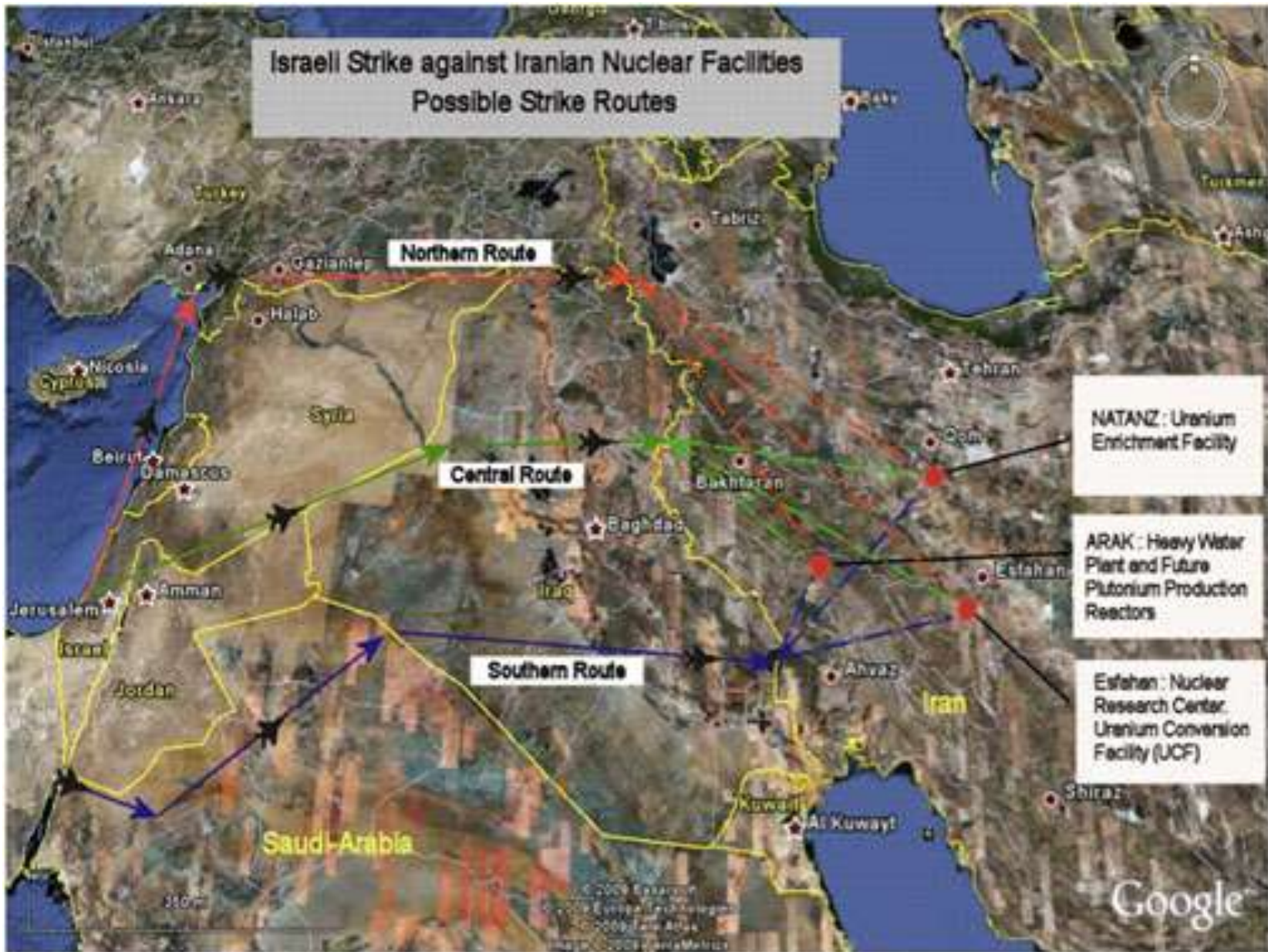
Israeli Low Yield Nuclear Strike on Iran?



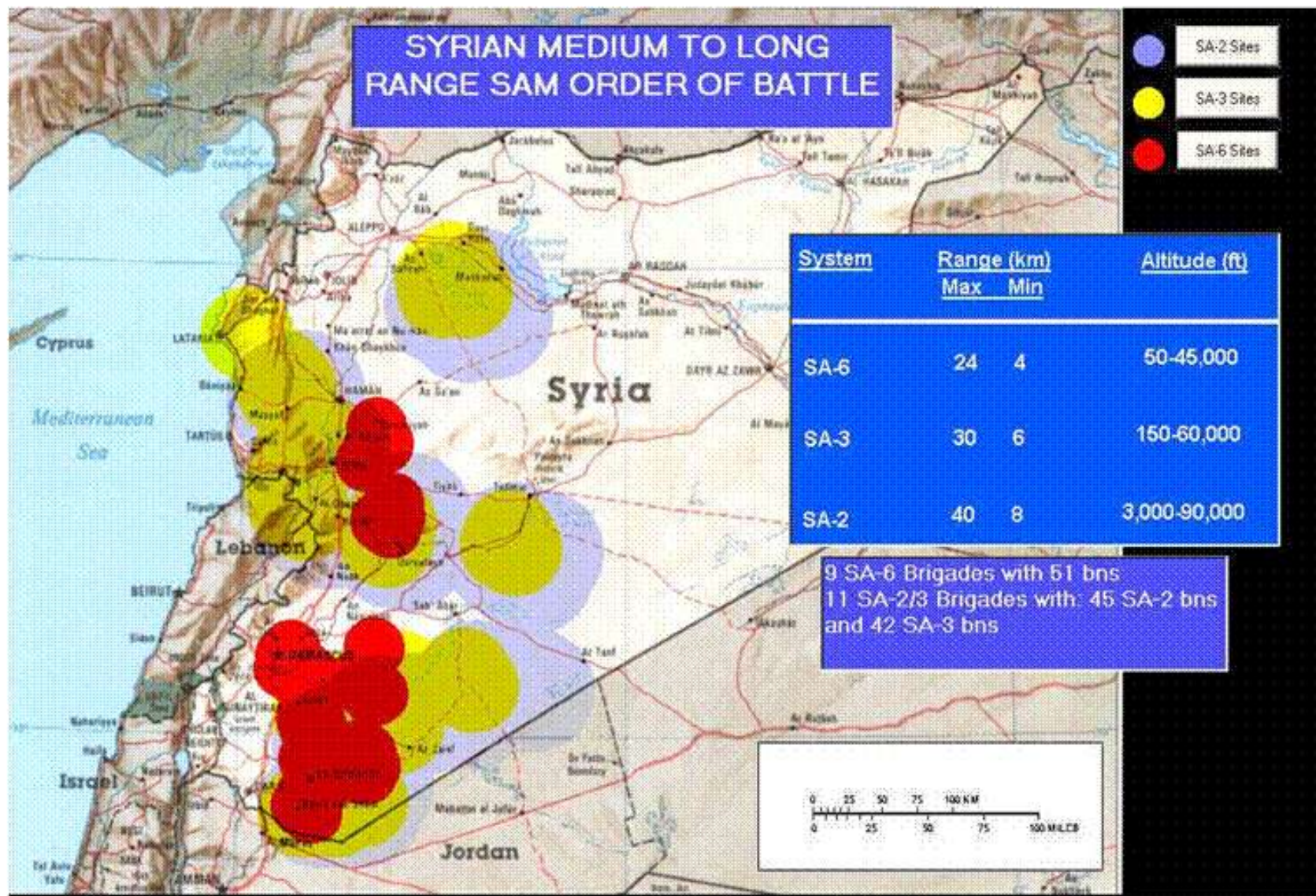
Israeli Conventional Air Strike on Iran?



