LESSONS OF IRANIAN MISSILE PROGRAMS FOR U.S. NONPROLIFERATION POLICY

by Aaron Karp

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Recent disclosures about Iran's long-range ballistic missile program have dramatically reoriented debates over how to deal with missile proliferation threats. How this new challenge is addressed depends partially on technical assessments of Iranian capability. Even more salient are the political factors governing Iran's ability to acquire that technology. The immediate priority for countering Iranian proliferation is finding ways to deal with exports from China, Russia, and, to a lesser degree, North Korea.

In addition to the specific problem of Iran's strategic ambitions, its programs raise two general challenges for U.S. foreign policy. First, how should the United States handle the most intractable regional proliferators? The mechanisms that worked with countries like Argentina, South Korea and Ukraine are less effective with remaining proliferators like North Korea, India and Pakistan. The second group has not responded to the same combination of export controls, sanctions, economic incentives, and security assurances that worked so well with the first. These countries are more determined and less amenable to outside influence. Iran's proliferation challenge is another one seemingly immune to old nonproliferation formulas. Additional sanctions—like those in the 1998 Iran Missile Proliferation Sanctions Act, may slow Iran down somewhat, but by no more than a few years

Secondly, Iran raises the delicate issue of how to build better relations in general with important regional actors who refuse to cooperate on key issues. In President Muhammad Khatami and Secretary of State Madeleine Albright, both Iran and the United States have powerful advocates of dialogue.[1] But flexibility is constrained by many factors, of which Iran's ballistic missile program is the most visible. Recent revelations of the *Shahab* missiles hardly could have come at a worse moment, just as Iran's relations with the West are beginning to improve after 19 years of confrontation. While Washington and Tehran take tentative steps toward rapprochement, neither can expect the other to budge on essential premises of national policy. America will not dilute its commitment to nonproliferation and Iran will not compromise on its strategic interests.

Iranian weapons proliferation is all but guaranteed to constrain and maybe prevent meaningful rapprochement. The problem is similar to that faced by the United States in its efforts to improve relations with countries like India and Pakistan where proliferation issues top the bilateral agenda. Despite its reputation for revolutionary fervor, though, Iran may be the most flexible of all of these countries. In both nonproliferation and regional foreign policy, Iran is emerging as a "test case" for developing new approaches to deal with these fundamental problems of American and Western regional relations. In the long run, there may be no alternative to dealing directly with Iran itself.

This article analyzes Iran's missile programs from the context of U.S. nonproliferation policy. It begins by discussing the increased salience of the Iranian threat on the U.S. nonproliferation agenda. It then traces in detail the technical evolution of various missiles in the Iranian arsenal, as well as their limitations. The article next considers the important—yet often overlooked—factor of "soft technology," the human and organizational obstacles that have constrained Iran's missile programs to date. Finally, the analysis turns to external factors and conditions within Iran's potential suppliers, particularly China and Russia, where new conditions of growing pluralism are rendering old-style nonproliferation controls ineffective. The article concludes by providing guidelines for a new U.S. nonproliferation strategy regarding Iran. Like other intractable actors, Iran must be addressed through more than new sanctions alone. Ultimately, there may be no alternative to creating a more balanced political relationship, leading to a tailored "packaged deal" combining new nonproliferation instruments with economic and political initiatives.[2]

IRAN'S NEW SALIENCE

America's previous debate over missile proliferation surrounded the National Intelligence Estimate NIE-95-19 "Emerging Threats to North America During the Next 15 Years," issued in November 1995. Although this document dealt with global threats, the debate it catalyzed focused almost entirely on the missile projects of one country—North Korea.[3] Since then, North Korea's projects have slowed, losing their erstwhile urgency.

Today's debate over missile proliferation and missile defense is being propelled instead by revelations over Iran.[4] Once again, a regional rocketry program has become an intellectual prism, diffracting issues that go far beyond immediate technical matters. Of central importance are broader questions regarding nonproliferation objectives, missile defense, and Middle East strategy. Equally salient are foreign policy questions about relations with Iran, engagement of difficult regional actors, in general, and the prospects for policies based on sanctions and export controls.

Missile programs elsewhere are no less provocative. Iraq has abandoned none of its long-range rocketry ambitions, including plans for a 3,000-km weapon, sufficient to reach Paris.[5] Saddam is only waiting for a second chance to scour the international market for useful materials. North Korea's *Taepo-dong* projects may have subsided, but it appears to have gone back to concentrate on the *Nodong* series.[6] Egypt appears to be receiving new installments of technical assistance from North Korea, probably supporting improved Scuds.[7] India continues development of its 2,500-km *Agni*, with a new version currently being prepared for flight test, now clearly intended to carry nuclear warheads.[8] Pakistan has renewed its own long-stymied missile program through the 1,500-km *Ghauri*, test-fired on April 6, 1998.[9]

Missile proliferation is a global problem, but the focus on Iran is justified and useful nevertheless. Although we are accustomed to treating Iran as a revolutionary state, an exception in every way, its missile projects are typical in some respects of the technical and political problems of regional long-range rocketry in the late-1990s, illustrating many key general issues for the future of missile proliferation.

