Iran’s Strategic Competition with the US and Arab States – Conventional, Asymmetric, and Missile Capabilities

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July 28, 2011
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

DOE-IEA, Annual Energy Outlook 2010, p. 77
EIA Projections of Gulf/ME Liquids Production By Country, 1990-2035 (Millions of Barrels Per Day)

<table>
<thead>
<tr>
<th>Year</th>
<th>Gulf</th>
<th>MENA</th>
<th>Other</th>
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<tbody>
<tr>
<td>1990</td>
<td>0.9</td>
<td>0.3</td>
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<tr>
<td>2008</td>
<td>0.9</td>
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<td>2015</td>
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<tr>
<td>2020</td>
<td>1.4</td>
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<td>0.2</td>
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<tr>
<td>2025</td>
<td>1.4</td>
<td>0.3</td>
<td>0.2</td>
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<td>2030</td>
<td>1.4</td>
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<td>2035</td>
<td>1.4</td>
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<td>0.2</td>
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Global Dependence on Gulf oil is steadily rising

EIA, IEO 2010, p. 2
Israeli Existential Concerns
Israel: Blast coverage of 20KT Iranian Nuclear Weapon
Israel:

Nominal Worst Case 20KT Fall Out Coverage

15 MPH Wind From North East 96 Hours After Detonation
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 must 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.
  - Two new combat speed boats in production: the Seraj-1 and the Zolfaqar. Both are capable of launching missiles and torpedoes.
  - New indigenous armed reconnaissance craft: Bavar-2 flying boat. Equipped with night vision, machine guns, rockets, and missiles

- 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.

- Iran could potentially acquire the supersonic Russian P-800 Yakhont anti-ship missile from Syria. 200kg warhead, 300km range.
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.
• Instability in Yemen, the Horn, and Red Sea area.
• Increased Iranian efforts to aid and supply Afghan insurgents.
Iran, Iraq, and the Uncertain Power Vacuum to the Northwest

• Loss of Iraq as Counterbalance to Iran; cannot be corrected before 2007-2010.


• “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. 2011

Main Battle Tanks

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<tr>
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<th>Iran</th>
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<tr>
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<td>1565</td>
<td>2200</td>
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Combat Aircraft

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<td>2003</td>
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<td>2011</td>
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8:1

336:0

## Details of Iraq’s Loss of Deterrent and Defense Capability: 2003-2011

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<td>Active Manpower</td>
<td>424,000</td>
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<td>OAFVs</td>
<td>1,300</td>
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<td>Reconnaissance</td>
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<td>MRLs</td>
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Vulnerability of Gulf Oil Fields

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.

Ras Tanura

Source: Google maps
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. The P-800 Yakhont has a 300km range.
- Smart mines, guided/smart torpedoes,
- Floating mines, small boat raids, harassment.
- Covert as well as overt sensors.

Source: http://www.lib.utexas.edu/maps/middle_east_and_asia/hormuz_80.jpg
The Entire Gulf: Breaking the Bottle at Any Point

Source: EIA, Country Briefs, World Oil Transit Chokepoints, January 2008
Severely Limited Alternative Routes
Iran’s Petroleum Infrastructure

### Iran Crude Refining Capacity
**January 1, 2010**

<table>
<thead>
<tr>
<th>Refinery</th>
<th>1000 bbl/day</th>
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<td>Abadan</td>
<td>350</td>
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<tr>
<td>Isfahan</td>
<td>280</td>
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<tr>
<td>Bandar Abbas</td>
<td>230</td>
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<tr>
<td>Tehran</td>
<td>220</td>
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<tr>
<td>Arak</td>
<td>170</td>
</tr>
<tr>
<td>Tabriz</td>
<td>100</td>
</tr>
<tr>
<td>Shiraz</td>
<td>40</td>
</tr>
<tr>
<td>Kermanshah</td>
<td>30</td>
</tr>
<tr>
<td>Lavan Island</td>
<td>30</td>
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<tr>
<td><strong>Total Existing</strong></td>
<td><strong>1,450</strong></td>
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</tbody>
</table>