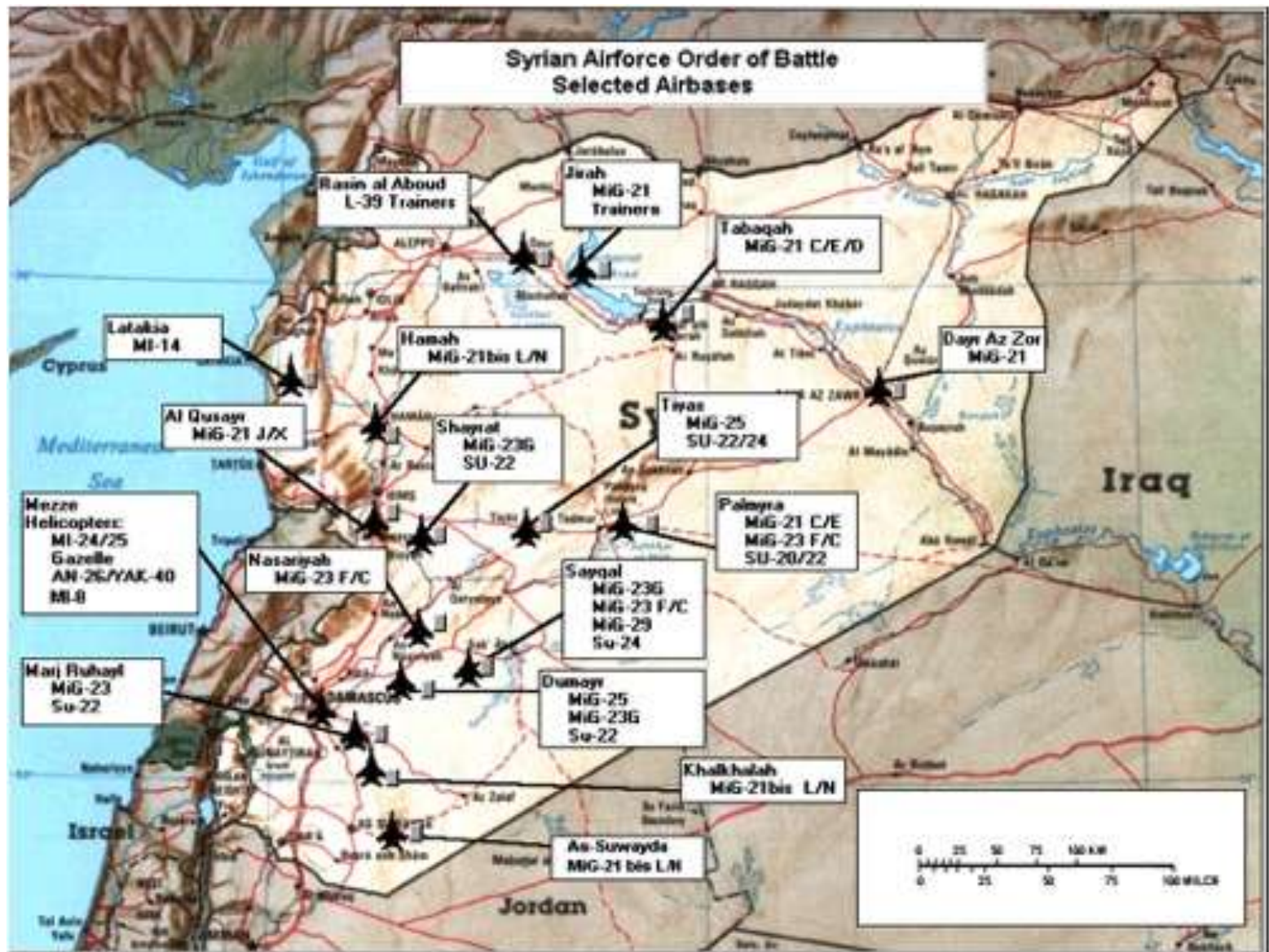
Possible Israeli Strike Route



Syrian SAM Coverage



Syrian Air Coverage



U.S. Strike against Iranian Nuclear Facilities

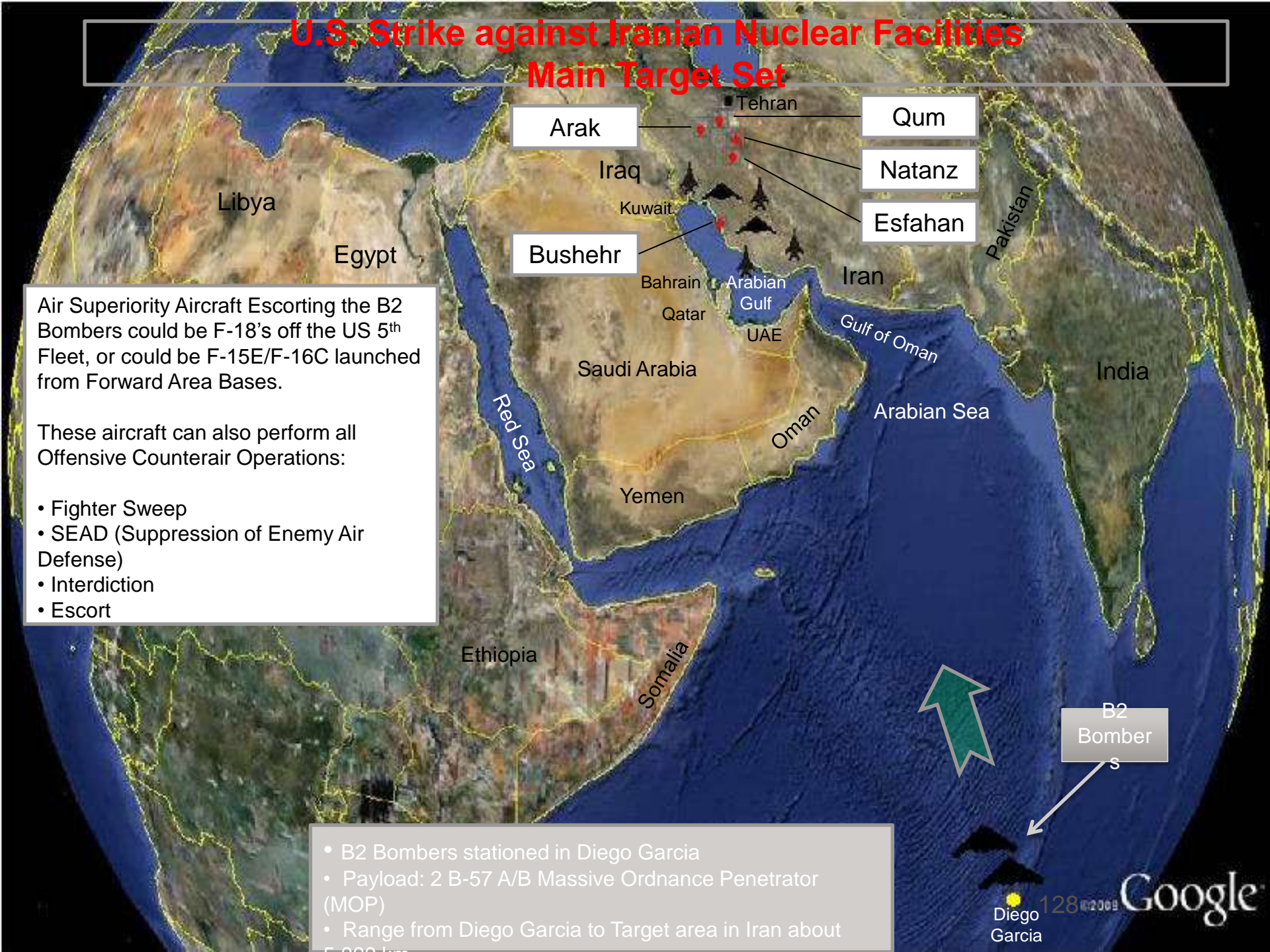
Main Target Set

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



B2 Bombers

Diego Garcia

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.