INDIGENOUS CAPABILITIES

Iran's long-range rocketry and ballistic missile program has long been one of the great enigmas in the spectrum of global proliferation concerns. Detailed information is spotty and general understanding weak. What can be concluded is that Iran's ballistic missile program appears to be roughly comparable to that of Pakistan, but less advanced than North Korea and well behind India. Although Iran has been trying to acquire long-range missiles since the mid-1970s, its efforts have met with unprecedented frustration. No other country has tried so hard and achieved so little.

Since starting under Shah Mohammed Reza Pahlavi, Iran has created a broad missile development infrastructure.[10] Its efforts can be divided into four basic programs: a solid fuel effort that led only to artillery rockets, a stillborn Scud-based program, a cruise missile program, and most recently a renewed intermediate-range ballistic missile (IRBM) program.

Even after some 25 years of work, Iran's greatest strength is manufacturing small-diameter solid motors, best suited for use in unguided artillery rockets. It has been extremely difficult for Iranian engineers and chemists to move beyond primitive double-based fuels to the more modern composite fuels better suited for larger weapons. Solid motor experience may be based on Chinese assistance, but the Chinese role appears to have been exaggerated in many accounts. Although China obviously is the source of Iran's cruise missile capability, none of its large artillery rockets closely resemble any known Chinese counterpart. A major question is whether Chinese firms have helped Iran move beyond their frustrations with double-based propellants.

The solid fuel program run by Iran's Missile Industries Group has unveiled numerous prototypes, none completely satisfactory. Time and again, Iranian engineers have unveiled new artillery rockets; their projects betray poor design, exceptional redundancy, and limited deployment at best. Despite its frustrations, Iran today is a world leader in the development of large artillery rockets, with ranges of 40 to 200 km.[11] These might not individually be very effective delivery systems, but any technical weakness could be compensated by their low cost. Deploying large numbers or arming them with chemical or biological agents could compensate for any technical weakness and saturate any defensive system.

Despite their significant tactical potential, even the largest artillery rockets, however, will not serve Iranian strategic priorities. Iran undoubtedly has tried to scale-up its solid motors, but without visible result. Although the general recipes for advanced solid fuels are well known, the manufacture of large fuel grains requires considerable chemical and manufacturing finesse. The Soviet Union required 25 years to master this technology, and China took even longer. Iran will require substantial foreign assistance to make faster progress.

THE SCUD DIVERSION

Iran's efforts to develop liquid propulsion have been no more successful, limited until recently by the weaknesses of its leading technical ally, North Korea. After modest transfers from Syria, Scud missiles and manufacturing wherewithal from North Korea began flowing into the country in 1985. Iran fired roughly 110 of them against Baghdad during the 1988 War of the Cities, seriously frightening the Baathist leadership, but not altering the course of the war.[12] Others were fired at anti-Iranian revolution *Mujahideen* forces as recently as 1994.[13] Scud development was an obvious route for Iran; the missile can be reverse engineered for production, readily stretched to ranges of approximately 1,000 km, and adapted to many specific uses.

North Korea had no inhibitions about helping Iran, but its support has been disappointing. Iran's inventory of approximately 210 Scuds apparently has not risen since the last consignment of North Korean Scud-Cs arrived in the early 1990s.[14] After building a Scud facility with North Korean help, according to the U.S. Defense Department, "the Iranians are now able to produce the missile themselves."[15] One of the many enigmas of Iranian rocketry is its failure to use this Scud production capability. The most likely explanation is that North Korea cannot supply essential manufacturing materials.

At one time, Iran was interested in the North Korean *Nodong*, usually described as a 1,000- to 1,300-km weapon based on Scud technology. Iranian officials were present for the first flight of the *Nodong* in May 1993. Development of the *Nodong* slowed to a crawl thereafter, roughly coinciding with negotiation of the October 1994 Agreed Framework, which halted Pyongyang's nuclear program. It also was at this time that North Korea's much more ambitious *Taepo-dong* missile project was discovered, raising the possibility that Pyongyang had traded a weak project for one based on different concepts and technology. Whether technical problems or a political decision stymied the *Nodong*, Iran was compelled to find an alternative.

