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IRAN'S DELIVERY SYSTEMS CAPABILITIES ¹

In late 2006 the United States announced plans to deploy elements of an anti-missile defense system in Eastern Europe. The White House's official justification for the plans was the need to defend Europe against Iran and North Korea--states that possess or intend to possess nuclear weapons. The deployment of U.S. missile interceptors in Poland and radars in the Czech Republic has already resulted in a confrontation between the West and Russia. Russians believe that the U.S. arguments are groundless, and recently proposed the joint use of the Soviet-built radar in Azerbaijan. But does Iran really have the capability to create nuclear weapon delivery systems such as ballistic missiles, bombers, and submarines?

The examples of official nuclear weapon states, as well as India and Pakistan, indicate that nuclear weapons did not appear in a vacuum, but together with means of their delivery. Moreover, in many respects it was these delivery systems that determined the mass and dimensions of the warheads as well as their possible applications. Furthermore, in all of the above countries, with the possible exception of Pakistan, the first delivery system, chronologically, was aviation, and only later were ground-based and sea-based missiles developed. Before testing their first usable nuclear bombs, all of these countries already had aircraft in series production that could be employed at the tactical and, partially, the intercontinental level (at least via the "one-way ticket" tactic, like the Soviet Air Force's *Tu-4* and *M-4* bombers).

The examples of North Korea and, partially, Iran (if one assumes that the Islamic Republic of Iran does in fact intend to develop nuclear weapons) are of particular interest here. When you begin to analyze the data about their missile and nuclear programs carefully, you cannot fail to think about the "chicken and egg" dilemma: what comes first and what follows in these states' military strategy—the creation of a nuclear bomb, which will necessitate the development of means of its delivery, or the relatively successful development of means of delivery leading to an acceleration of nuclear weapons programs?

BALLISTIC MISSILES

At present, Iran is one of the most "dynamic" missile states. This is attested to by the fact that from the mid-1980s through the end of the 1990s there were 23 known missile programs in the country, a record unsurpassed in recent years.² By 2000-01 Iran had nine programs for the production and development of ballistic missiles.³ The Iranian missile program, which took the shape in the 1990s through the testing and production of the *Shahab* missile, is the result of



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long-standing work by the Iranian leadership, resting on a foundation established under the Shah's regime.

Already in the 1970s, Iran had concluded a number of agreements with U.S. firms not just for the production of aircraft fuselages and "surface-to-air" missiles in Iran, but also for joint production of "surface-to-surface" missiles with a throw-weight of 350 pounds (approximately 140 kg).⁴ One should also note that in 1974 the United States exported *MGM-52 Lance* missiles to Iran with a range of 130 km.⁵

As a result of the Iran-Iraq war, Iran entered into the "closed" club of states that had made substantial use of ballistic missiles in war. There are few such states: Germany (in 1944-1945, using *A-4* rockets, also known as *W-2*), Egypt (a limited number of Soviet *SCUD* missiles were used against Israel in the 1973 war), Iraq, the Soviet Union/Russia (*FROG-7* missiles in Afghanistan, *SCUDs* and *Scarabs* during both Chechen wars), Afghanistan (after the departure of Soviet troops in 1989, the Afghan government used *FROG-7* and *SCUD* missiles against the mujahedin), Libya (in the border wars in Chad, as well as when they fired at the U.S. base on the Italian island of Lampedusa in 1986), Yemen (*SCUD* and *Scarab* missiles were used in the civil war in 1994) and Yugoslavia (in Kosovo).⁶ Among these nations, Iraq and Iran occupy the second and third places in terms of the number of missiles fired (Germany is in first place, with 3,165 combat launches of the *A-4* missile, of which 543 exploded on launch⁷).

Thus, Iraq had already fired *FROG-7* tactical missiles at its opponent in 1980, in total launching approximately 70 at Iranian cities.⁸ Subsequently, Iraq moved to the use of medium-range *R-17 (SCUD-B)* missiles. In 1983, 37 missiles were launched at Iran, both at Tehran and at other sites.⁹ In 1985, Iraq was already launching 82 missiles at its enemy.¹⁰

The "war of the cities" exerted a strong influence on the Iranian leadership and its determination to develop its missile program. As a result of Iraqi missile attacks, approximately 5,000 people (the overwhelming majority of whom were civilians) perished. The missile attacks had a significant psychological and social influence on the country's population, primarily due to the constant fear of being harmed by the "dumb" weapons, which the Iraqis predominantly used again densely populated parts of the country.

Due to its inability to defend against Iraqi missiles, Iran decided to obtain its own missiles. It therefore expanded the military industrial base created under the Shah, made significant investments in rocketry R&D, and initiated cooperation in this sphere with the PRC, North Korea, Libya, and Syria, and undertook large-scale missile purchases. These efforts already began to produce results in 1985, when the Iranian military, the Islamic Revolutionary Guards in particular, obtained the first mobile *SCUD* missiles.

The first ballistic missiles came from Libya, with which negotiations had begun in 1984. According to foreign sources, in 1985 the first tranche of 20 missiles and two *MAZ-543* transporters arrived in Iran.¹¹ At the time, Iran's missile units supplemented the air force's significantly weakened strike power.

Iran began producing missiles nearly immediately. The country produced 14 ballistic missiles in 1985, 16 in 1987, and 76 in 1988.¹² There are reports that during the war, Iran launched 120 *SCUD-B* ballistic missiles at its enemy, with a maximum range of 325 km.¹³ Iran's strategy was to target civilian Iraqi sites exclusively to stave off missile strikes on its own cities and industrial facilities, i.e. scare tactics were used.¹⁴ It became clear that in order to counter the Iraqi threat, both at the time (of military actions) and in the future, Iran needed ballistic missiles with a variety of ranges and warhead yields. There were two possible ways to meet this goal: importing complete missile systems or arranging for domestic production and the assembly of imported components.

By 1987, it became clear that Libya and Syria could no longer meet Iran's ballistic missile needs; thus, Iran's attention turned to North Korea, which not only had a significant number of the same type of ballistic missiles in its arsenal, but also produced them. Therefore, beginning in 1986-87, Iran's main partner in the missile sphere became North Korea.

Available information indicates that in the late 1980s Iran pursued both methods of obtaining missiles. In 1987, the Iranian government stated that the country was then producing a certain number of *Shahab-1* missiles.¹⁵ Western analysts believe that a Soviet *R-17* missile, which had been obtained from Libya, served as the model for them.¹⁶ Most likely, at this stage Iran was actually undertaking the “turn-key assembly” of “missile complexes” supplied from other countries, primarily North Korea. Thus, during the Iran-Iraq war, North Korea supplied Iran with about 100 *SCUD-B* missiles and equipment for their production. According to other sources, in 1987-92 North Korea supplied about 200 ballistic missiles and 6-12 mobile launchers.¹⁷ Although in the beginning the missile program was run out of the Islamic Revolutionary Guards, by 1989 production facilities had already been put under the Defense Industries Organization. But the missile units continued to be directly under the jurisdiction of the Islamic Revolutionary Guards. At about this time, Iran switched to completely independent missile production. The characteristics of these missiles were fairly similar to the Soviet *R-17*: a flight range of 50-300/320 km, a warhead mass of 985 kg, and a maximum error of 450-800/1,000 m.¹⁸ The *Shahab-1* turned out to be the most “martial” Iranian missile: during the Iran-Iraq war about 90 were launched, while in 1994-2001 another 50-80 more (according to different sources) were launched at rebel bases in Iraq.¹⁹