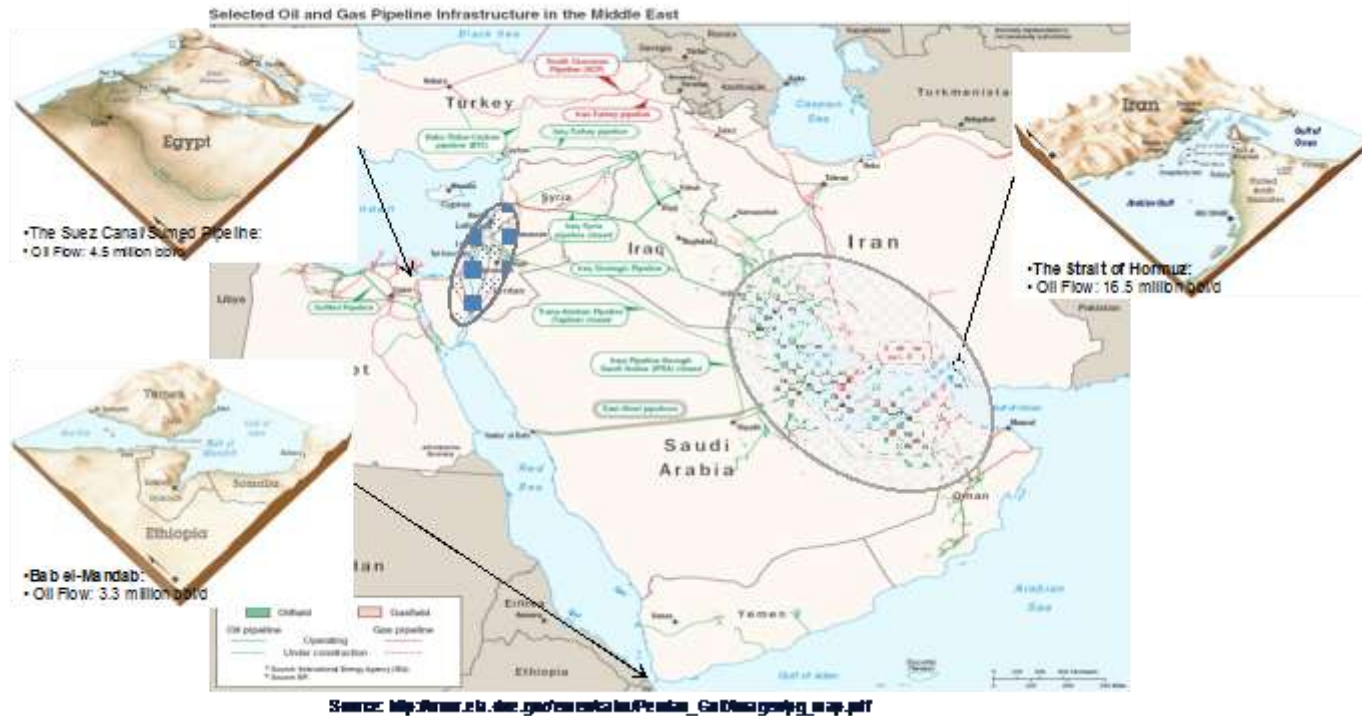


(Source: Anthony Cordesman. Israeli Weapons of Mass Destruction” CSIS June 2, 2008)

Post-Strike on Iran/ Parallel Iranian Options

- **IR-2, IR-3, IR-3 “cooled,” IR-4**
- **Folded centrifuge**
- **Concealed heavy water reactor**
- **LWR cannibalization**
- **LWR download**
- **Dirty weapons**
- **Basic biological**
- **Genetic engineered weapons**

Possible Iranian Responses



- **Withdraw from the NPT and Increase it's long term resolve to develop a nuclear deterrent program.**
- **Immediate retaliation using its ballistic missiles on Israel. Multiple launches of Shahab-3 including the possibility of CBR**
- **warheads against Tel Aviv, Israeli military and civilian centers, and Israeli suspected nuclear weapons sites.**
- **Use proxy groups such as Hezbollah or Hamas to attack Israel proper with suicide bombings, covert CBR attacks, and**
- **rocket attacks from southern Lebanon.**
- **Launch asymmetric attacks against American interests and allies in the Arabian Gulf.**
- **Target U.S. and Western shipping in the Gulf, and possibly attempt to interrupt the flow of oil through the Strait of Hormuz.**

Dealing with Nuclear Uncertainty

- **Decide proper mix of four basic military options:**
 - **Prevention/preemption,**
 - **Active and passive defense,**
 - **Acquiring own nuclear weapons, and/or**
 - **US extended deterrence.**
- **Can wait for diplomacy for time being, but need to start considering future options.**
 - **Ballistic and cruise missile defenses maybe cost-effective simply to deal with conventional threat.**
 - **A number of systems offer both improved air and missile defense.**
 - **Need quiet talks with US on containment options; extended deterrence.**
 - **Open support for IAEA and diplomatic options key passive approach.**

*The Potential Nuclear/
Missile Arms Race*

Guesstimates of Israel's Nuclear Forces

- **Israel almost certainly has a significant, if undeclared, inventory of nuclear weapons.**
- **Reports were manufactured at the Negev Nuclear Research Center, outside the town of Dimona.**
- **Based on estimates of the plutonium production capacity of the Dimona reactor, Israel has approximately 100-200 advanced nuclear explosive devices but such estimates are based on nominal production figures and very uncertain estimates of the material required for a given number of nuclear weapons. They do not address yield, design, or the mix of fission, boosted, and thermonuclear weapons,**
- **Global Security estimates that the total could be as high as 375 to 500 weapons. No reliable unclassified data on Israel mix of nuclear weapons, but Israel did obtain substantial amounts of nuclear weapons design and test data from France before 1968, and probably has a stock of both tactical and thermonuclear weapons.**

Guesstimates of Israel's Missile Forces

Virtually any Israeli fighter could be equipped with nuclear bombs or stand off weapons, but its F-15s and F-16s seem the most likely delivery platforms.

No reliable unclassified reports on Israel's ballistic missile holdings, but **unclassified sources speculate Israel has the following capabilities:**

Jericho I: Range of 500 km (310 mi) and a nominal CEP of 1,000 m (3,300 ft), with a payload of 400 kilograms (880 lb). It seems to be close or identical to the Dassault MD-620, which was test fired in 1965. IAI produced such missiles at its Beit Zachariah facility. It also reports that that around 100 missiles of this type were produced, although there were some problems with its guidance systems. It also reports that The Jericho I is now considered obsolete and was taken out of service during the 1990s.

Jericho II: Solid fuel, two-stage medium-range ballistic missile system tested in launches into the Mediterranean from 1987 to 1992. Reports that the longest was around 1,300 km, and fired from the facility at Palmachim, south of Tel Aviv. Jane's reports that a test launch of 1,400 km is believed to have taken place from South Africa's Overberg Test Range in June 1989, but other sources indicate that this was part of a series of launches of a system using a larger booster. reports that it has a 1,000 kg payload, capable of carrying a considerable amount of high explosives or a 1 MT yield nuclear warhead. It uses a two-stage solid propellant engine with a separating warhead. It also reports that the missile can be launched from a silo, a railroad flat truck, or a mobile vehicle. This gives it the ability to be hidden, moved quickly, or kept in a hardened silo, ensuring survival against any attack.

Jericho III: Estimates differ sharply. It may have entered service in the late 1990s, but some put it in the late 2006-2008 period. It is reported to be a three-stage solid propellant and a payload of 1,000 to 1,300 kg. Wikipedia reports it may have a single 750 kg nuclear warhead or two or three low yield MIRV warheads; an estimated launch weight of 30,000 kg and a length of 15.5 m with a width of 1.56 m. Some reports indicate that Jericho III has a radar guided, terminal homing warhead in addition to inertial guidance, and silo-based with road and rail mobility. No reliable estimate of its range exists. It may have maximum range of about 7,800 km with a smaller 500 kg payload. This could hit any target in the Middle East and targets as far away as Pakistan and Russia,

Israel's Hypothetical Forces in 2020

- **200-400 boosted and fusion weapons.**
 - **Most 20-100 Kt variable yield, some 1 Megaton.**
- **100 Jericho 1 and 2.**
- **30-100 Jericho 3/ER.**
- **JSF, F15I, F-16I with nuclear-armed cruise missiles, advanced conventional precision strike capability.**
- **3 Dolphin submarines with nuclear armed SLCMs.**
- **High resolution satellite targeting and damage assessment capability.**
- **Moderate ballistic missile point and area defense capability with Arrow IV/V and Patriot PAC-3 TMD.**
- **CW? Assume Yes. BW? Assume No.**
- **Meaningful civil defense? CW only.**

Iran's Hypothetical Forces in 2020

- **Less than 50 nuclear weapons, most fission, possibly some boosted. 30 Nuclear warheads, 20 bombs.**
 - **Most 20-30 Kt, some 100 KT**
- **100 Shahab 3 and 3 ER on mobile TELs. 60 TELs.**
- **Su-24, F-14 convert, and Su-37 strike aircraft.**
- **Reverse engineered KH-55 cruise missiles.**
- **Mustard and persistent nerve gas, stable bombs, bombs and warheads with cluster munitions.**
- **Limited satellite targeting and damage assessment capability.**
- **Limited ballistic missile point defense capability with SA-300/SA-400**
- **Meaningful civil defense? No.**

*Mutual Assured Destruction?
The Deterrent Impact of an Israeli-
Iranian Nuclear Exchange*