Japanese sources now say that North Korea has gone back to the *Nodong*. This was partially confirmed by reports that the *Ghauri* missile launched by Pakistan in April actually was an imported *Nodong*.[16] If so, Iran may turn to North Korea again. But there are serious limits to North Korean assistance. North Korea is even more isolated than Iran, cut off even from imports of raw materials and components, and its engineering skills are little better. In some respects, its technology is inferior to Iran's—especially in solid propulsion—giving Iran strong incentives to look elsewhere for assistance.[17]

A CRUISE MISSILE ALTERNATIVE?

With much less visibility than its ballistic missile projects, Iran also has been at the forefront of regional efforts to develop cruise missiles. So far, its efforts in this area have been restrained by lack of advanced technology, weak aerodynamic infrastructure, and a low funding priority. Yet Iranian interest in cruise missile options is unmistakable and, given the growing availability of relevant dual-use technology like global positioning satellites (GPS) for guidance, further progress seems extremely likely.[18]

Iran reportedly is extending the range and accuracy of Chinese-supplied HY-1 Silkworms. Based on readily mastered technology from the 1950s, the Silkworm and its Russian counterpart (the Styx) are to cruise missiles what the Scud is to ballistic missiles: cheap, easily reverse-engineered, and well suited to modification and mass production.[19] Although this rocket-propelled cruise missile has a designed range of only 80 km, Western experts believe this can be extended to ranges of 400 km and perhaps more. To develop its cruise missile potential, Iran can take advantage of poorly regulated dual-use equipment. Its Styx/Silkworm modification work is believed to benefit from direct Russian assistance. Iran also has more advanced Chinese supplied C-801/802 anti-ship weapons (resembling the French Exocet and U.S. Harpoon), which could be modified to fly roughly 500 km.[20]

Despite their important advantages, cruise missiles are not yet alternatives to long-range ballistic missiles. By concentrating deployment of cruise missiles to its coasts, Iran leaves no doubt that it continues to view them primarily as naval weapons. As the ranges of follow-on systems grow and new guidance technologies are perfected, land-attack missions will become more likely. A new generation of cruise missiles—such as stretched Styx/Silkworm versions redesigned for air-breathing propulsion—could give Iran weapons effective to ranges of approximately 600 to 800 km.

Without massive foreign assistance, though, Iran will find it extremely difficult to develop cruise missiles able to reach farther within the next 15 years. To do so would require granting much higher national priority to cruise missiles and levels of financial and engineering commitment so far reserved for ballistic missiles and other weapons, like armored vehicles.

Cruise missiles must be taken seriously by Western planners, even if they are unlikely to overcome the range limitations of Scud-type weapons. In lieu of sudden technical leaps, they are an ancillary system, essentially a low-tech, fallback option. Other things being equal, Iran will deploy them in conjunction with Scud-type weapons, taking advantage of their lower cost, greater accuracy and more effective delivery of some warheads, especially chemical and biological weapons (CBW).

RISE OF THE *SHAHABS*

In the mid-1990s Iran started two new projects to develop long-range ballistic missiles, the *Shahab*-3 and -4.[21] The revelations about these two projects are not without credibility problems. They come almost exclusively from Israeli sources seeking American financial support for the Arrow theater missile defense (TMD) system, and from Iranian expatriots trying to mobilize opposition to the Islamic government. While both sources may exaggerate aspects of the two new weapons, there is a growing consensus on their general characteristics.

Shahab-3 is reported to be a solid-fuel weapon capable of carrying a 700-kg payload to a range of 1,300 km. It appears to be totally new Iranian design. Its characteristics do not match any known Russian or Chinese weapon. The closest counterparts are the larger Soviet SS-22 and the smaller SS-23, both eliminated under the 1987 Intermediate Nuclear Forces (INF) Treaty, although Bulgaria and Slovakia still have small numbers of SS-23s. The closest Chinese counterpart was the DF-25, a larger (1,700-km range) solid-fuel missile under development in the mid-1980s. The latter reportedly was cancelled in the mid-1990s for lack of a requirement from the Chinese People's Liberation Army.[22]

The most likely possibility is that the *Shahab*-3 is a domestic Iranian design, but with extensive foreign assistance to accelerated fuel casting, casing, and nozzle fabrication. According to Israeli reports, engine development for the *Shahab*-3 is nearing completion and the missile could be flight tested as early as 1999-2000, although more work undoubtedly will be necessary to master the complicated problems of fuel casting to insure predictable performance. The status of other essential subsystems is unknown.