In 1991, North Korea began supplying perfected *SCUD-C* missiles to Iran, which the Iranians designated the *Shahab-2*. According to foreign expert assessments, about 60 missiles assembled in North Korea were supplied to Iran, while in late 1991-early 1992 Iran began to produce them independently.²⁰ Western experts estimate that approximately 170 missiles of this type were produced.²¹ This missile represents a significant step forward in comparison to the previous version, since its maximum flight range is 500 km (its minimum is 50 km), the warhead weighs 500 kg, and its maximum error is 1,000 m.²²

According to Western sources, cooperation between these two countries was not limited to this. In 1991, in addition to providing *SCUD-C* missiles, North Korea provided technical assistance in the development of *Shahab-3* missiles (in the mid-1990s, Western sources also believed that this project was initially called the *Zelzal-3*²³)—particularly in the area of increasing missile accuracy—which, according to the experts, are a further development of the North Korean *Nodong-1* ballistic missile.²⁴

Strong working-level ties were established between the two countries in the early 1990s. Thus, in April 1993 the first group of Iranian experts—a group of 15 men headed by Brigadier General Manteghi, head of the Defense Industries Organization, arrived in North Korea.²⁵ After this first visit, there were supposedly over 300 more Iranian experts who received instruction in North Korea.²⁶ According to Western media reports, Iran initially planned to purchase and produce at its own factories a total of about 150 *Nodong* missiles.²⁷ These assessments indicate that North Korea supplied Iran with 5-12 ballistic missiles and four launch systems in 1994-97.²⁸ In 1997-2002, a second tranche of North Korean missiles was supplied, about 20 “missile sets” in all.²⁹ According to 2001 estimates, Iran planned to produce on the order of 20 missiles per year; small-scale production using North Korean engines had already begun by 2001.³⁰ Evidently using both the missiles it already had and in expectation of new supplies, in 2000 the Islamic Revolutionary Guards created five new missile units armed with *Shahab-3s*.³¹

It is interesting to note that the missiles and components were probably sent from North Korea to Iran by air. In June 2003 the South Korean newspaper *JoongAng* reported that since April 2003, an Iranian *Il-76* medium-sized transport aircraft had been noted at the Pyongyang airport Sunan several times. This plane apparently transported the dismantled *Nodong* missiles in containers.³² The South Korean journalists also reported that through 2003, Iranian transport workers were seen in North Korea at least twice a year.³³

As was mentioned above, the *Shahab-3/Shahab-3D* was based on the North Korean *Nodong-1* and is the first missile that can reach Israeli territory.³⁴ It is also interesting that there are reports that Iran co-sponsored development of the *Nodong-1* missile in North Korea, and conducted negotiations on the purchase of 150 missiles in exchange for oil.



Foreign sources indicate that Iran began to produce missiles in 2001, but at first was using missile engines imported from North Korea.³⁵ The missile's range is on the order of 1,300 km,³⁶ its warhead mass is 1,000 kg,³⁷ and the *Shahab-3's* maximum error was estimated to be 0.08 percent of the distance flown, or about one kilometer, which would appear to be mistaken.³⁸ There are reports that Iran is also undertaking efforts to increase the range of the *Shahab-3* by 1,300-1,600 km. Furthermore, work on modernizing the *Shahab-3* is being conducted as an alternative to the development of the new *Shahab-4* missile, which was shut down in November 2003.³⁹

In June 2005, a solid-fuel *Shahab-3* missile (according to the Iranian Defense Ministry) reached a distance of 2,000 km during a test launch, along with an increase in accuracy.⁴⁰ From the technical point of view, however, re-equipped *Shahab-3* with solid fuel actually appears to be a new missile. One should also note that in late 2004, Israel reported that the improved *Shahab-3/Shahab-3D*, with the help of a Chinese guidance system, had decreased the maximum error range to 250 m, which is clearly an exaggeration.⁴¹ As of May 2004, 20 ballistic missiles were considered combat-ready.⁴²

Modernization basically consists of converting the *Shahab* family of missiles to solid fuel. In May 2005, Iranian Minister of Defense Ali Shamhani announced that Iran had conducted a successful test of a solid-fuel engine for the *Shahab-3* ballistic missile. Furthermore, it was noted that "the use of solid fuel makes it possible to increase the missile's storage period and improve its accuracy."⁴³ Therefore, one cannot exclude the possibility that Iran has conducted tests for other missile families, or that Iran is developing a new solid-fuel missile that would represent a qualitative jump in its missile program. In any case, this event indicates that Iran intends to pay serious attention to the development of solid-fuel engines for intermediate-range missiles, which unavoidably places increased requirements on Iran's missile and chemical industries.

It should also be recognized that Iran has had combat experience using *Shahab* missiles since the Iran-Iraq war. As mentioned above, during the low-intensity conflict through 2001 between Iran and the opposition Muhajedin Khalq party (also known as the People's Muhajedin of Iran) based in the Iraqi border regions, the Iranian military launched 58-77 *Shahab* (of unknown modifications, but most probably *Shahab-1* and *Shahab-2*) ballistic missiles at enemy bases.⁴⁴ This was clearly due both to the limited ability of the Iranian air force to deliver retaliatory strikes at bases located on the territory of the neighboring state, as well as, probably, the desire to test the effectiveness of missiles assembled domestically through large-scale use in a real combat situation.

In the West, there have also been discussions about Iran's possible development of *Shahab-4* missiles, which are likely either the further development of Soviet *R-12* missiles (which is a rather far-fetched assumption, given that the last *R-12* was decommissioned in May 1990) or an improvement on the *Shahab-3* analogous to Pakistan's *Gauri-2*.⁴⁵ In fact, the first mention of the development of the intermediate-range *Shahab-4* missile was made by Israel in the mid-1990s; indeed, in 1997 Israeli experts noted the Iranian development of missiles with ranges of 5,500 and 10,000 km!⁴⁶ According to information provided by Iranian opposition groups, the *Shahab-4* has a range of 2,000 km and a throw-weight of 1.4 tons.⁴⁷ However, official Iranian representatives have stated that the *Shahab-4* development program has been discontinued.⁴⁸ Moreover, as early as 2000 it was announced that the *Shahab-4* designation had been given to a space satellite launch vehicle.⁴⁹

It is noteworthy that after yet another test of a *Shahab-3* in June 2005, Iranian Minister of Defense A. Shamhani stated that "The *Shahab-3*, which was tested using solid fuel, could be called the *Shahab-4*, however, in principle, the missile designation itself is not important."⁵⁰

The charges that Russia helped the Iranian missile program are overstated. Iran received help on a considerably greater scale from North Korea—virtually all of the ballistic missile production infrastructure for the *Shahab* missile family was created by Iran with North Korean assistance. It is clear that this cooperation went in stages: first the purchase of complete missiles, then supply of components for assembly at Iranian enterprises, and finally assistance in mod-

ernizing missiles and organizing the production of new missiles types. It is quite possible that joint work will continue in future; furthermore, Iran may well take upon itself the funding of research and development work, something that has already occurred in the past. If the international situation sharply deteriorates, the supply of complete systems to Iran also remains possible.

In addition to the liquid-fueled *Shahab* missiles family, the Iranian missile arsenal also includes solid-fueled missiles: the Chinese *CSS-8* (called *Tondar-69* in Iran) and the *Fateh*. *Tondar-69* is an alteration of the Chinese copy of the Soviet “surface-to-air” *S-75* (the Chinese version is called *HQ-2* in the West), built in the PRC, turned into a “surface-to-surface” missile. The *Fateh A-110* is a relatively new missile, the existence of which was only officially announced in September 2002 when Tehran’s official representatives declared the successful launch of a missile of this type.