Iran's Hypothetical Forces

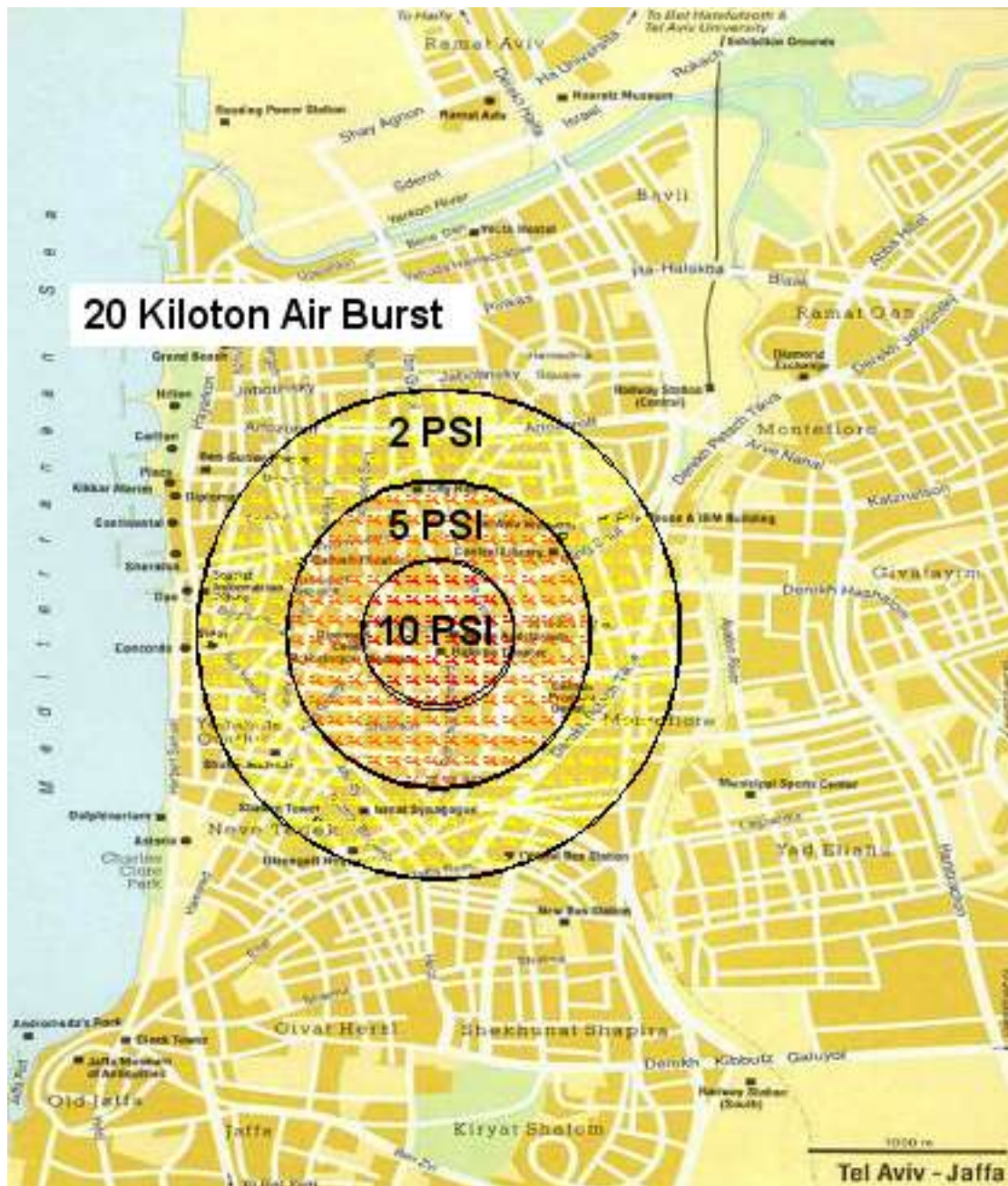
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- **Meaningful civil defense? No.**

Israel's Hypothetical Forces

- **200+ boosted and fusion weapons.**
 - **Most 20-100 Kt variable yield, some 1 Megaton.**
- **100 Jericho 1 and 2.**
- **30 Jericho ER.**
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- **3 Dolphin submarines with nuclear armed SLCMs.**
- **High resolution satellite targeting and damage assessment capability.**
- **Moderate ballistic missile point and area defense capability with Arrow IV/V and Patriot PAC-3 TMD.**
- **CW? Assume Yes. BW? Assume No.**
- **Meaningful civil defense? CW only.**

Israel:

**Blast
coverage
of 20KT
Iranian
Nuclear
Weapon**

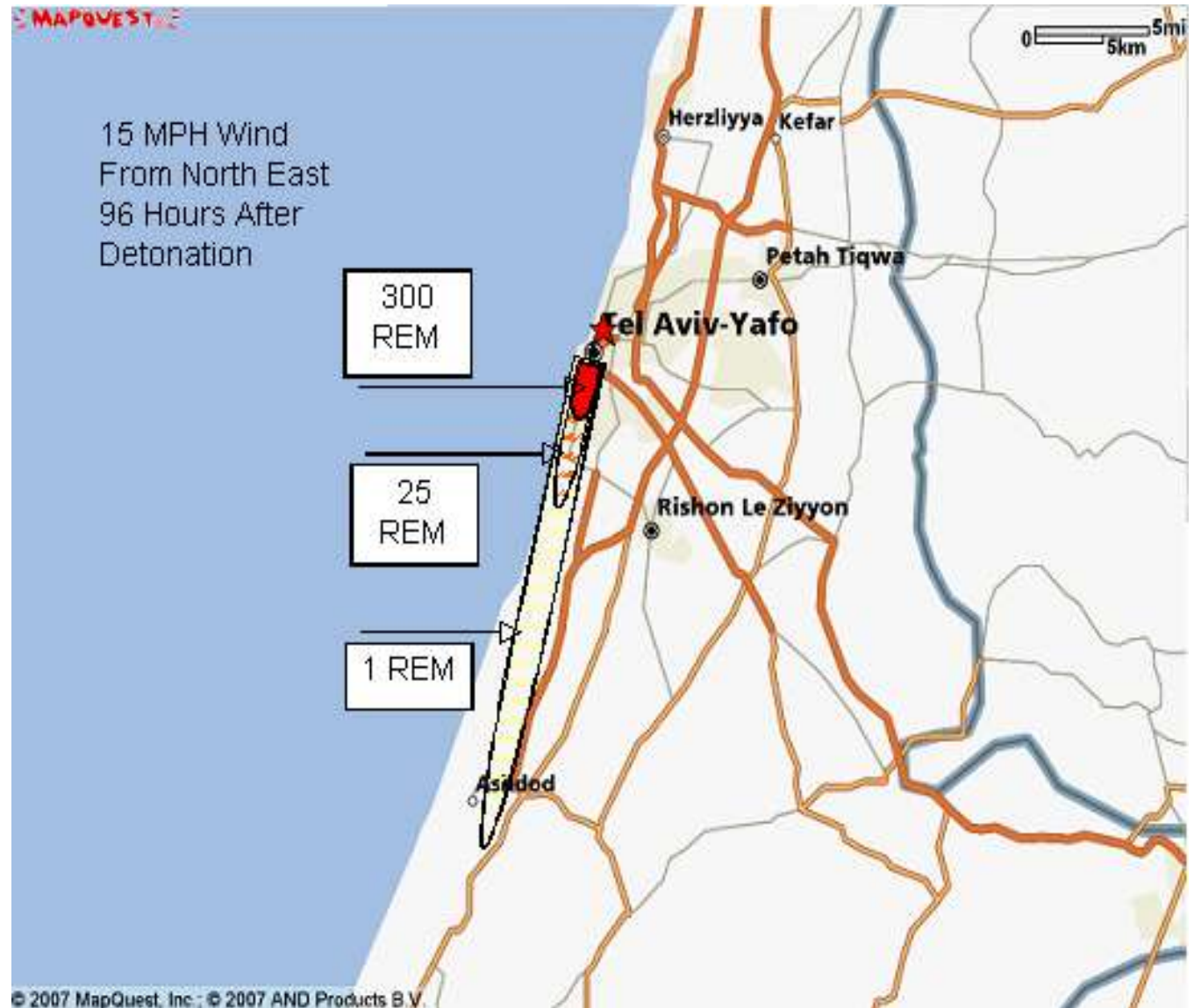


Fall Out

- **The closer to ground a bomb is detonated, the more dust and debris is thrown into the air, and the more local fallout.**
- **Impact with the ground severely limits the blast and radiation from a bomb. Ground bursts are not usually considered tactically advantageous, with the exception of hardened underground targets such as missile silos or command centers.**
- **Population kills can be different. For a 1 MT explosion, lethal ellipses can reach 40-80 miles against unsheltered populations after 18 hours**
- **For a 1 MT explosion, lethal ellipses will reach 40-80 miles against unsheltered populations after 18 hours. Area of extreme lethality (3000 rads) can easily reach 20+ miles.**
- **A dose of 5.3 Gy (Grays) to 8.3 Gy is considered lethal but not immediately incapacitating. Personnel will have their performance degraded within 2 to 3 hours, and will remain in this disabled state at least 2 days. However, at that point they will experience a recovery period and be effective at performing non-demanding tasks for about 6 days, after which they will relapse for about 4 weeks. At this time they will begin exhibiting symptoms of radiation poisoning of sufficient severity to render them totally ineffective. Death follows at approximately 6 weeks after exposure.**
- **Delayed effects may appear months to years following exposure. Most effects involve tissues or organs. Include life shortening, carcinogenesis, cataract formation, chronic radiodermatitis, decreased fertility, and genetic mutations.**