Shahab-4 appears to be a liquid-fuel weapon based on and possibly copied from the 1950s Soviet SS-4 Sandal (or R-12). The latter could carry a payload of 1,360 kg to a range of 1,940 km. Best-known for its role in the Cuban missile crisis, it too was banned by the INF Treaty. A complicated system, it required a fleet of 20 vehicles to transport and launch.[23] Although later simplified through use of semi-storable fuels, it never was easily transported nor could its vulnerability overcome by adapting it for silo launching.

The SS-4 might appeal not as a weapon to be deployed but as an educational vehicle, helping Iranian engineers master techniques necessary for other things in the future. Static engine tests undertaken by Iran in late 1997 mostly likely involved a liquid motor (under favorable conditions, liquid motors can be run over and over, while solid motors usually must be replaced completely). The SS-4 was powered by the 65,000-kg thrust RD-214, a typical Soviet design of the period and a close relative of the Scud's engine. Although its scale far surpasses anything in Iran's previous experience, it would be a sensible choice for a country beginning to master long-range rockets. It also is possible, but less likely, that Iran's liquid propulsion relies on North Korean technology.

Neither *Shahab* is being managed like a systematic American or NATO procurement program. Rather than clear strategic goals or a rigorous time schedule, they appear to be motivated by a general Iranian desire to have long-range ballistic missiles and the availability of foreign assistance. They are essentially opportunistic undertakings, driven not by strategy but by access to technology and resources. It is enough for Iranian leaders that the weapons could serve a variety of purposes and that their development is feasible.

Neither project is systematically conceived, since essential components and sub-systems are unavoidably absent or lag far behind. In lieu of reliable suppliers, they rely on improvisation, progressing not smoothly but in fits and jerks interrupted by long pauses. Iran will complete these weapons if and when feasible; it is doubtful if project managers specify milestone dates in terms more rigorous than periods of several years.

With missiles, as with other weapons, Iran resembles not so much a determined proliferator as what Brad Roberts calls a "dabbler," pursuing opportunities as they appear.[24] This does not make its programs any easier to stop. Indeed, the opportunistic and improvised nature of Iran's long-range rocketry makes it virtually impossible for outside powers to stop it altogether. But its dependence on foreign technology makes it vulnerable to interruption.

HARD TECHNOLOGY

After over 25 years of rocketry research, Iran has a considerable technical endowment. The essential equipment to create long-range missiles of mid- to late- 1950s vintage appears to be largely in hand. If Iran decides to give the program higher national priority, making the leap from a dabbler to a determined proliferator, it could have a long-range system sufficiently advanced for flight testing to begin within two years, although key technologies still would have to be mastered. The pacing technology no longer appears to be propulsion or guidance. It is more likely to be warheads and re-entry vehicles.

If minimal performance characteristics are acceptable, there may no longer be a hardware barrier to IRBM deployment. If the engine tests this winter were successful, a prototype flight article of the *Shahab*-4 could be ready within a year. An unproven, "stove-pipe" weapon could be deployed within two years. A minimally reliable weapon (50 percent or less) based on approximately six flight tests could be deployed in about five years. A high reliability weapon (75 percent or better) would require at least 12 test flights and approximately eight years to develop and deploy.

If Iran benefits from sufficient foreign assistance and a solid motor of suitable diameter can be mastered, the *Shahab*-3 could be deployed slightly faster than its liquid-fuel stable mate, since less flight-testing would be necessary. If it is ready for flight test in 1999-2000, an all-out push might make deployment of a small quantity at minimum reliability possible in 2001. More could be deployed with higher reliability in 2003.

Guidance, the traditional bottleneck after propulsion, could be overcome if specifications are relaxed to permit minimal accuracy. Although inertial navigation systems (INS) are highly desirable, they are not a *sine qua non* of ballistic missile development. Simple gyro systems can be adapted from other tactical missiles for ballistic missions. Used in conjunction with radio-command guidance, a missile can be flown to intermediate ranges with sufficient accuracy to deliver a nuclear warhead. Although the system is vulnerable to jamming (signals can be intercepted from test-flight telemetry and countermeasures readied) adroit signal management can minimize such risks.

Warhead problems are much harder to overcome. Despite the obvious strategic connection, Iran's nuclear program does not appear to be accelerating to match its missiles. A recent study concludes that "Most experts feel that Iran has all the basic technology to build a bomb, but only keeps a low to moderate level weapons design and development effort."[25] The round of nuclear tests by India and Pakistan in May 1998 may inspire Iran to pursue its own nuclear option more aggressively, but the weaknesses of its program still must be overcome. Unless its nuclear program receives massive foreign assistance, possibly including the import of fissile material, Iran must rely on conventional explosives or CBW for many years to come. Iran probably has experimented with chemical warheads for its Scuds, but their destructiveness is difficult to test and would be unknown until actual use.