According to available information, the *Fateh A-110* is single-stage missile with a range of 200 km, warhead mass of 500 kg.⁵¹ According to official statements, Iran makes both the missiles and the solid-fuel engine for them independently, and has built a special plant for their construction.⁵² The missile’s maximum error, in the opinion of U.S. experts, is about 100 m.⁵³ The missile’s one drawback is its fixed launcher, though Western experts believe that work on a mobile launcher for this missile is ongoing.⁵⁴

The *Nazeat* missile family could be considered the “oldest” of those developed and produced in Iran. Work on this system began in the late 1970s; assistance was received from North Korea, China, and possibly even Brazil.⁵⁵ A significant number of types of this missile have been created. The *Nazeat N-5* and *N-6* were used in the war with Iraq. The maximum range of the *N-5* is 105 km, the *N-6* is 120-130 km, and the *N-10* is 150 km. The warhead mass of these types is 150 kg, though in the *N-8* this was increased to 300 kg (in the *N-10* warhead mass was once again reduced, to 250 kg, apparently to increase range).

It appears that Iran is also developing a solid fuel missile program based on the Chinese *M-11* (*DF-11/CSS-7*) and *M-9* (*DF-15/CSS-6*). The former reportedly has the Iranian designation *Tondar 68* or *Gadr*.⁵⁶ As it is related to Pakistan’s *Ghazvani* missile, which flew 290 km during a test in 2002, it is likely that the Iranian version has a similar range. The *Tondar 68/Gadr* is apparently equipped with a 500 kg warhead that can separate during flight, which theoretically makes it more precise than the *Shahab-2*.⁵⁷ An important feature of the Chinese version of the *M-11* is its capability of being launched from a mobile launcher based on the *MAZ-543*, which, given Iran’s possession of similar launchers, means that the *Tondar 68/Gadr* can likely be launched from them.

Reports indicating that Iran has been developing a second solid-fuel missile program on the basis of the Chinese *M-9* are fragmentary at best. Western analysts estimate that the Iranian version of the missile can deliver a 320 kg warhead a distance of 800 km.⁵⁸

It would appear that the Chinese missiles will be developed in parallel with the improvement of the *Shahab* liquid-fueled missile. Given the situation with the North Korean nuclear program—Pyongyang has been threatened with virtually total international isolation since its test of a nuclear device—Iranian cooperation with North Korea may come to a temporary halt or become significantly more complicated. Therefore, it would not be surprising if the “Chinese” path were developed more dynamically. Moreover, intermediate-range solid-fuel missiles have been the core development choice in many countries of the world, including the new Chinese intermediate-range missiles and SLBMs.

In 2006, Iran’s tests of the new *Saegheh* “surface-to-surface” tactical missile class were reported. In August 2006, Iranian televisions reported 10 test launches of new missiles at one of the military test sites, during the course of which a range of 80-250 km was achieved.⁵⁹ Other characteristics of the missile were not provided.



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Table 1: Main Specifications of Iranian Ballistic Missiles

Name	Range, km		Mass, kg		Maximum error, m	Type of engine
	Min.	Max.	missile	warhead		
<i>Nazeat N-6 (Iran 130, Mushak 120)</i>	unknown	105	unknown	150	unknown	solid
<i>Nazeat N-8</i>	unknown	unknown	unknown	300	unknown	solid
<i>Nazeat N-10</i>	unknown	150	unknown	250	unknown	solid
<i>Zelzal-1</i>	unknown	100-150	unknown	600	unknown	solid
<i>Zelzal-2</i>	unknown	350-400	unknown	600	unknown	solid
<i>CSS-8 (M-7)</i>	unknown	150-180	unknown	190	unknown	liquid
<i>Shahab-1 (SCUD-B)</i>	50	300	5862	989	450 – 1000	liquid
<i>Shahab-2 (SCUD-C)</i>	55	700	6400	700	1000	liquid
<i>Shahab-3 (Zelzal-3)</i>	unknown	1300-1500	16000	760-1100	1000	liquid
<i>Shahab-4</i>	unknown	1800 – 2000	22000	750-1000	unknown	liquid
<i>M-11</i>	unknown	290	unknown	500	unknown	solid
<i>M-9</i>	unknown	800	unknown	320	unknown	solid

Figure 1. Iran's Main Missile Production Centers



Source: http://www.waronline.org/mideast/iran_wmd.htm

Note: centers for cooperation in the production of Iranian missiles:

- Isfahan: R&D, missile production, fuel production;
- Semnan: production of tactical missiles, test site;
- Shahroud: R&D, missile fuel, and test site;

- Shiraz: R&D, production of missiles and missile fuel;
- Sultanatabad, Lavizan: R&D;
- Kukh-e-Barjamali: production of measuring equipment for tests.

Sites of small enterprises involved in cooperation for the production of missiles:

- Abadan: missile production;
- Aliabad: missile launcher equipment;
- Arak: R&D, *SCUD* reequipping (modification) plant;
- Bandar Abbas: missile production;
- Dorud: R&D;
- Gamsar: test site;
- Gostaresh: R&D;
- Karaj: R&D, missile production;
- Khoramabad: missile production;
- Manzariyah: R&D, missile fuel production;
- Mashhad: missile production (missiles, solid-fuel engines);
- Okaraman: missile production (parts for the *Shahab*);
- Parchin: missile production (solid-fuel engines, guided air-defense missiles, anti-tank guided missiles, airborne missiles, parts for the *Shahab*);
- Sarji: missile production;
- Tebriz: missile production (*Shahab*);
- Tehran: R&D and missile production.⁶⁰

Along with the development and production of its own missiles, Iran necessarily needs launchers for them as well. The 1991 military clash between neighboring Iraq and the coalition of predominantly western states clearly showed the strong and weak points of various types of launchers. Iraq used both mobile and stationary launchers to launch *SCUD* missiles, an inheritance of the Iran-Iraq war when the enemy did not pose a threat to them. The danger Iraq's ballistic missiles posed for its enemy is indicated by the fact that on the first day of Desert Storm, January 15, 1991, 11 percent of the targets were parts of the *SCUD* missile complex (the same proportion as air defense system targets; while command, communication, and control centers made up the greatest share of targets—16 percent; i.e. missiles and air defense were in second place as far as coalition priorities were concerned).⁶¹

During the first days of the war all stationary launchers were attacked, of which 12 were destroyed and 13 damaged.⁶² However, the mobile installations, which were estimated to total 30-50, remained through the end of combat. Coalition air forces only managed to hit "facilities with characteristics similar to launchers"⁶³ eight times.