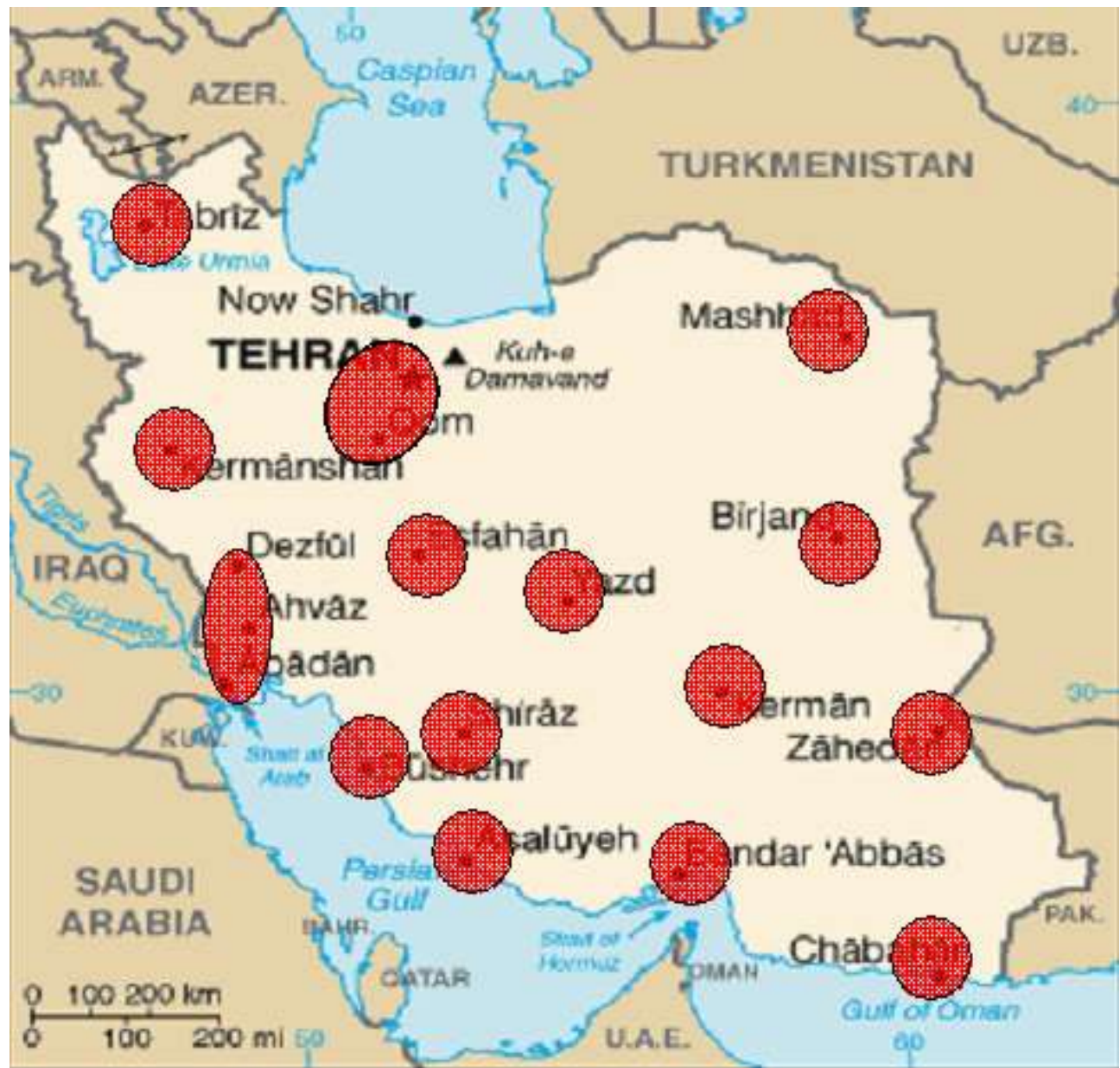
Israel:

Nominal Worst Case 20KT Fall Out Coverage

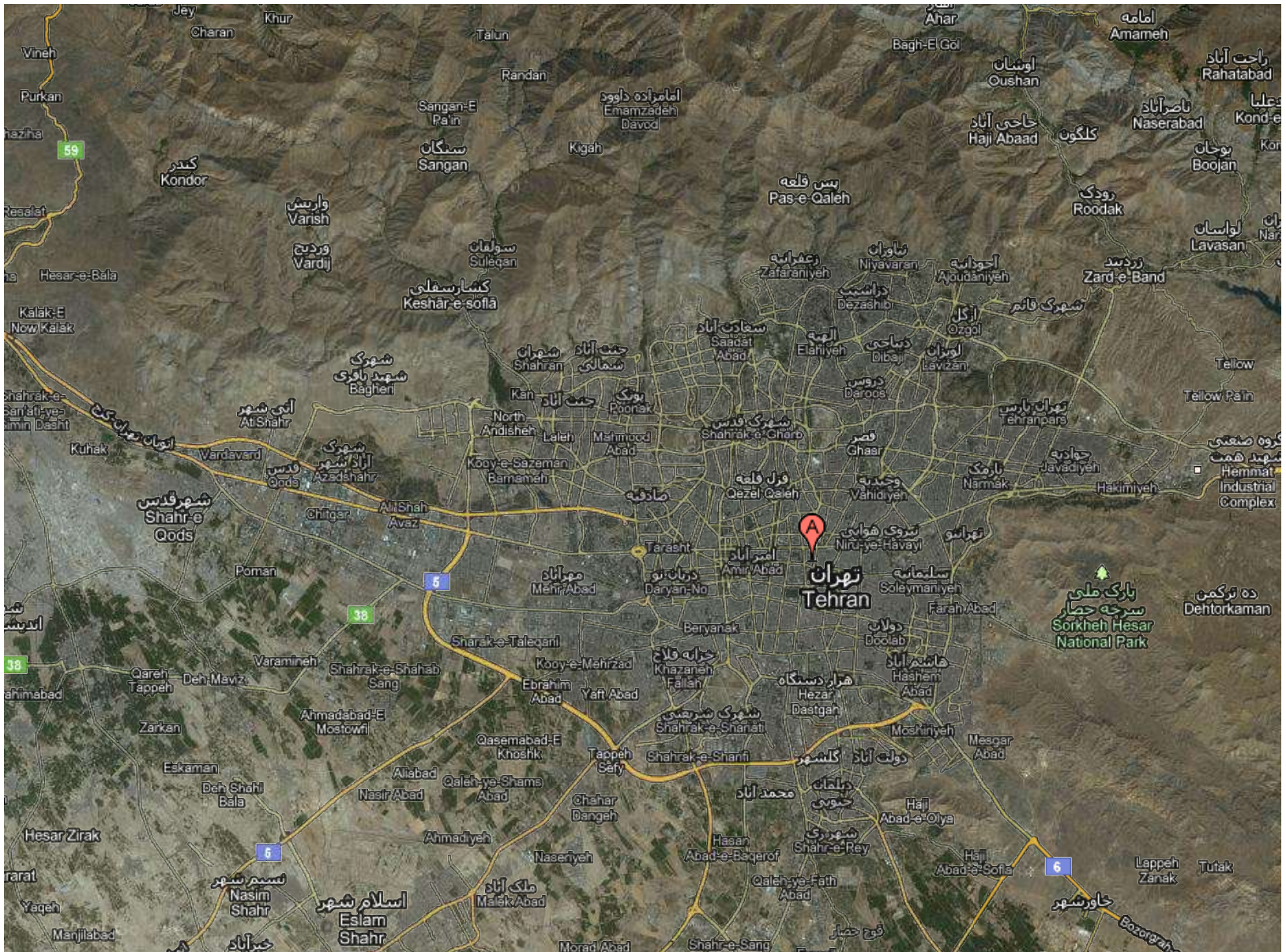


Iran:

High Value Population Centers



Downtown Tehran: 7.7 of 76.9 million

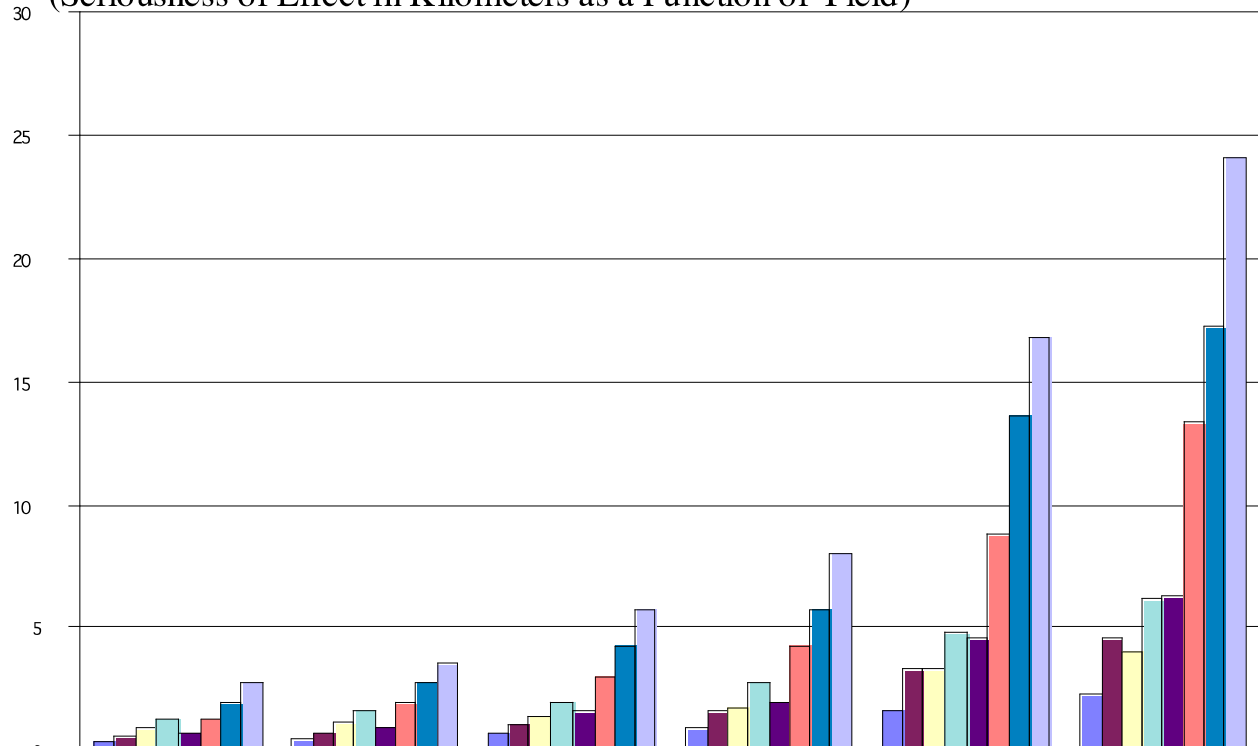


Tehran

- **Iran: Total of 68.7 million.**
 - **Ethnicity:** Persian 51%, Azeri 24%, Gilaki and Mazandarani 8%, Kurd 7%, Arab 3%, Lur 2%, Baloch 2%, Turkmen 2%, other 1%
 - **Religions:** Muslim 98% (Shi'a 89%, Sunni 9%), other (includes Zoroastrian, Jewish, Christian, and Baha'i) 2%
- **Tehran: Topographic basin with mountain reflector. Nearly ideal nuclear killing ground.**
 - Land area of 658 square kilometers (254 sq mi)
 - Approximately 7.6 million people in city.
 - 12.6 million in municipal area and greater metropolitan area, and 15 million in municipal area. **Some 20% of Iran's population.**
 - Tehran is a sprawling city at the foot of the Alborz mountain range with an immense network of highways unparalleled in western Asia.
 - Hub of the country's railway network. The city has numerous cultural centers
 - About 30% of Iran's public-sector workforce and 45% of large industrial firms are located in Tehran. More than half of Iran's industry is based in Tehran..
 - Tehran is the biggest and most important educational center of Iran. Nearly 50 major colleges and universities in Greater Tehran.
 - Majority of residents are Persians who speak many different dialects of Persian corresponding to their hometown. (including Esfahani, Shirazi, Yazdi, Khuzestani, Semnani, Taleghani, Dari, Judeo-Persian, etc) The second largest linguistic group is that of the Azari.

Why Yield Matters

(Seriousness of Effect in Kilometers as a Function of Yield)

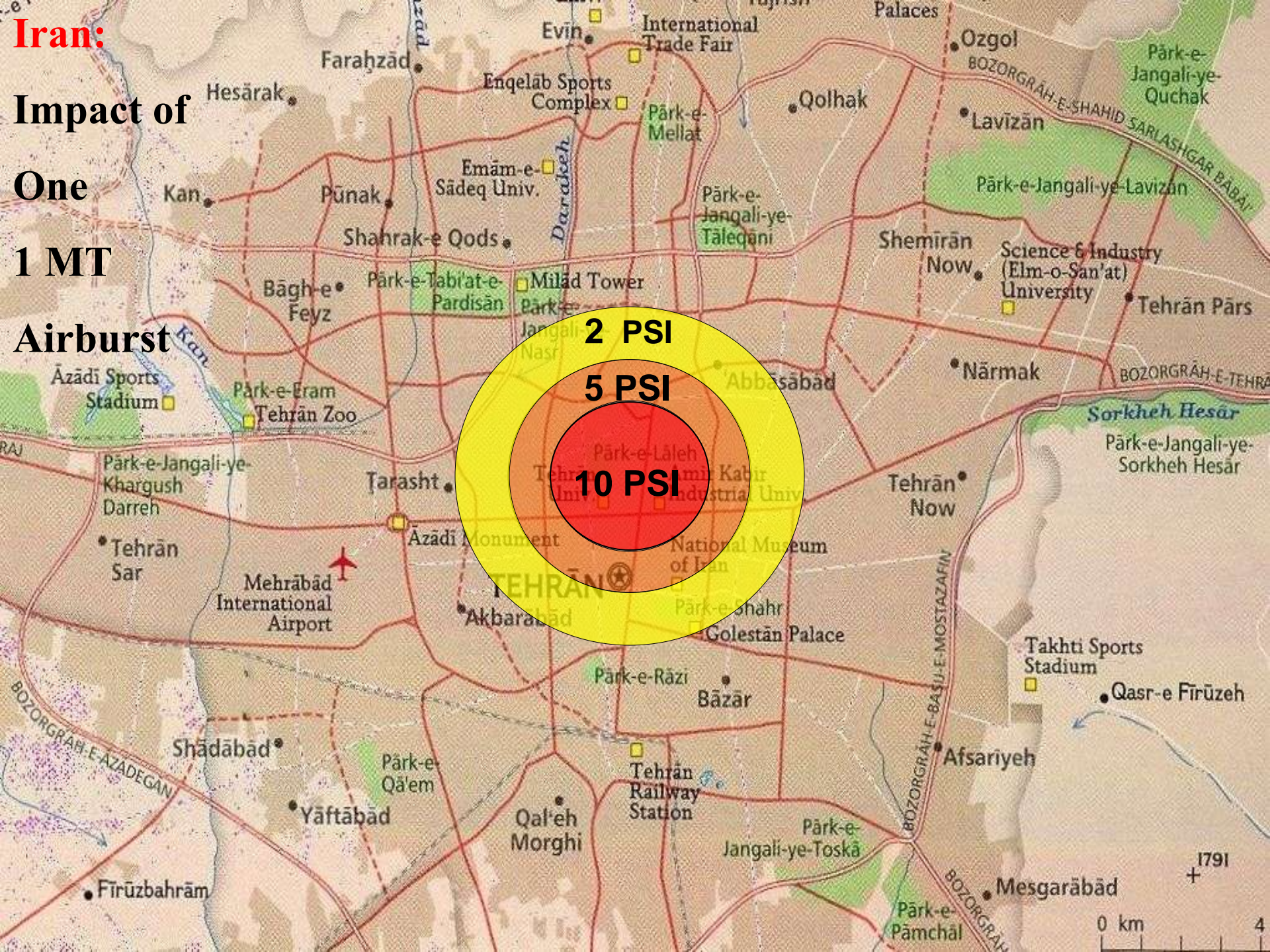
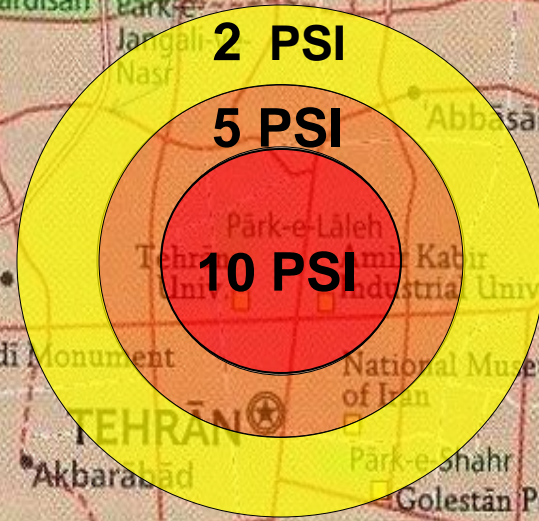