Another question concerns re-entry vehicles (RVs). Unless Iran has a foreign-developed re-entry system, the range of its first IRBMs will be limited to approximately 1,000 to 1,200 km. Greater ranges involve higher re-entry speeds and concomitant heating and instability, necessitating more advanced RVs, which Iran is not capable of creating rapidly by itself.

As for ICBM potential, Iran faces enormous technical barriers. Development of an IRBM like the *Shahab*-3 or -4 is a vital stepping-stone to larger systems, but ICBMs require far greater levels of support and entirely new technologies. Iran would have to master much higher performance specifications and the completely foreign engineering problems of engine clustering, multiple staging and systems integration. It would have to acquire INS and a highly destructive warhead. Overcoming these problems would require at least 15 years and is likely to be impossible without considerable foreign aid.

SOFT TECHNOLOGY

While selected imports might accelerate development and improve performance, the most difficult barriers facing Iran's missile program may have nothing to do with hardware. They are in realm of so-called "soft technology": decisionmaking, management expertise, engineering skills, and finance.[26] In rocketry, as in other aspects of its military industrial program, such as armored vehicles and artillery, Iran has proven its ability to create new prototypes, but it has been less successful in bringing these designs to series production. Several factors are worth examining.

Problems in the Decisionmaking Structure

Poor decisionmaking has been especially significant. Iranian political leaders have been unwilling or unable to streamline the nation's rocketry projects. Resources continue to be divided between the *Pasdaran* (the Islamic Revolutionary Guard Corps), the Army, and the Ministry of Defense.[27] With roughly a dozen missile projects under way simultaneously, resources cannot be concentrated for maximum effect. Because of their unprecedented scale as development projects, this problem will be most severe for the *Shahab*-3 and -4.

The critical decision for Iran may be to pick a clear preference, something it has avoided historically. Eventually, the Iranian government will recognize that the Missile Technology Control Regime (MTCR) is not the only enemy of the *Shahab*-3 and -4; each missile, rather, is the worst enemy of the other. It is when we see Iran making a choice between them that we should become most alarmed.

Trained Personnel Shortages

Shortfalls of skilled personnel limit Iran's ability to absorb foreign technology, both dual-use and dedicated missile design and production equipment. Iran's missile program appears to have competent engineers on top, but its human resources grower weaker as one goes down the chain of command. Design may be adequate, but development is poor, system integration worse, and production extremely difficult.

This problem undoubtedly is responsible for Iran's efforts to create educational centers for missile training. Two Russian institutions are heavily involved: the Bauman National Technical University in Moscow and the Baltic State Technical University in St. Petersburg (before 1990, the Military Mechanical Institute imeni Ustinova). The latter established a joint missile education center in Persepolis under the direction of Iran's Sanam Industries Group, an arm of the Iranian Defense Industries Organization (DIO), which reportedly directs the nation's solid-fuel rocketry program.[28]

Closing down these training centers must be a high priority, but it may be difficult. Russia has undertaken symbolic steps, like expelling in November 1997 a highly visible Iranian caught trying to buy missile technology.[29] But institutional cooperation continues. Until this can be halted, efforts must be made to assure that theoretical training stays to a minimum, that the new centers do not become vehicles for dispatching Russian rocketry and missile experts, and that they do not facilitate transfers of MTCR-controlled equipment.

When bringing Russian experts to Iran is too sensitive, it still may be feasible for Iran to subcontract specific tasks to Russian groups for assistance. For example, Iran's Shahid Hemmat Industrial Group reportedly has enlisted the services of the Russian Central Aerohyrodynamic Institute for missile design and development support.[30]

In addition to Russia, there are other sources for human assistance. North Korea already has supported Iran's missile program and created much of its Scud missile infrastructure. Transfers probably include partial engineering for the still incomplete *Nodong*. There still may be North Korean missile-engineering cadres there. More support could come following the collapse of the North Korean state.[31] This could release a flood of scientists and engineers unmatched since the collapse of the Soviet Union in 1991.

Cost

Finances will remain a serious problem for years to come. Iranian military spending fell from an estimated \$11.5 billion in 1986 to \$3 billion in 1994 (in constant 1994 U.S. dollars). Even after rebounding to \$3.8 billion in 1996, there is virtually no latitude for expensive new programs.[32] Nor is it clear where additional funds might come from. The prospect of new oil deals with Western petroleum firms is offset by the unstable price of oil.

Unless new funding or new elasticity in government spending can be found, budgets are unlikely to permit anything beyond prototypes and very limited deployment of new weapons. Financial problems will not halt Iranian rocketry. But unless budgets rise swiftly and consistently, finances will slow technical progress, delaying deployments by several years.