**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**
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

Source: Google maps
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 tilt towards Iraq
- 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?).
  - Increased satellite launches
- Naval guards seizure of British boat, confrontation with US Navy, exercises in Gulf.
- Development of limited “close the Gulf” capability.
- Flow of illegals and smuggling across Yemeni border.
- Material support and training for Hamas and Hezbollah, among other proxies.
- Attempts to exploit regional instability in the wake of the unrest currently sweeping the Arab world.
Comparative Main Battle Tank Inventory, Regardless of Age or Quality

<table>
<thead>
<tr>
<th>Country</th>
<th>Main Battle Tanks</th>
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<tbody>
<tr>
<td>Qatar</td>
<td>30</td>
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<tr>
<td>Oman</td>
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<tr>
<td>Bahrain</td>
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<td>Iraq</td>
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<td>Kuwait</td>
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<tr>
<td>UAE</td>
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<tr>
<td>Saudi</td>
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<tr>
<td>Yemen</td>
<td>790</td>
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<tr>
<td>Iran</td>
<td>1613</td>
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</table>

Derived from IISS, Military Balance, various editions and Jane’s
Comparative Modern Tank Strength, 2011

Gulf Air Balance

Air Bases and Air Force Order of Battle (2009)

<table>
<thead>
<tr>
<th>Country</th>
<th>Combat A/C</th>
<th>Attack Helos</th>
</tr>
</thead>
<tbody>
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<td>Iran</td>
<td>319</td>
<td>95</td>
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<td>Iraq</td>
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<td>37</td>
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<td>Kuwait</td>
<td>50</td>
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<tr>
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<td>Qatar</td>
<td>18</td>
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<tr>
<td>UAE</td>
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<tr>
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<td>Saudi Arabia</td>
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<td>67</td>
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<tr>
<td>Yemen</td>
<td>179</td>
<td>18</td>
</tr>
</tbody>
</table>

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 2011

40% to 60% of Iranian inventory is not operational

Derived from IISS, Military Balance 2011, and Jane’s
### Comparative High Quality Fighter/Attack Aircraft in 2011

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

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### Chart Details

- Typhoon-2: 16
- Tornado ADV: 15
- Tornado IDS: 75
- Mirage 2000: 12
- MiG-29: 35
- MiG-25: 18
- Su-25: 13
- Su-24: 30
- Su-20/22: 30
- F-18: 31
- F-16: 21
- F-15C/D: 84
- F-15S: 70
- F-14: 44
- F-4D/E: 65
- Saegheh: 3
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
<table>
<thead>
<tr>
<th>Country</th>
<th>Major SAM</th>
<th>Light SAM</th>
<th>AA Guns</th>
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<tr>
<td>Bahrain</td>
<td>8 I Hawk MIM-23B</td>
<td>60&lt;br&gt;RB S-70&lt;br&gt;18 FIM-92A Stinger&lt;br&gt;7 Crotale</td>
<td>15&lt;br&gt;27 guns&lt;br&gt;Oerlikon 35mm&lt;br&gt;12 L/70 40 mm</td>
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<tr>
<td>Iran</td>
<td>16/150 I Hawk&lt;br&gt;3/10 SA-5&lt;br&gt;45 SA-2 Guideline</td>
<td>SA-7/14/16, HQ-7&lt;br&gt;29 SA-15&lt;br&gt;Some QW-1 Misaq&lt;br&gt;29 TQR-M1&lt;br&gt;Some HN-5&lt;br&gt;5/30 Rapier&lt;br&gt;10 Pantsyr (SA-22)&lt;br&gt;Some FM-80 (Ch Crotale)&lt;br&gt;15 TigerCat&lt;br&gt;Some FIM-92A Stinger</td>
<td>1,700 Guns&lt;br&gt;ZSU-23-4 23mm&lt;br&gt;ZPU-2/4 23 mm&lt;br&gt;ZU-23 23mm&lt;br&gt;M-1939 37mm&lt;br&gt;S-60 57mm&lt;br&gt;ZSU-57-2</td>
</tr>
<tr>
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</tr>
<tr>
<td>Kuwait</td>
<td>5/24 I Hawk Phase III&lt;br&gt;5/40 Patriot PAC-2</td>
<td>12&lt;br&gt;Aspide&lt;br&gt;Starrubust Aspide&lt;br&gt;Stinger</td>
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<td>Blowpipe&lt;br&gt;8 Mistral 2 SP&lt;br&gt;12 Pantsyr S1E&lt;br&gt;34 SA-7&lt;br&gt;6 Blindfire S713 Martello&lt;br&gt;20 Javelin&lt;br&gt;40 Rapier</td>
<td>26 guns&lt;br&gt;4 ZU-23-2 23 mm&lt;br&gt;10 GDF-005 Skyguard 35&lt;br&gt;12 L/60 40 mm</td>
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<td>40 Crotale&lt;br&gt;5 00 Crotale (ARMY)&lt;br&gt;5 00 Mistral (ADF)&lt;br&gt;16/96 PAC-2 launchers&lt;br&gt;17 ANA/FP-117 radar&lt;br&gt;73/69 Crotale/Shahine&lt;br&gt;500&lt;br&gt;5 00 FIM-43 Redeye (ADF)&lt;br&gt;7 3 -141 Shahine static</td>
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<td>Some 800 SA-7&lt;br&gt;Some SA-9 SP&lt;br&gt;Some SA-13 SP&lt;br&gt;Some SA-14</td>
<td>530 guns&lt;br&gt;20 M-163 Vulcan SP 20mm&lt;br&gt;50 ZSU-23-4 SP 23 mm&lt;br&gt;100 ZSU-23-2 23 mm&lt;br&gt;150 M-1939 37 mm&lt;br&gt;50 M-167 20mm&lt;br&gt;120 S-60 57 mm&lt;br&gt;40 M-1939 KS-12 85 mm</td>
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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.