	10KT	20 KT	50 KT	100 KT	500 KT	1 MT
Fireball	0.352	0.464	0.67	0.884	1.6	2.2
Metals Vaporize	0.477	0.675	1	1.5	3.2	4.5
10-Psi	0.875	1.1	1.4	1.7	3.2	4
5-Psi	1.3	1.6	2	2.7	4.8	6.1
Metals Melt	0.675	0.954	1.5	2	4.5	6.2
Plastics Melt/Ignite	1.3	1.9	3	4.3	8.8	13.3
Woodchairs/Burns	1.9	2.7	4.3	5.7	13.6	17.2
3rd Degree Burns	2.7	3.5	5.7	8	16.8	24.1

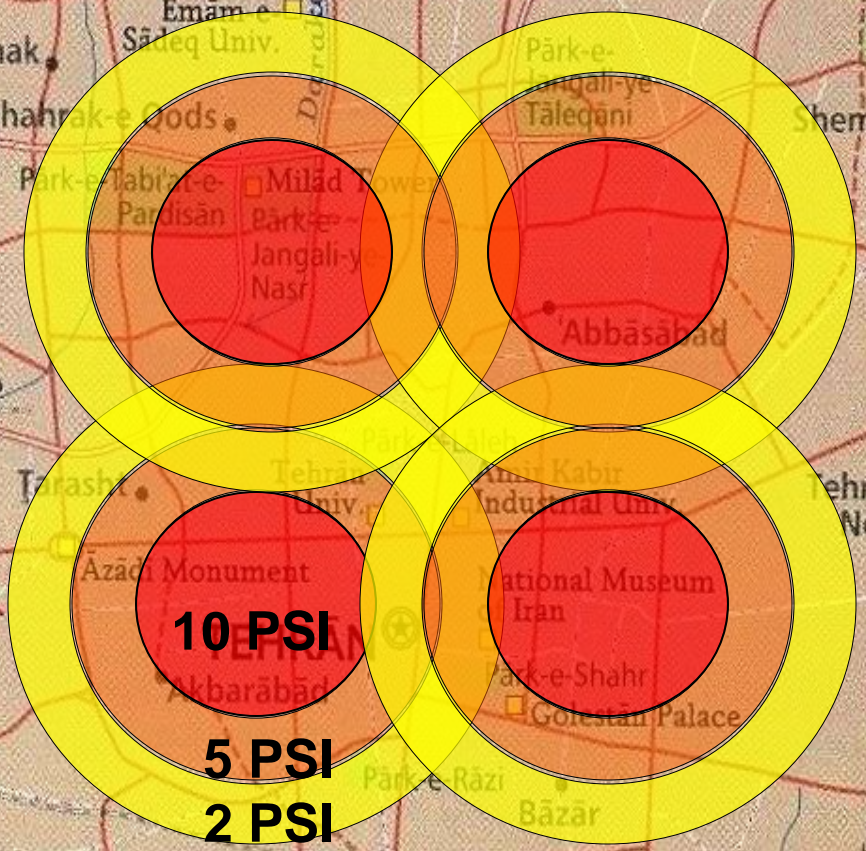
Source: Adapted by Anthony H. Cordesman from the Royal United Services Institute, Civil Defense, London, RUSI/Brassey's, 1982, pp. 30 -36

Nuclear Attack:

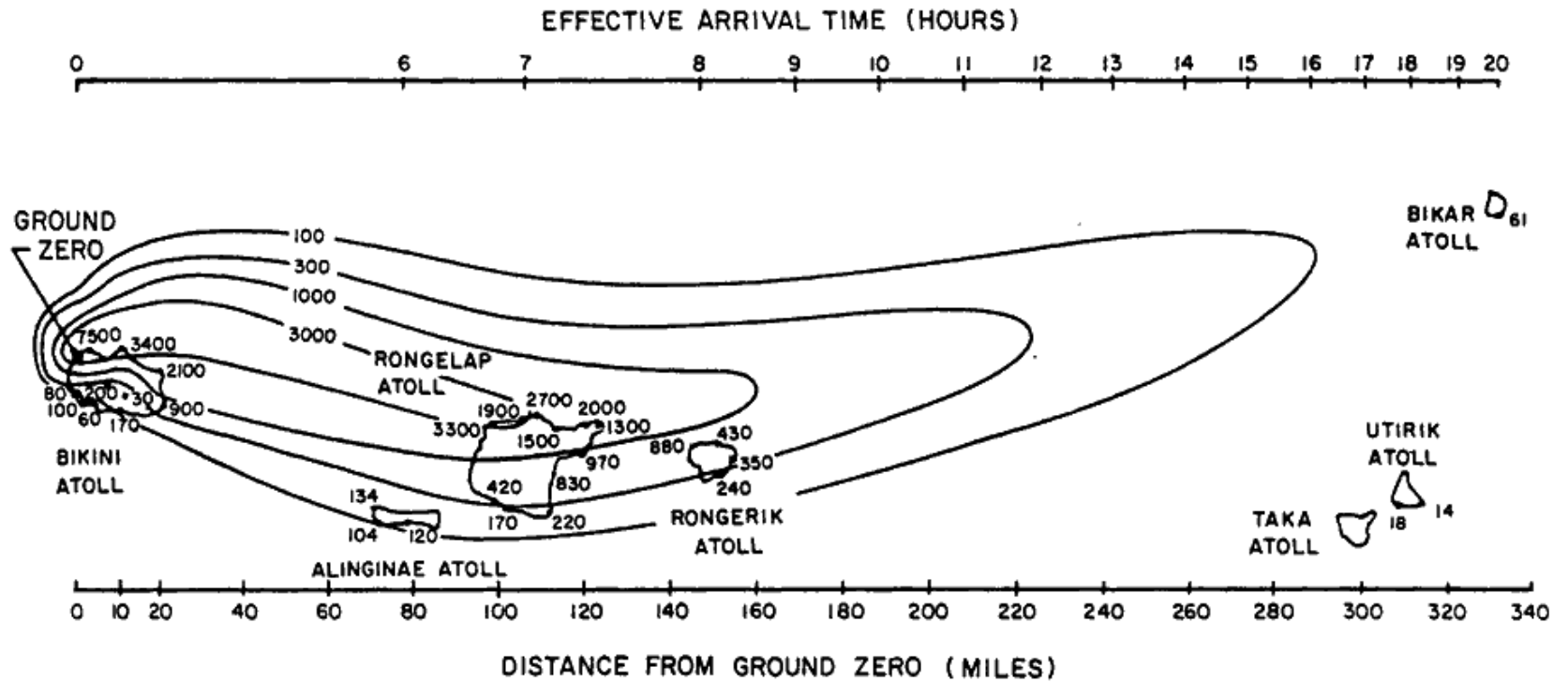
Iran:
Impact of
One
1 MT
Airburst



Iran:
Impact of
Four
1 MT
Airbursts



Tehran: The Fallout Problem



Source: http://en.wikipedia.org/wiki/Nuclear_fallout

*Looking Towards the Future: US
Extended Deterrence and “Weapons
of Mass Effectiveness”*