THE NEW POLITICS OF TECHNOLOGY SUPPLIERS

After the choices Iran itself makes, the next most important questions are the export policies of China and Russia. They are Iran's most important technology suppliers, the only ones capable of transforming Iran into a long-range missile power. Both clearly are supplying equipment, development assistance, and manufacturing facilities. Both also are extremely difficult for Washington to deal with, sharing a well-known pattern of officially denying involvement, eventually promising to halt further assistance, but continuing nonetheless.

A typical cycle of this pattern began in January 1997 when Israeli sources revealed that Russia was aiding Iran's missile program. Russian officials initially denied any involvement. Later, they claimed that Iranian efforts to acquire Russian technological assistance had been thwarted. On October 26, 1997, Foreign Minister Evgeniy Primakov said that "There is no basis to rumors that the Iranians are receiving missiles from Russia."[33] Perhaps the most revealing comment came from Yuri Koptev, director of Glavkosmos, who dismissed the matter by saying "The 13 cases which our American colleagues have so nicely informed us of have been considered and we have provided detailed explanations."[34] U.S. officials and press revelations leave no doubt that Russian technical assistance continues.[35] Although Russian officials are more outspoken, they are following a pattern set by China in its aid to Iran and Pakistan.

The Chinese and Russian pattern of "transfer/deny/pledge but continue" can be explained in three different ways, each based on a different view of the nature of their national governments. These alternatives point to the conclusion that nonproliferation policy in Beijing and Moscow is determined not by official decisionmaking, but by the deteriorating control of the governments themselves.

Proliferation policy has become part of larger constitutional question about the future of the Chinese and the Russian states. Does the central government still call the shots, or do individual exporters? The alternate explanations for decisionmaking in China and Russia can be summarized according to three possible models: *formal authorization*, *informal acquiescence*, or *contraventions of policy*.

Formal Authorization

China or Russia may be transferring ballistic missile technology with explicit and formal authorization from their central governments, which may even positively encourage such transfers. If so, their promises and assurances to the contrary are disinformation for foreign consumption. The implications are very disturbing for diplomacy, since the integrity of their leaders comes into question.

On the other hand, even if there is a yawning gap between declaratory statements and action policy, the outlook for future control is not so discouraging. Since the formal institutions of government remain effective, strenuous diplomacy can work. Pressure must be strong and expensive incentives may be necessary. The degree of interaction necessary to control proliferation may have changed, but not the kind of interactions. Formal state-to-state diplomacy, both bilaterally and through multinational nonproliferation regimes alike, still hold the best promise of success.

Informal Acquiescence

The governments in Beijing and Moscow may be unsure of their national interests and unwilling to act decisively.[36] Their policies may be essentially passive, based on a blind eye, tolerating transfers that serve some clear and immediate national interests—such as the welfare of key technological sectors—while potentially harming only speculative and long-term security interests.[37]

If so, the statements and pledges of their officials may represent genuine intentions, but they are not sufficient to make policy. In this case, the interests of Western nonproliferation policy lie in inducing their leaders to make decisions and regularly reiterate them, both in highly visible declarations and through official regulations and inter-agency consultations to insure compliance throughout the government.

Contraventions of Policy

The authority of central governments in Beijing and Moscow may have deteriorated to the point that policy is unenforceable. Agencies and firms no longer respond to regulations and follow their own inclinations. Regional and economic interests have overwhelmed the ability of the state to regulate economic behavior. The weakness of the state may be uneven, affecting some sectors more than others. This would explain why Chinese missile policy continues to be virtually laissez-faire although its nuclear export control have tightened considerably.[38]

If the state is essentially incompetent in nonproliferation and national leaders are all but irrelevant, there is little to be accomplished through traditional diplomacy. Instead, to be effective, measures must deal directly with the immediate agents of proliferation, the offending firms and laboratories. Some of these may be within reach of carrots and sticks. Others have no export markets beyond proliferators like Iran; they have no Western business, no reason to cooperate with Washington. The only solution may be restructuring or closing them outright.

CONCLUSION: IMPLICATIONS FOR U.S. POLICY

The implications of these questions are so troublesome that Western officials typically avoid even acknowledging them. Yet it would be misleading to continue ignoring the mounting evidence that neither Russia nor China can be dealt with in the traditional manner of orthodox states. Formal regimes like the MTCR and the Wassenaar Arrangement for dual-use technology are designed to regulate interactions between states. They are of dubious utility when individual ministries, firms, and laboratories are able to flout state authority. The tough sanctions against Russia mandated by the 1998 Iran Missile Proliferation Sanctions Act, for example, promise greater international pain but little nonproliferation gain; Russia simply may lack the ability to act effectively, regardless of its intentions.