Iran obviously studied the Iraqi experience carefully; the issue of how to ensure launcher survivability is one of the most urgent for Iran. Iran has evidently bet on the use of mobile launchers; however, in the mid-1990s there were reports that Iran had built an underground bunker system for *Shahab* missiles on the banks of the Persian Gulf.⁶⁴ Western analysts believe that missiles launched from these bunkers could reach Oman, Qatar, and the United Arab Emirates (UAE).⁶⁵

Nevertheless, it would seem that plans call for most of the missiles to be launched from mobile launchers. In the late 1990s, the number of launchers based on the Soviet *MAZ-543* and German-built trucks was estimated to be about 100.⁶⁶

Iranian missile launchers will still, however, remain very vulnerable in the face of an enemy with a powerful air force. The example of Israel's campaign in Lebanon in July confirms this fact. According to information from Israel's AMAN military intelligence, at the beginning of combat actions the air force destroyed 59 Iranian *Zelzal-2* and *Fadjr* launchers.⁶⁷



CRUISE MISSILES

Iran has had considerable success in the development and production of cruise missiles. True, here we are primarily talking about anti-ship missiles, but they could potentially be used against surface targets as well. The main Iranian surface-to-surface missile class is a local copy of the Chinese *CSSC-2 Silkworm (HY-1)* and *CSSC-3 Seersucker (HY-2)*. Western sources indicate that in 1987 Iran began production of this type of missile with the assistance of the PRC and the DPRK, then later turned to production of improved models of their own design. It is also possible that while working on increasing the range of the *CSSC-2*, Iran made use of the Iraqi *FAW-150* and *FAW-200* cruise missiles, which are also based on a Chinese prototype.⁶⁸ The *CSSC-2* warhead weighs 400 kg, while the *CSSC-3* is 513 kg, which theoretically makes it possible to accommodate a nuclear device on the latter.⁶⁹ The Iranian version of the improved *CSSC-2* was designated *Piruzi-75*, but work on it ended in 1996 when all attention turned to producing more advanced models: the Chinese *C-801* and *C-802*. In 2004, Iran demonstrated yet another modification of the *CSSC-2* called the *Raad*, which reportedly carries a 500 kg warhead some 150-400 km.⁷⁰

Work on the Iranian versions of the *C-801 (Karus)* and *C-802 (Tondar)* are believed to have begun in 1996. The *Karus* has a range of 40km, while *Tondar's* is 120 km. It has been noted that both missiles can not only be launched from ships, but also from mobile launchers for coastal defense.

The story of Iran's acquisition of Soviet *Kh-55* missiles is worth describing in detail. The new Ukrainian government has acknowledged that *Kh-55* cruise missiles were sold to Iran. According to some reports, 12 missiles were sold to Iran, while six KNO-120 ground equipment systems were sold to China (although according to other reports, there were six units sold to each country). These missile systems cannot be deployed on Iranian aircraft, even the "mythical" *Tu-22M* (more on this aircraft below), which were armed with *Kh-22* and *Kh-15* missiles.⁷¹ The *Kh-55* can only be launched (moreover, only with a nuclear warhead) from a *Tu-95MS* or *Tu-160* strategic bomber, which at the present time are only present in the Russian arsenal. Thus, one can confidently say that the *Kh-55* that ended up in Iran can only be used for the study of Iranian experts. Furthermore, airborne delivery systems were transferred from Ukraine to Russia, reportedly together with the relevant *Kh-55* nuclear warheads.⁷²

In late July 2005, the Iranian opposition came out with information that the Islamic Revolutionary Guards had mastered the production of the *Kh-55*.⁷³ It is rather difficult to evaluate the veracity of this information, since the announcements of the Iranian opposition are often false, but one cannot completely ignore the possibility that Iran has become capable of using the relevant technologies.

The *Kh-55* is a highly perfected weapon, despite the fact that development of the missile began in 1976 and the first one was officially commissioned in December 25, 1979 (the first to be produced via serial production was completed on February 23, 1981). With an official maximum error of 100 m, the Soviet air force was able to obtain results with a deviation of just 20-30 m, making it possible to characterize the *Kh-55* as a "high precision" weapon.⁷⁴ Its range is 2,500 km, and warhead is 410 kg. The missile is guided by an autonomous inertial navigational system (INS) with corrections based on the local geographical relief. The basic flight regime is at minimum altitude (50-100 m), following the lay of the land, at speeds of 500-700 km/hour.⁷⁵

There is yet one more aspect of the Ukrainian *Kh-55* story worthy of note. Already in March 1978, a decision was made to develop series missile production at the Kharkiv Avionics Association (KhAPO). And although a decree on the cessation of *Kh-55* production at KhAPO and the transfer of equipment and parts to the Kirov Mechanical Plant was issued in December 1986, it is well known that the following March the plant completed 16 modernized *Kh-55SM* missiles for tests of the new missile system.⁷⁶

Thus, one cannot exclude the possibility that the necessary specialists remained at the plant, as well as some of the equipment, parts, documents, etc., that would make it possible not simply to restore the units that remained in Ukrainian military storage, but also to use them, or parts remaining at the plant, to bring some *Kh-55* up to, for instance, the level of the *Kh-55SM*

(with an increased range). This would theoretically make it possible for Iranian experts to obtain access to the most advanced long-range cruise missile, and if there were exchanges with Pakistani missile experts, very interesting joint developments could be obtained.

One must assume that the missiles were unlikely to have been produced in their original form as strategic missiles. This is due both to Iran's lack of equipment to obtain a detailed "picture" of a potential opponent's targets for the INS as well as the lack of delivery systems with the precise navigation needed for the INS to work. Moreover, the special design features of the *Kh-55* (suspension with four spread-out attachment joints, instead of the traditional suspension from a single joint) require a special launcher, which Iran is unlikely to be able to develop.

But it is possible that the *Kh-55* could be used as a basis for the creation of a tactical cruise missile (like the Pakistani *Babur*) with a range of 500-600 km, which would have the key advantages of greater mobility, accuracy, concealment, and lower cost. Moreover, a smaller range would make it possible to increase warhead mass and, correspondingly, the likelihood that the missile will be equipped with a nuclear warhead.

AIRBORNE DELIVERY SYSTEMS

The Iranian air force has a large number of aircraft; however, only the third and fourth generation equipment meets minimum modern requirements: the U.S. *F-4* and *F-14* fighter planes, French *Mirage F-1*, and Soviet *Su-24MK* front-line bombers and *MiG-29* fighter planes. Of these, only the *F-4*, *F-1*, *Su-24MK* and *MiG-29* are of relatively high combat value; these vehicles can also be used against surface targets.

The *F-1 EQ-2* and *-4* modifications of the *Mirage F-1* have the greatest value as strike aircraft; they can be refueled in-flight, are equipped with the *Q-5* version of the *Cyrano-IV* radar, and can launch *AM.39 Exocet* anti-ship missiles. In all, 24 were flown to Iran, of which one was apparently lost in 2001.⁷⁷ These planes are theoretically capable of launching nuclear weapons, but only the *Q-5* modification, of which there are no more than ten, has real combat value as a strike aircraft.

The Iranian air force's main strike plane, the *F-4D/E Phantom II*, of which it has about 60-66 with about 30 in a combat ready state, is also worth noting.⁷⁸ Although the *F-4* was used as a strike plane by the Iranians in the Iran-Iraq war, and is considered to be the main airborne delivery vehicle developed by the Iranians, the aircraft, the most recent of which was delivered in 1977, cannot be viewed as an effective and prospective delivery vehicle, although its load capacity, range, and the relatively large number of *F-4s* make it theoretically possible to imagine its use as a nuclear weapons delivery system.