Source: Tehran, Reuters, Reporting by Robin Pomeroy; editing by Mark Heinrich, 11-18-2010
Major Combat Warships in 2011


Note: 8 of Iran's submarines are Swimmer Delivery Vehicles (SDVs) used for SF insertion and mine-laying.
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: 2011

<table>
<thead>
<tr>
<th>Country</th>
<th>Basij</th>
<th>Other</th>
<th>Police</th>
<th>Special Security</th>
<th>Border Guard</th>
<th>Coastguard</th>
<th>Tribal Levies</th>
<th>MOI Forces</th>
<th>Navy</th>
<th>Air Def</th>
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</table>

Note: The number of Iran's Basij paramilitaries is often estimated at approximately 1 million.
### The Broader Patterns in Iranian Activity

<table>
<thead>
<tr>
<th>Iranian Actors</th>
<th>Related States/Non-State Actors</th>
<th>Target/Operating Country</th>
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</thead>
<tbody>
<tr>
<td>Revolutionary Guards</td>
<td>Iran</td>
<td>Iraq</td>
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<td>Al Qaeda force</td>
<td>Syria</td>
<td>Israel</td>
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<tr>
<td>Vevak/other intelligence</td>
<td>Hezbollah</td>
<td>Egypt</td>
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<td>Arms transfers</td>
<td>Hamas</td>
<td>Kuwait</td>
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<tr>
<td>Military and security advisors</td>
<td>Mahdi Army</td>
<td>Bahrain</td>
</tr>
<tr>
<td>Clerics, pilgrims, shrines</td>
<td>Yemeni Shi’ites</td>
<td>Yemen</td>
</tr>
<tr>
<td>Commercial training</td>
<td>Bahraini Shi’ites</td>
<td>Lebanon</td>
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<td>Finance/investment</td>
<td>Saudi Shi’ites</td>
<td>Afghanistan</td>
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<td>Investment/training companies</td>
<td>Afghan insurgents</td>
<td>Venezuela</td>
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<tr>
<td>Education: scholarships, teachers</td>
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<td>Bolivia</td>
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<td>Cultural exchanges</td>
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<td></td>
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<tr>
<td>Athletic visits</td>
<td></td>
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</tr>
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</table>
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.
  • Two new combat speed boats in production: the Seraj-1 and the Zolfaqar. Both are capable of launching missiles and torpedoes.
  • New indigenous armed reconnaissance craft: Bavar-2 flying boat. Equipped with night vision, machine guns, rockets, and missiles

• 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?).

• Iran could potentially acquire the supersonic Russian P-800 Yakhont anti-ship missile from Syria. 200kg warhead, 300km range.

• 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

Source: Google maps
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 to Shia proxies, 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.

Source: various news outlets, CRS reports, Congressional testimony, Intelligence assessments and official statements.
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.