If the Chinese and Russian central governments no longer run nonproliferation policy, as increasingly appears to be the case, traditional nonproliferation mechanisms like the MTCR, sanctions, and embassy *demarches* probably have passed their point of marginal returns. The same can be said of more imaginative bilateral arrangements. Since 1993, the United States has invested more than $470 million in the Russian space program. This keeps Russia's manned space program alive, but it has been irrelevant to missile-related exports.[39] Efforts to end missile-related exports by offering compensation in the form of space launch contracts, while very lucrative for Russian and Chinese space launch agencies, also are unlikely to be effective, since they do not directly compensate missile makers and exporters.[40]

Even if the MTCR cannot stop Iranian ballistic missiles, it is essential to delaying Iranian progress. Meanwhile, existing nonproliferation policies, based on government-to-government cooperation probably should be broadened to deal with the new challenges. Restraining Iranian proliferation may require shifting our focus from supplier countries to individual firms, such as Russian rocket engine-maker NPO Trud, NPO Polyus, China Great Wall Industries, China Precision Engineering Corporation, and even Russian and Chinese government-run laboratories. If so, new mechanisms, tailored to deal not with governments but with recalcitrant ministries and firms, will be essential if today's flow of technology is to be significantly restrained.

Unless sudden leaps can be made toward better Iranian-American relations—a distant hope to be sure—TMD almost certainly will be needed to insure Middle East stability and preserve American strategic options when Iranian IRBMs are deployed. So long as Iran relies on indigenous weapons, existing deployment plans for defensive programs like Arrow, the Theater High Altitude Area Defense (or its successor), and Navy Theater Wide will be adequate to meet Iran's capability as it emerges. But if Iran prepares to purchase off-the-shelf weapons such as the *Nodong*, accelerated TMD deployment may be necessary. What must be appreciated more widely than it is today, however, is that while TMD may be necessary, it will not solve the basic problem created by Iranian missile ambitions.

In the long term, neither export controls nor defenses are likely to be sufficient. No export control system will stop all Iranian progress. No defense will stop all Iranian missiles. As with other successful nonproliferation efforts, control of Iranian weapons of mass destruction and delivery systems almost certainly will come only through a broader relationship with the proliferator itself.[41] This might take the form of additional "soccer" diplomacy and other cultural exchanges, yielding to enhanced trade, and culminating in the short term with a strategic dialogue. The precise form is secondary to the general problem of creating a political relationship that goes beyond the perennial issues of proliferation and terrorism, permitting discussion of mutually acceptable solutions for regional security. Although it has not brought the rapid success that many had hoped for, Secretary of States Albright's effort to create a more balanced bilateral relationship with Iran offers a potentially worthwhile alternative to confrontation.

It is tempting to see improved bilateral relations as a reward for Iranian concessions, but this would only undermine political prospects without affecting Iranian strategic intentions. Engaging Iran, developing a meaningful bilateral dialogue strong enough to address delicate subjects like proliferation and rich enough to offer useful trade-offs, should not necessarily be a reward to Iran for giving up its strategic programs. Engagement, rather, may be essential if the Iranian challenge is to be controlled.

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1 Peter Sawchyn, "Gulf Policy Experts Call for More Dialogue between US and Iran," *USIS Wireless File*, April 22, 1998.

2 On the most important precedent for package deals see Michael J. Mazarr, *North Korea and the Bomb* (New York: St. Martin's Press, 1995), pp. 226-231.

3 Aaron Karp, "The New Politics of Missile Proliferation," *Arms Control Today* 26 (October 1996), pp. 10-14.

4 For example, see *Ballistic Missile Threat from Iran*, Hearing before the Military Research and Development Subcommittee of the House National Security Committee, November 5, 1997.

5 "Iraq's Program of Mass Destruction," *Fact Sheet*, The White House, November 19, 1997.

6 "Japan Plans Ballistic Missile Defence Decision," *Jane's Defence Weekly*, February 25, 1998, p. 3.

7 "U.S. Checking Sale of Missiles," *International Herald Tribune,* June 22-23, 1996, p. 1; Barbara Starr, "CIA Discloses Source of Egyptian 'Scud-B' Parts," *Jane's Defence Weekly*, July 9, 1997, p. 5.

8 "India Ready for Lift-Off on Agni Missile Production," *Jane's Defence Weekly*, February 25, 1998, p. 17.

9 Zahid Hussain, "Pakistani Missile Can Hit Delhi," *The Times* (London), April 7, 1998.

10 Joseph S. Bermudez, Jr., "Iran's Missile Development," in Harlan Jencks and William C. Potter, eds., *The International Missile Bazaar* (Boulder: Westview, 1994), Chapter 3.