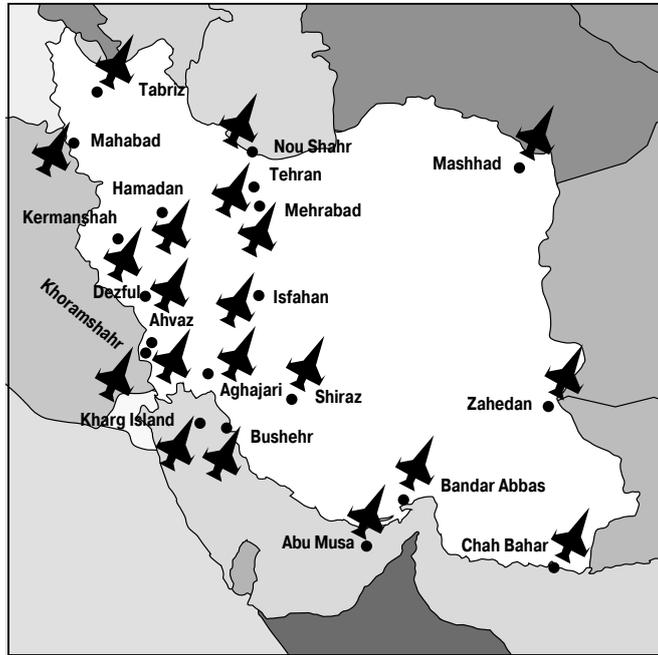
The *Su-24MK*, an airplane specially constructed to strike surface targets, has the greatest potential in this regard. Most of the aircraft of this type were obtained from Iran in an unusual way: during Desert Storm in 1991, when multinational forces were operating in Iraq, Iraq's air force transferred some of its most modern airplanes to neighboring Iran in order to avoid their destruction. It is remarkable that during this operation, not one of the 24 Iraqi *Su-24MK* that participated was hit. After the end of the war, Iran refused to return the airplanes to its former enemy. According to Western estimates, there are 24 *Su-24s* in Iran's air force, including those purchased in the Soviet Union and requisitioned from the Iraqis (in total, Iran had at most 22 Iraqi *Su-24MK* and 12 *Su-24MK* received directly from the Soviet Union).⁷⁹ These aircraft are in 72 squadrons based at the air station in Shiraz.⁸⁰

The condition of the aircraft that remain in Iran is unknown. However, several experts believe that the aircraft could be brought back into a combat-ready state through the purchase of the necessary spare parts on the "black market."⁸¹ It has been noted as well that the "*Su-24MK* could be an effective nuclear weapons delivery vehicle, which Westerners believe is being developed by Iran. The *Su-24MK* aircraft can be adapted for this purpose by domestic industry."⁸²



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Figure 2. Iranian Air Bases



Source: "Air Force, Iran," *Jane's Sentinel Security Assessment—The Gulf States*, November 22, 2004.

However, this picture is seriously altered by the portion of aircraft that are not combat-ready, in particular the *Su-24*, the state of which is not clear. If Iran succeeds in undertaking at least a major overhaul of the aircraft that were produced at the latest in the end of the 1980s, or at best the general modernization of their targeting systems, avionics and signals jamming equipment of the *Su-24* first and foremost, as well as the equipping of these planes with in-flight refueling systems, Iran will obtain a highly mobile, and therefore less vulnerable, delivery vehicle. Furthermore, it will be significantly more accurate than existing and prospective ballistic missiles.

Some sources also say that Iran acquired long-range *Tu-22M3* bombers from Russia or Ukraine.⁸³ One even finds the number of "Iranian" *Tu-22M* that were ordered: 12 units.⁸⁴ There are also reports that Iran "is seen as a potential purchaser" of *Tu-22M*.⁸⁵ However, it would seem that the actual implementation of any such initiative is quite far away. The Ukrainian *Tu-22M* are being destroyed in accordance with the bilateral U.S.-Ukrainian "Agreement Between the United States and Ukraine Concerning Assistance to Ukraine in the Elimination of Strategic Nuclear Arms and the Prevention of Proliferation of Weapons of Mass Destruction" signed on November 25, 1993. Of course, work only began in November 2002, but according to the agreement, by early 2005 17 *Tu22M2* and 14 *Tu-22M3* were to have been destroyed, and the Ukrainian air force would only have 20 aircraft, all in the 185th Heavy Bomber Regiment.⁸⁶ It should be noted that when the Soviet Union collapsed, there were about 100 *Tu-22M2/M3* remaining on Ukrainian territory.⁸⁷ In 1999, there were just 55 airplanes of this type in the Ukrainian air force.⁸⁸ Thus, theoretically, some of the 40 bombers that "disappeared" could have ended up in Iran, but the airplane is too large to be transferred to Iran unnoticed, in addition to which it is highly likely that the potential WMD delivery vehicles on the territory of CIS states have been under close U.S. attention; the

Americans would take the appropriate steps if there were an attempt to transfer the *Tu-22M* to Iran.

The “Russian trail” also seems fairly implausible. The example of the long negotiations between Russia and India over the lease of several *Tu-22M*, which never reached the final stages, testifies to this. The same thing happened with the prospective lease/sale of *Tu-22M* to China. In any case, a possible deal to transfer *Tu-22M* to Iran is not likely to happen before there is a similar deal with India.

It is theoretically impossible to deny the Iranian interest in this sort of system. After all, during the Iran-Iraq war Iraqi *Tu-22B* (the precursor of the *Tu-22M*) were actively used against Iranian targets, primarily in bombing Tehran, Isfahan, and Shiraz. However, along with the undoubted merits of long-range bombers, their deficiencies also became clear to the Iranians: the existence of just one airbase made the Iraqi *Tu-22B* very vulnerable to airborne attack which, as noted earlier, forced Baghdad to transfer its aircraft onto the territory of Saudi Arabia and North Yemen.⁸⁹ Consequently, if Iran were to acquire similar aircraft it would need to expand its airfield network and strengthen the airfields’ air defense systems, making this system less attractive in terms of cost-effectiveness. Moreover, the prospects of even the *Tu22M3* in hypothetical strikes on targets in Israel or on U.S. bases in the Middle East are illusory, given the strong air defense systems and insignificant number of operational aircraft, as well as the absence of support systems (intelligence services, signals jamming equipment, etc.)⁹⁰ And the use of this sort of system to deliver free-falling bombs (including nuclear weapons) against other states in the region would seem to be superfluous.

On the whole, looking back at the story of the “Iranian” *Tu-22*, it would seem to be directed not so much against Iran as against Russia. It is quite possible that the entire uproar was due to U.S. fears of the possible “spread” of this powerful system from former Soviet states. In addition, this situation could also be used to prevent the export of *Tu-22Ms* from Russia to India (negotiations on supplying two to four to India have continued without success since the mid-1990s) or to China.

SEA-BASED DELIVERY VEHICLES

It is quite clear that the Iranian navy does not have the capability to deliver WMD to a target. This is due both to its lack of WMD delivery vehicles—such as missile cruisers, cruise or ballistic missile submarines (SSGNs and SSBNs), or navy fighter planes—and to the general obsolescence of the vehicles in the fleet that could potentially be capable of delivering this sort of weaponry. The only potential delivery system are the three Russian-built Project 877EKM (NATO name *Kilo*-class) diesel submarines *Tariq*, *Nuur*, and *Yunez*. They are relatively new ships (commissioned by the Iranian navy in 1992, 1993, and 1996) that have a decreased noise level so that it is relatively difficult to detect them—an important factor for a potential WMD carrier. In their present configuration, boats of this type only have torpedoes and it is impossible to launch missiles, including anti-ship cruise missiles, from them. However, these boats can be modernized when they receive intermediate overhauls, to make possible the launch of the *Club/3M54* missile complex, which makes it possible to launch not just anti-ship cruise missiles, but also surface-to-surface *3M14* missiles. According to Western reports, there were plans to equip a submarine with either Chinese *YJ-1* or Russian *Alfa* anti-ship cruise missiles (currently known under the export name *Club*).⁹¹

Modernization of Iranian submarines along the lines of the Indian submarines of the same type, with the installation of the *Club* missile complex, would appear to be the most realistic and logical way to proceed. This has been indirectly confirmed by media reports that Iran is interested in having its three submarine equipped with this complex.⁹² The *3M14* missile can be used to strike ground-based targets. The missile’s range is 300 km. It uses an inertial guidance system with corrections from the GPS/GLONASS navigational system.⁹³ Of course, available evi-



dence suggests that the *3M14* missile has yet to enter series production, and there is no talk yet of equipping ships or submarines with them.⁹⁴