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.
• Program has suffered recent technical setbacks in part due to the Stuxnet worm that infected Iranian nuclear facilities starting in 2010.
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/derived 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?
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
What Range of Scenario(s)?

- Intimidation vs. deterrence?
- 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?
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 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 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.

OODNI, Report to Congress on Acquisition of Technology Relating to Weapons of Mass Destruction and Advanced Conventional Munitions, March 2010
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

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<th>Range (km)</th>
<th>Payload (kg)</th>
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</table>

(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)
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
Impact

- Estimated Casualties would still be low
- Iran must unleashed it’s 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 tone 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
## Iranian Rockets and Missiles

<table>
<thead>
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<th>Missile</th>
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<th>Fuel Type</th>
<th>Estimated Range</th>
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<td>Fateh-110</td>
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<td>Ghadr-1</td>
<td>Powerful-1</td>
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<td>1600km</td>
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<td>Liquid</td>
<td>300km</td>
<td>1000kg</td>
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<td>Meteor-2</td>
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<td>500km</td>
<td>730kg</td>
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<td>800-1000km</td>
<td>760-1100kg</td>
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<td>600kg</td>
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Source: 2010 IISS Iran’s Ballistic Missile Capabilities: A Net Assessment
<table>
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<td>2,000</td>
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<tr>
<td>Payload</td>
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<td>700-1000</td>
<td>?</td>
<td>700</td>
<td>~1,000</td>
</tr>
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</table>
Iran’s Ballistic Missile Arsenal

Shahab-3 ("Meteor") 800-mile range. The Defense Department report of April 2010, cited earlier, has the missiles as “deployed.” Still, several of its tests (July 1998, July 2000, and September 2000) reportedly were unsuccessful or partially successful, and U.S. experts say the missile is not completely reliable. Iran tested several of the missiles on September 28, 2009, in advance of the October 1 meeting with the P5+1.

Shahab-3 “Variant”/Sajjil 1,200-1,500-mile range. The April 2010 Defense Department report has the liquid fueled Shahab-3 “variant” as “possibly deployed.” The solid fuel version, called the Sajjil, is considered “not” deployed by the Defense Department. The Sajjil is alternatively called the “Ashoura.” These missiles potentially put large portions of the Near East and Southeastern Europe in range, including U.S. bases in Turkey.

BM-25 1,500-mile range. On April 27, 2006, Israel’s military intelligence chief said that Iran had received a shipment of North Korean-supplied BM-25 missiles. Missile said to be capable of carrying nuclear warheads. The Washington Times appeared to corroborate this reporting in a July 6, 2006 story, which asserted that the North Korean-supplied missile is based on a Soviet-era “SS-N-6” missile. Press accounts in December 2010 indicate that Iran may have received components but not the entire BM-25 missile from North Korea.

ICBM U.S. officials believe Iran might be capable of developing an intercontinental ballistic missile (3,000 mile range) by 2015, a timeframe reiterated by the April 2010 DOD report.

Other Missiles On September 6, 2002, Iran said it successfully tested a 200 mile range “Fateh-110” missile (solid propellant), and Iran said in late September 2002 that it had begun production. Iran also possesses a few hundred short-range ballistic missiles, including the Shahab-1 (Scud-B), the Shahab-2 (Scud-C), and the Tondar-69 (CSS-8). In January 2009, Iran claimed to have tested a new air-to-air missile. On March 7, 2010, Iran claimed it was now producing short-range cruise missiles that it claimed are highly accurate and can destroy heavy targets.

Space Vehicle In February 2008, Iran claimed to have launched a probe into space, suggesting its missile technology might be improving to the point where an Iranian ICBM is realistic. Following an August 2008 failure, in early February 2009, Iran successfully launched a small, low-earth satellite on a Safir-2 rocket (range about 155 miles). The Pentagon said the launch was “clearly a concern of ours” because “there are dual-use capabilities here which could be applied toward the development of long-range missiles.”