Iran Nuclear, US Conventional

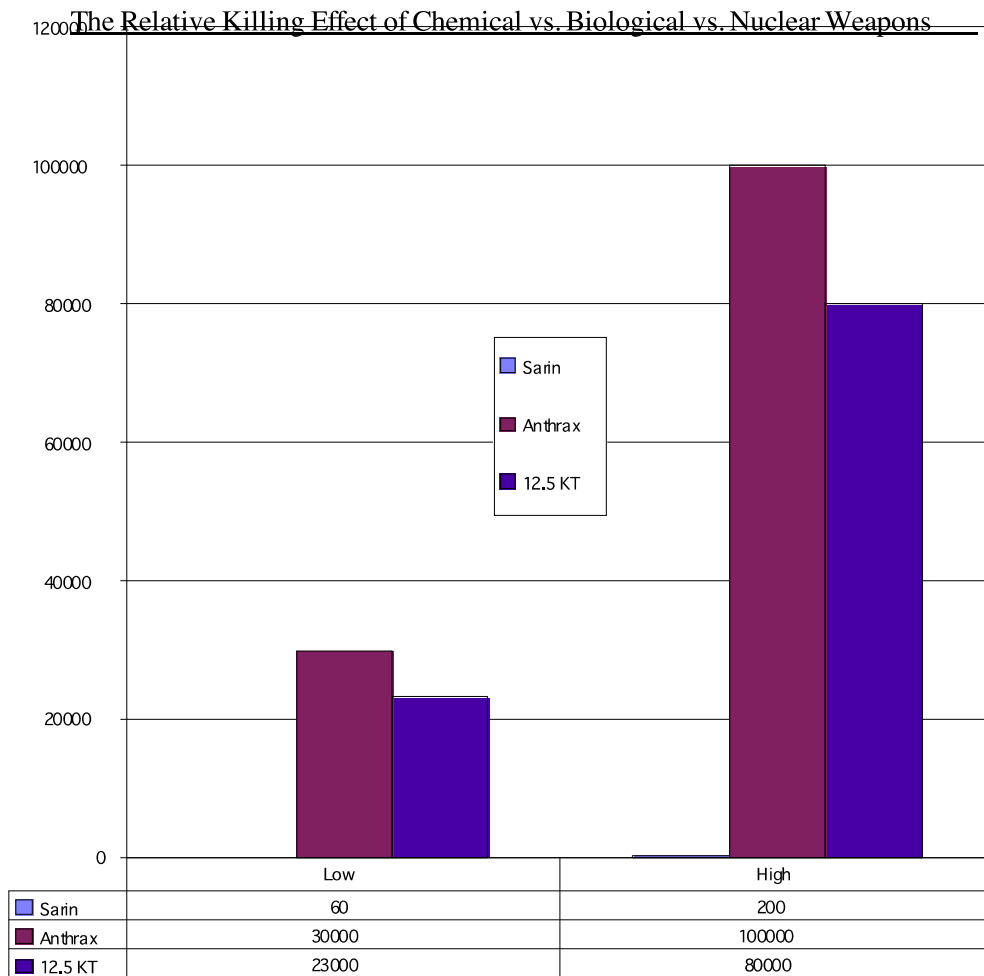
- Assume mature, dispersed Iranian force. Preemption limited option for US, but face launch on warning, launch under attack option.
- Iran cannot threaten US. Can threaten US bases in Gulf, Israel, Europe, GCC allies, Egypt, Jordan, oil export capabilities.
- SAD-like environment relying on proxy targets for maximum damage to US.
- Iranian side:
 - Limited strike designed to intimidate or show resolve, force issue without generating massive nuclear retaliation. Might focus on Arab target, rather than US or Israel, to try to limit retaliation.
 - *Reserve strike capability critical.*
 - *Lower fission yields, less accurate force* limit range of targeting, but can cover all US bases and mix of other targets.
 - Target to maximize casualties, clear attention to fall out, lasting effects.
 - Inflict 2,000,000 to 8,000,000 prompt to 21-day dead; long term death rate cannot be calculated.
 - Iranian recovery very possible.
- US side:
 - Some preemptive damage limitation possible.
 - Launch on confirmed warning from US satellites.
 - Massive reserve conventional and nuclear strike capability.
 - Stealth and precision strike capability give weapons of mass effectiveness (WME) capability.
 - Power, refineries, continuity of government, C4I assets.
 - EMP option would be “semi-nuclear” response.

WME: “Weapons of Mass Effectiveness”

- **Theoretical possibility, give precision long-range strike capability.**
- **Target mix varies with attacker’s motives.**
- **Broad possible target base in MENA area, varying sharply by country.**
 - **Desalination**
 - **Major power plants, nuclear power plants.**
 - **Water purification and distribution.**
 - **Refinery**
 - **High value, long-lead time oil, gas, and petrochemical facilities.**
 - **Ethnic and sectarian high value targets.**
 - **Leadership elite: Royal family, president, etc.**

Chemical & Biological Options

CBRN Prompt (48-hour) Killing Effect in an Urban Environment



Source: Adapted by Anthony H. Cordesman from Victor A. Utgoff, *The Challenge of Chemical Weapons*, New York, St. Martin's, 1991, pp. 238-242 and Office of Technology Assessment, *Proliferation of Weapons of Mass Destruction: Assessing the Risks*, U.S. Congress OTA-ISC-559, Washington, August, 1993, pp. 56-57.

Q₅₀ for Some Types of BW - Open-Air Deployment

- **Plague (liquid): 3.5-4.5 liter/sq.km**
- **Tularemia (dry): 3.0-4.0 kg/sq.km**
- **Anthrax (dry, old version): 15-20 kg/sq.km**
- **Anthrax (dry, new version): 4.5-5.0 kg/sq.km**
- **Anthrax (liquid): 5.0-5.5 liter/sq.km**
- **Brucellosis (dry): 3.5-4.5 kg/sq.km**
- **Glanders/Melioidosis (liquid): 4.5-5.5 liter/sq.km**
- **Smallpox (liquid): 3.5-4.0 liter/sq.km**
- **Marburg (dry): less than 1.0 kg/sq.km**

New Types of Biological Weapons

- *Binary biological weapons* that use two safe to handle elements that can be assembled before use. This could be a virus and helper virus like Hepatitis D or a bacterial virulence plasmid like E. coli, plague, Anthrax, and dysentery.
- *Designer genes and life forms*, which could include synthetic genes and gene networks, synthetic viruses, and synthetic organisms. These weapons include DNA shuffling, synthetic forms of the flu – which killed more people in 1918 than died in all of World War I and which still kills about 30,000 Americans a year – and synthetic microorganisms.
- *"Gene therapy" weapons* that use transforming viruses or similar DNA vectors carrying Trojan horse genes (retrovirus, adenovirus, poxvirus, HSV-1). Such weapons can produce single individual (somatic cell) or inheritable (germline) changes. It can also remove immunities and wound healing capabilities.
- *Stealth viruses* can be transforming or conditionally inducible. They exploit the fact that humans normally carry a substantial viral load, and examples are the herpes virus, cytomegalovirus, Epstein-Barr, and SV40 contamination which are normally dormant or limited in infect but can be transformed into far more lethal diseases. They can be introduced over years and then used to blackmail a population.
- *Host-swapping diseases*: Viral parasites normally have narrow host ranges and develop an evolutionary equilibrium with their hosts. Disruption of this equilibrium normally produces no results, but it can be extremely lethal. Natural examples include AIDS, Hantavirus, Marburg, and Ebola. Tailoring the disruption for attack purposes can produce weapons that are extremely lethal and for which there is no treatment. A tailored disease like AIDS could combine serious initial lethality with crippling long-term effects lasting decades.
- *Designer diseases* involve using molecular biology to create the disease first and then constructing a pathogen to produce it. It could eliminate immunity, target normally dormant genes, or instruct cells to commit suicide. Apoptosis is programmed cell death, and specific apoptosis can be used to kill any mix of cells.

Soviet RBK-type Cluster Bomb for CBR Weapons



Non-State Actor CBR(N?)

- **Independent, Proxy, False Flag, or Trigger Force?**
- **Access likely to be more critical in determining capability than ability to create own weapons, but highly lethal BW and genetic weapons may be becoming “off the shelf” option.**
- **Many of same twists as covert State Actor attacks:**
 - **Bypasses defenses.**
 - **Plausible deniability?**
 - **Exploits special vulnerability of “one bomb” states.**
 - **Psychological and political impacts as important as direct killing effects.**
 - **False flag and proxy options clear.**
 - **Buying time may limit risk of retaliation.**
 - **Allows to exploit “slow kill” nature of biological strikes. Achieve “line source” effects**
 - **Covert forces in place can restrike or escalate.**
- **Unclear Non-State Actors are deterrable by any form of retaliation.**

State Actor Covert Bioterrorism, Suitcase Nuclear

- **Bypasses defenses.**
- **Plausible deniability?**
- **Exploits special vulnerability of “one bomb” states.**
- **Psychological and political impacts as important as direct killing effects.**
- **False flag and proxy options clear.**
- **Buying time may limit risk of retaliation.**
- **Allows to exploit “slow kill” nature of biological strikes. Achieve “line source” effects**
- **Covert forces in place can restrike or escalate.**
- **Target potentially faces major weakening of conventional capabilities without ability to counter-escalate.**

Possible Terrorist/Covert/Irregular Deployment of Biological Weapons

- **Use of infected vectors (mosquitoes, fleas, lice, etc.)**
- **Contamination of food and water supplies**
- **Contamination of various articles (letters, books, surfaces, etc.)**
- **Use of different aerosolizing devices and approaches to contaminate inner spaces of various buildings (line and point sources)**
- **Use of different aerosolizing devices and approaches for open-air dissemination (line and point sources)**
- **Inner- and outer-space explosive dissemination including suicide bombers**
- **Terrorist/Sabotage methods of infecting crops and livestock**