This assumption was indirectly confirmed in July 2005 when Russia's Rosoboronexport and Iran conducted negotiations on the repair and modernization of Iranian submarines at the Second International Naval Salon in St. Petersburg. Analysts believe that each boat will have certain equipment replaced, and a *Club-S* anti-ship cruise missile system will be installed. There will be a separate contract signed for the modernization of each submarine, which will cost an estimated \$80-90 million apiece. Initially it was thought that this work would be conducted at Zvezdochka Shipyard in Severodvinsk, but St. Petersburg's Admiralty Shipyard, which had originally built the three diesel submarines for Iran, also competed for the contract.⁹⁵ It seems that Zvezdochka probably won the contract, since in April 2006 there was an announcement that experts from this yard visited Iran's shipyard in Bender Abbas, where they familiarized themselves with "the possibilities for conducting an intermediate overhaul on a Project 877EKM diesel-electric submarine."⁹⁶

It is quite likely that some work has been carried out on the submarines: in August 2006 Iranian television showed video clips of the underwater launch of Iran's new *Thaqeb* missiles. However, Western analysts have cast doubt on the validity of these clips.⁹⁷ Nonetheless, the very fact of such an action by the Iranians indicates that Iran views its diesel submarines as a missile carrier.

The cost of modernizing all three boats in this manner, though, could be a significant burden on the Iranian navy's budget. It is therefore unlikely that all three boats would be modernized simultaneously.

SO WHY DOES IRAN NEED MISSILES AND WHAT DOES THIS MEAN FOR RUSSIA?

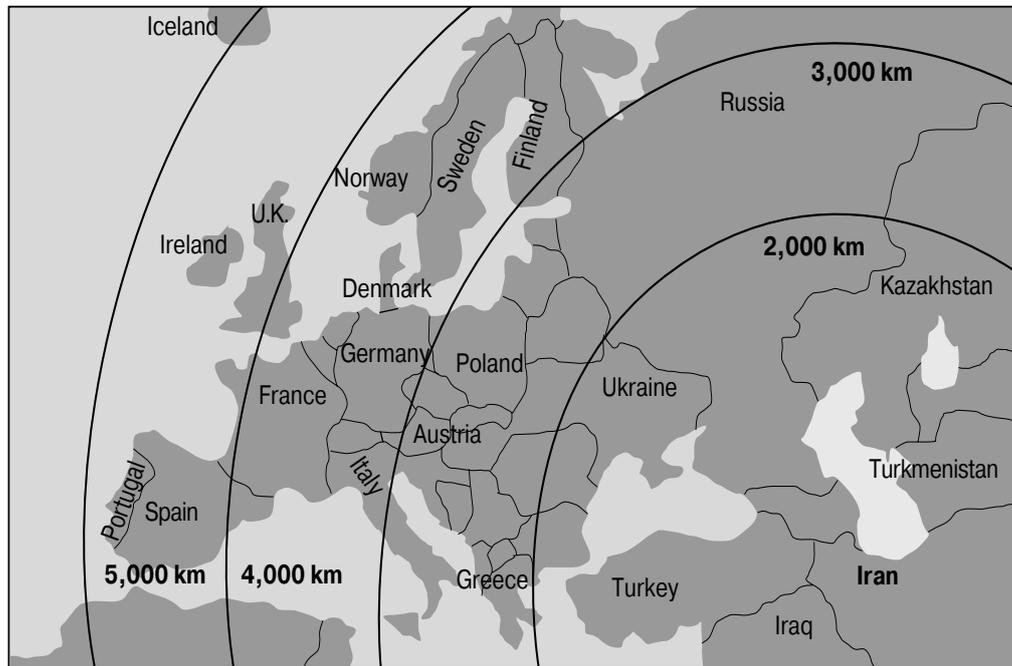
At present, the main and most likely means of delivery for a potential Iranian nuclear weapon is the *Shahab*. This is due to the fact that at present ballistic missiles are the only type of long-range weapon against which a country can not build a defense that guarantees its protection. Ballistic missiles' ability to ensure that its warhead is delivered to a target makes this class of weapon quite attractive to regional powers. Iran is no exception here.

Iran has succeeded in establishing a diverse arsenal of tactical and intermediate-range missiles that give Iran's leaders significant decisionmaking flexibility. As was noted above, the "long arm" of the Islamic state can only be exercised today via the *Shahab* missile. It can simultaneously lift several hundred tons of explosive and, possibly, WMD, and bring it down on an enemy up to 1,500 km away from Iran's borders. The *Shahab*'s range makes it possible to cover:

- Targets within 300 km: Baghdad, Kuwait, Bahrain, and Qatar;
- 600 km: western parts of Iraq and southern Turkey;
- 1,000 km: Riyadh, Damascus, Amman, and Kabul;
- 1,200 km: Tel Aviv, Ankara;
- 1,500 km: Cairo, Delhi, Mumbai;
- 2,000 km: Kiev, Moscow, Athens;
- 3,000 km: Berlin, Rome.

However, these numbers indicate the maximum casualty radius, if calculating from Iran's borders, which is improbably given the increased vulnerabilities launchers would face there. If one assumes that the launches will come from internal parts of the country, then a ballistic missile with a range of 800 km can strike the whole of Iraq; one with a range of 1,000 km can hit the states of the Persian Gulf, southern Turkey, Afghanistan, Jordan, and Syria; 1,500 km includes Israel and Turkey; and 2,000 km Egypt and western India.

Figure 3. Range of Missiles Launched from Northeastern Iran



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The missile arsenal Iran has today allows it to check nearly the entire Middle Eastern region, including Israel, Central Asia, and Turkey, which would appear to be enough to deter Israel in particular, as well as to threaten U.S. bases in the region (in Iraq, Afghanistan, Qatar, and Saudi Arabia).

However, the missiles' lack of high-tech features makes it impossible to count on destroying pinpoint targets, and instead to its use as a weapon of fear against civilian targets and large areas, such as large bases, storage facilities, and cities, while large-scale use would make it possible to "trample" even Israeli anti-missile defense or U.S. theater missile defense. However, there do not appear to be a large number of *Shahab-3* missiles that can reach Israel, which theoretically increases the chance of missile defense systems destroying all of their targets.

Another important shortcoming of Iran's liquid fuel missiles is the relatively long preparatory period needed to service them before launch (one-two hours), which increases the vulnerability of the missiles and slows down reaction time. It was apparently the realization of this fact that led to the initiation of alternative, solid-fuel missile programs based on Chinese technologies.

Furthermore, it seems that the North Korean reserves and assistance, used to iron out production of the *Shahab-1*, *Shahab-2*, and *Shahab-3*, are becoming exhausted, since the Korean technology, to the best of our knowledge, does not allow for a qualitative leap in areas such as increasing accuracy and range. Cooperation with China in these areas would not seem irrational.

The reasoning behind the Iranian missile program is quite interesting. Tehran has succeeded in creating and initiating series production of various missile types, making it possible to use them "step-by-step," depending on the degree to which a potential conflict has escalated, and not employ the *Shahab* missiles, which are expensive and of which there are not many, when it is not justifiable.