Warheads A Wall Street Journal report of September 14, 2005, said that U.S. intelligence believes Iran is working to adapt the Shahab-3 to deliver a nuclear warhead. Subsequent press reports say that U.S. intelligence captured an Iranian computer in mid-2004 showing plans to construct a nuclear warhead for the Shahab. The IAEA is seeking additional information from Iran.
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”

• February 8, 2011
  • Iranian reporting quotes IRGC chief Mohammed Ali Jafari as stating that Iran had developed “supersonic” smart ballistic missiles which “cannot be tracked and can hit targets with high precision” as well as “coastal radars with a range of 300km.”
  • Regarding the missile, Jafari also stated that “as the enemy’s threats will likely come from the sea, air, and by missiles, the Revolutionary Guard has been equipped with capabilities to neutralize the enemy’s advanced technology.”
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 Khaddaf to set up an entire missile industry in Libya and were very upset when Khaddaf 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, 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-launch-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. 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.

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 than 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.

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. 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).

Source: AFP, August 20, 2010; Telegraph, August 20, 2010.
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.

Source: AP20100922950145 Tehran Fars News Agency in English 1535 GMT 22 Sep 10.
Qiam-1 Missile Performance

- Jane’s reports that the missile appears to be similar to the Shabab 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 tmidway down the missile's body, possibly carrying cables from the warhead section to the motor section.
- No details are provided on the launcher. Janes indicates it may have been from a mobile transporter-erector-launcher (TEL) vehicle.
- Janes 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 be accuracy and increased range, but the Iranian Defence Ministry and other military sources do not provide details.
“Guesstimated” Iranian Missile Ranges

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

Source: Abdullah Toucan, Multi-layered Defense against Missiles: Challenges and Solutions from a ME Regional Perspective, December 15, 2008
Gulf Integrated Missile Defenses

Components of a multi-layered integrated Ballistic Missile Defense System

- **Mid-Course Phase**
  - Sea Based Radar
  - Forward-Based Radar
  - Midcourse Radar
- **Terminal Phase**
  - Speed of warhead and short duration of terminal phase are challenges.
  - Warheads can maneuver.
  - Longer flight duration
  - Exoatmospheric (above atmosphere)
  - Must be able to discriminate between weapons and decoys.

**Boost Phase Vehicles**
- Boost Phase short in time duration limiting interception opportunities.
- Missile destruction occurs before dispersal of payload.
- Debris from missile, including warheads, may fall on the launching country.

**Defense Support Program in Boost Phase**

**C4I and Battle Management**

- THAAD "Hit to Kill" Technology
  - Direct hit of incoming ballistic missile.
- Sea Based Terminal
- Patriot Advanced Capability PAC-3
- U.S. Aegis Ballistic Missile Defense
- Standard Missile-3
  - Ground Based Midcourse Defense
- Multiple Kill Vehicle
- Airborne Lasers
- Kinetic Energy Interceptors
- Counterforce Operations
- Early Warning Radar
- Ground Based Radar
- C4I and Battle Management

**Sensors**

**Ground Based Interceptor**

**In Mid-Course Phase**

**Reentry Vehicles & Decoys**

**Sea Based Vehicles**

**Forward Based Vehicles**

**Midcourse Vehicles**
Iranian Integrated Missile Defenses

A Multi-Layered Integrated Ballistic Missile Defense System

- Sensors
  - Space Tracking and Surveillance System

- Reentry Vehicles & Decoys
  - Terminal Phase
    - Speed of warhead and short duration of terminal phase are challenges.
    - Warheads can maneuver.

- (Option II)
  - Vehicles & Decoys
    - Sea Based Radar
    - Sea Based Radar
    - Forward-Based Radar
    - Midcourse Radar

- Mid-Course Phase
  - Longer flight duration
  - Exoatmospheric (above atmosphere)
  - Must be able to discriminate between weapons and decoys.

- Boost Phase Vehicles
  - Boost Phase short in time duration limiting interception opportunities.
  - Missile destruction occurs before dispersal of payload.
  - Debris from missile, including warheads, may fall on the launching country.

- Iran BMD
  - Ground Based Interceptor

Antey 2500 / S-300PMU2 "Favorit"

- Potentiality of Antey 2500 System in Destruction of Air Targets
  - Maximum launching range of BM engaged: 2500km
  - Area protected by one fire unit against:
    - Medium Range BM with 2500 km range: 1000 - 1750 km²
    - Theater BM with 1100 km range: 2000 - 2500 km²
    - Tactical BM with 600km range: 2500 km²

- C4I and Battle Management

Armed Forces
- Air Defense
- Surface-to-Air Missile (SAM) Systems
- Airborne Lasers
- Kinetic Energy Interceptors
- Countercircular Operations

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