Further, if Iran succeeds in developing missile production on its territory, it may become a new global supplier of inexpensive missile technologies as well as of the missiles themselves. Iran's role in this regard may grow if it takes "decisive measures" towards North Korea and/or the unification of the two Koreas. In future, Iran could certainly become the regional supplier of missiles for states in the Middle East and Africa. The first indication of this could be the unconfirmed report of the delivery of ballistic missiles from Iran to Sudan in 1996, though it has been refuted by both countries.⁹⁸

The recent conflict in Lebanon is a telling example of the use of mobile launchers: a significant number of unguided solid-fuel missiles of varying ranges were launched against Israel. The large-scale use of these weapons had a strategic effect, since the normal functioning of Israeli border regions was evidently paralyzed. According to official sources, in 33 days of combat Hezbollah's missile brigades launched 3,970 missiles, killing 41 innocent civilians.⁹⁹ The intensity of the strikes on average comprised about 120 missiles per day. Moreover, it became clear that the launchers practically could not be destroyed from the air, and it was quite complicated to "catch" them during ground operations. In all, according to official Israeli data, 126 launchers were destroyed.¹⁰⁰

According to Israeli sources, the Hezbollah arsenal includes the following unguided missiles produced in Iran: *Falak-1*, -2 (with ranges of 10 and 11 km, respectively), *Fadjr-3* and *Fadjr-5* (with ranges of 43 and 75 km, respectively), *Nazit-6* (90 km), *Zelzal-1* (150 km), and *Zelzal-2* (400 km).¹⁰¹ The latter, as far as can be judged, had not been used in combat, though were the *Zelzal-2* to be launched from Hezbollah-controlled territory in Lebanon it would reach practically all of Israel. In fact, though, the *Falak* and *Fadjr* missiles were used in bulk. Their warheads vary from 50 kg (*Falak-1*) to 90 kg (*Falak-2* and *Fadjr-5*). In other words, on average 8.4 tons of explosives fell on Israel each day, comparable to the total mass of the 8-12 *Shahab-1-3* warheads.

Clearly were more powerful missiles like the *Nazeat* (with a 240-430 kg explosive charge, depending on the version of the missile) or *Zelzal* (600 kg warhead) to be employed, this number would increase considerably.

Thus, Iran already possesses what is essentially a *substrategic* weapon to use against Israel. However, this requires maintaining control of the borderlands near Israeli territory, making southern Lebanon analogous to Cuba when intermediate-range Soviet missiles were based there. Thus an expansion of the "security zone" under the control of U.N. forces or Israeli forces will decrease the effectiveness of most of the light Iranian projectiles; however, to balance the threat of heavier systems with greater ranges the occupation of a significant part of Lebanon would be needed, which is not acceptable to the international community.

In addition, the presence of Iranian tactical missiles in Lebanon makes the following scenario possible. If there is a confrontation with Israel, the large-scale use of long-range projectiles* and shorter-range intermediate-range missiles (SRINF) from Lebanese territory against well-known air defense weapons and Israeli air defense could lead to the mass use of *Shahab-3* ballistic missiles against strategic targets and facilities. If this were to happen, the ability of Israeli air defense to intercept all of the missiles is unclear.

Finally, the changed circumstances in Iraq should also be noted. It appears that in 2003-04 there was a sharp decrease in the Iranian missile program's development of new long-range missiles. Probably the Iranian missile industry was concentrating on improving the *Shahab-3* missiles in terms of accuracy, reliability, and operational characteristics. As a result of the U.S. invasion of Iraq, U.S. troops themselves have come very close to Iran's borders, putting them in the range of many Iranian tactical missiles. Thus, there are currently about 12 large permanent U.S. bases in Iraq that are located practically in a straight line through the country's central regions.¹⁰² In total, there are about 130,000 U.S. troops in Iraq today, the majority of whom are carrying out operations in the Shi'ite parts of the country that border Iran and are therefore within the range of Iranian "substrategic" missiles. It is possible that Iran might provoke an armed conflict in the Iraqi borderlands, among other things, to "draw in" U.S. troops, bringing them within reach of less long-range systems.

Under this scenario, the U.S. contingent would become a virtual hostage to U.S.-Iranian relations and far more vulnerable than U.S. bases in the Persian Gulf region and U.S. territory itself. Further, those who would be hit by Iran's tactical missiles would be military servicemen, making it possible to avoid blame for striking innocent civilians in the case of a strike. Accordingly, fairly simple and cheap systems could be used to strike the United States, making it possible for Iran to concentrate on enhancing *Shahab-3* missiles and gradually improving its characteristics. This hypothesis fits well into the basic postulates of Iranian military doctrine: deterring possible aggression by causing a potential aggressor to pay the maximum possible price for its actions.¹⁰³

Iran's experience testifies to the fact that the mass use of ballistic missiles against civilian targets does not lead to the desired effect, while the large-scale use of missiles in today's world is extremely expensive (according to some sources at the end of the "war of the cities" Iran was left with just 20 *SCUD-B* missiles).

Hence, it logically follows that Iran's missile arsenal today, when conventionally equipped, is chiefly for use as part of a fear tactic, aimed primarily against civilians or a potential enemy's large military facilities. In order to increase its effectiveness there must be investment in the modernization of existing missiles, firstly in increasing accuracy and secondly, and to a lesser extent, in increasing range, which is very expensive in terms of both time and money. One cannot exclude the possibility of a compromise solution, where the missiles' "bludgeon" is augmented by the "foil" of aircraft; the only candidate for such a role in the Iranian air force is the *Su-24*. However, in this case Iran would have to expend significant funds not so much for modernization, as for simply performing routine repairs on the aircraft. But if this were done, Iran's arsenal would then have a substrategic means of WMD delivery with increased accuracy, and if in-flight refueling capabilities were added (like those on the Soviet/Russian *Su-24M*) then the range would increase still further.¹⁰⁴

The prospects for intermediate-range missiles, strategic cruise missiles, and long-range bombers appear quite distant, primarily due to the significant costs of such systems, as well as the completely different technological level required for their development, production, and use. All things considered, it appears that promising R&D on this sort of system is being undertaken (primarily on cruise missiles and intermediate-range ballistic missiles); the Iranian arsenal may even come to include such high-tech systems as the Russian strategic *Kh-55* cruise missile.¹⁰⁵ From time to time there are reports of Iran's development of a space delivery system; however, practical results have not been achieved to date, which is indirectly indicated by the contract signed with Russia in early 2005 to launch an Iranian satellite.

Moreover, we are not talking about the possible presence of *Tu-22M* long-range bombers in Iran. The appearance of this sort of equipment in Iran would not go unnoticed, and there is not even a theoretical possibility that they could have been obtained from Ukraine, to say nothing of Russia.¹⁰⁶ Given the enormous cost of operating this type of equipment, it would seem that Iran simply does not need them, if judged on the basis of cost effectiveness.

Thus, Iran's only practical means of WMD delivery is the *Shahab*, of which the most recent modification, the *Shahab-3* poses the greatest threat. It is important to realize that Iran has broad experience in the operation of this type of missile; they were mastered by Islamic Revolutionary Guard units and apparently have been cured of all of the "children's ailments" faced by the *Shahab-1* and *-2*. It would seem that these are likely to be replaced by the *Shahab-3* ballistic missile in the near future as well as, most likely, solid-fuel missiles.

In analyzing potential delivery systems, one must consider not just the existence of one system or another in arsenals or even in series production, but also the system's ability to lift and deliver a nuclear charge to a target. It is nearly impossible to estimate the mass and dimensions of an Iranian nuclear warhead, but several Western analysts have surmised that they are to a large extent based on Chinese projects obtained through the A.Q. Khan network, and likely weigh 1-2,000 pounds (450-900 kg).¹⁰⁷ At present this weight can be carried by the Iranian delivery systems noted in Table 2.



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Table 2. Means for the Delivery of Nuclear Weapons Capable of Carrying Warheads Weighing at Least 500 kg.

Name	Range, km Min.-Max.	Weight, kg missile warhead		CEP, m	Engine type
Solid fuel Ballistic Missiles					
<i>Zelzal-2</i>	350–400	No information	600	No information	Solid fuel engine
Liquid Fuel Ballistic Missiles					
<i>Shahab-1 (SCUD-B)</i>	50–300	5,862	989	450–1,000	Liquid fuel engine
<i>Shahab-2 (SCUD-C)</i>	55–700	6,400	700	1,000	Liquid fuel engine
<i>Shahab-3 (Zelzal-3)</i>	1,300–1,500	16,000	760-1,100	1,000	Liquid fuel engine
<i>Shahab-4</i>	1,800–2,000	22,000	750–1,000	No information	Liquid fuel engine
Cruise Missiles					
<i>CSSC-2</i>	85	2,300	400		turboprop
<i>CSSC-3</i>	95	3,000	513		turboprop
<i>Raad</i>	150–400	No information	500		
Bombers					
<i>Su-24MK</i>	950 km with a payload totaling 2,500 kg 1,050 km with a payload totaling 3,000 kg and two auxiliary tanks	Maximum weight of individual bomb: 1,500 kg			

Thus, we see that at present there are two types of ballistic missiles and front-line *Su-24MK* bombers that could be considered substrategic nuclear weapons delivery vehicles, if Iranian physicists are able to decrease the size of potential nuclear charges and ensure that their weight is no more than 1,000 kg. If the mass of the nuclear charges can be further decreased, then the spectrum of means of delivery is considerably increased. However, this would seem to be likely only in the very distant future; that is, only the *Su-24MK* and *Shahab-2* and *Shahab-3* can be considered realistic delivery vehicles at this point in time. Moreover, the bombers could be used for pinpoint strikes, while the ballistic missiles would be used as a means to frighten and deter primarily neighboring Arab states and Israel with the possible use of WMD. The basic question remains: how capable is Iranian technology of creating a warhead suitable for use on a ballistic missile, in terms of mass and dimensions? One should remember that in the recognized nuclear weapon states, the first nuclear delivery systems were bombers. It is difficult to assess the cases of Israel, India, and Pakistan, since there is no detailed information on their nuclear warheads, but it is impossible to completely exclude the possibility that they have placed their warheads on missiles.

Iran's missile program does not threaten Russia at present. It would seem that Iran was never the target of Soviet/Russian strategic nuclear forces (like North Korea, which has a substantially more advanced missile program while that nation shares a border with Russia).¹⁰⁸ If Iran obtains nuclear weapons and intermediate-range missiles, it would seem that the main deterrent force will nonetheless primarily be airborne delivery systems: strategic and long-range aviation as well as the *Su-24M*, *M2* and *Su-34* tactical bombers.

CONCLUSION

It follows from the above analysis that Iran's missile and nuclear programs are not synchronized. Iran's missile program is developing according to its own internal logic. The "intersection" of the nuclear and missile programs, of course, is possible—not at present, but in the future, and of course only if Iran is really striving to obtain a nuclear bomb (which is not the subject of this article)

Given the complex negotiations on the Iranian nuclear program, the combination of these two issues could considerably harden the Iranian position and is therefore not advisable. 

Notes

- ¹ The research for this paper was conducted as part of a project funded by the U.S. Institute of Peace.
- ² Duncan Lennox, "Iran's ballistic missile projects: uncovering the evidence," *Jane's Intelligence Review*, June 1, 1998.
- ³ "Iran's war of the cities' experience," *Ballistic Missile Proliferation*, March 2000.
- ⁴ Ibid.
- ⁵ Duncan Lennox, op. cit.
- ⁶ Data cited from "Free Rocket Over Ground (FROG) artillery rocket system (Luna-M)," *Jane's Armour and Artillery*, January 21, 2004; "SS-1 'Scud' (R-11/8A61/8K11, R-11FM (SS-N-1B) and R-17/8K14)," *Jane's Strategic Weapon Systems*, July 28, 2004; "SS-21 'Scarab' (OTR21/9M79 Tochka)," *Jane's Strategic Weapon Systems*, July 28, 2004.
- ⁷ Yu. Nenakhov, *The "Miracle weapons" of the Third Reich* (Minsk: Harvest, 1999), p. 575.
- ⁸ "Iran's war of the cities' experience," op. cit.
- ⁹ Ibid.
- ¹⁰ Ibid.
- ¹¹ Robin Hughes, "Iran's ballistic missile developments—long-range ambitions," *Jane's Defense Weekly*, September 13, 2006.
- ¹² "Iran's war of the cities' experience," op. cit.
- ¹³ Duncan Lennox, op. cit.
- ¹⁴ The majority of Iran's military industrial facilities and densely populated regions are within 400 km of the Iran-Iraq border, and thus within range of Iraqi-built SCUD and Al-Hussein missiles.
- ¹⁵ "Procurement, Iran," *Jane's Sentinel Security Assessment—The Gulf States*, November 24, 2004.
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- ¹⁹ "Offensive Weapons—Unclassified Projects, Iran," *Jane's Strategic Weapons Systems*, January 26, 2005.
- ²⁰ "'SCUD-C' variant (Hwasong 6) and 'SCUD-D' variants (Hwasong 7)," *Jane's Strategic Weapons Systems*, June 15, 2004.
- ²¹ "Offensive Weapons—Unclassified Projects, Iran," op. cit.
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- ²⁷ “Shahab 3/4,” *Jane’s Strategic Weapon Systems*, June 15, 2004.
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- ³¹ Ed Blanche, “Iran forms five units for Shahab ballistic missiles,” *Jane’s Defense Weekly*, July 12, 2000.
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- ³⁶ *Jane’s Defense Weekly*, March 10, 1999.
- ³⁷ *Jane’s Missiles and Rockets*, February 1, 2004.
- ³⁸ Doug Richardson, “Iran is developing an IRBM, claims resistance group,” *Jane’s Missiles and Rockets*, January 1, 2005.
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- ⁴⁸ Ibid.
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- ⁵⁰ “Iranian Ministry of Defense head announced that recent test of Shahab-3 missile is of an exclusively defensive nature,” op. cit.
- ⁵¹ “Fateh A-110,” *Jane’s Strategic Weapons Systems*, June 15, 2004.
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- ⁵⁴ Ibid.
- ⁵⁵ “Offensive Weapons—Unclassified Projects, Iran,” *Jane’s Strategic Weapons Systems*, January 26, 2005.
- ⁵⁶ Ibid.
- ⁵⁷ Ibid.
- ⁵⁸ Ibid.
- ⁵⁹ “Iran conducts tests of new tactical missile,” *Jane’s Missiles and Rockets*, October 1, 2006.
- ⁶⁰ “Iran’s unconventional weapons and missiles,” <http://www.waronline.org/mideast/iran_wmd.htm>.

- ⁶¹ Dmitri Fomin, "The hunt for 'Scuds'," *Voyenno-promyshlennyi kur'er* (Military Industry Courier), December 14-20, 2005.
- ⁶² Ibid.
- ⁶³ Ibid.
- ⁶⁴ Harold Hough, "Iran targets the Arabian Peninsula," *Jane's Intelligence Review*, October 1, 1996.
- ⁶⁵ Ibid.
- ⁶⁶ Duncan Lennox, "Iran's ballistic missile projects: uncovering the evidence," *Jane's Intelligence Review*, June 1, 1998.
- ⁶⁷ "Tzakhal' destroyed Iranian launchers in 34 minutes," <<http://www.pwgs.org/news/25-10-2006.htm>>, news from October 25, 2006. AAA PWG SYSTEMS, last accessed April 20, 2007.
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