11 A few have been at least partially successful, especial the Oghab and Nazeat series. Others never reached operational service, including the *Shahin*-1 and -2 and the mysterious *Mushak* and *Zelzal* series. The most recently revealed was the NP-110, with an estimated range of 130 to 170 km, described in Bill Gertz, "China Joins Forces with Iran on Short-Range Missile," *The Washington Times*, June 17, 1997, p. A3.

12 W. Seth Carus, *Ballistic Missiles in Modern Conflict* (Westport: Praeger, 1991), pp. 8-9, 37.

13 "Iran Fired...," *The Economist*, November 12, 1994, p. 6.

14 *The Military Balance 1997/98* (London: Oxford and the IISS, October 1997), p. 126.

15 U.S. Department of Defense, *Proliferation: Threat and Response 1997* (Washington, D.C.: U.S. Department of Defense, November 1997), p. 6.

16 Tim Weiner, "U.S. Says North Korea Helped Develop New Pakistani Missile," *The New York Times*, April 11, 1998, p. A3.

17 Reports that Iran's solid fuel *Shahab*-3 missile is "based on a North Korean design," cannot be reconciled with North Korea's minimal solid fuel expertise and probably should be dismissed. Cited in Eric Schmitt, "Senate Passes Bill to Punish Giving Missile Help to Iran," *The New York Times*, May 23, 1998, p. A3.

18 W. Seth Carus, *Cruise Missile Proliferation in the 1990s* (Westport: Praeger and the Center for Strategic and International Studies, 1992); K. Scott McMahon and Dennis M. Gormley, *Controlling the Spread of Land-Attack Cruise Missiles* (Marina del Ray: American Institute for Strategic Cooperation, 1995).

19 But they are not completely comparable. As an anonymous reviewer of this article noted, "It is marginally more difficult to produce the Volkhov (mod) engine used in this cruise missile than the Scud engine (due to finer tolerances for the shells and corrugates)."

20 Dennis M. Gormley, "Hedging against the Cruise-Missile Threat," *Survival* 40 (Spring 1998), pp. 97-98; Alan George, "Iran Uses Styx Technology in Cruise-Missile Development," *Flight International*, November 16, 1994.

21 The first report came from Kenneth Timmerman, *The Iran Brief*, September 9, 1996, pp. 1-2, and October 1, 1996, p. 3, which refer to the *Zelzal*-3. Another early and detailed report was

Barbara Opall, "Israelis Say Russia Aids Iran's Quest for Missiles," *Defense News*, February 10, 1997, p. 1.

[22] According to a report by SIPRI researcher Eric Arnett in *Jane's Defence Weekly*, December 4, 1996.

[23] Steven Zaloga, "The Missiles of October: Soviet ballistic Missile Forces during the Cuban Crisis," *Journal of Soviet Military Studies* 3 (June 1990), pp. 307-323.

[24] Brad Roberts, "Rethinking N+1," *The National Interest* 51 (Spring 1988), p. 77.

[25] Anthony H. Cordesman and Ahmed S. Hashim, *Iran: Dilemmas of Dual Containment* (Boulder: Westview, 1997), p. 306.

[26] The concept of soft technology is developed more fully in Aaron Karp, *Ballistic Missile Proliferation: the Politics and Technics* (Oxford: Oxford University Press, 1996), pp. 51-98.

[27] Shahram Chubin, "Arms procurement in Iran," in Eric Arnett, ed., *Military Capacity and the Risk of War* (Oxford: Oxford University Press and SIPRI, 1997), pp. 233-234.

[28] Bill Gertz, "Russia Conspiring with Iran on Missiles," *The Washington Times*, February 23, 1997, p. A1.

[29] Michael R. Gordon, "Russians Order Expulsion of Iranian Detained as a Missile Spy," *The New York Times*, November 18, 1997, p. A10.

[30] Bill Gertz, "Russia Disregards Pledge to Curb Iran Missile Output," *The Washington Times*, May 22, 1997, p. A3.

[31] Amos A. Jordan and Jae H. Ku, "Coping with North Korea," *The Washington Quarterly* 21 (Winter 1998), pp. 33-34; Barbara Starr, "N Korean Government 'Could Collapse by 2001,'" *Jane's Defence Weekly*, January 7, 1998, p. 14.

[32] *World Military Expenditures and Arms Transfers 1995* (Washington, D.C.: U.S. Arms Control and Disarmament Agency, April 1996), p. 78; Cordesman and Hashim, *Iran: Dilemmas of Dual Containment*, pp. 170-175.

[33] Primakov quoted in Dina Kraft, "Russian Minister Tells Israelis Moscow Is Not Arming Iran," *Washington Times*, October 27, 1997, p. A11.

[34] Koptev in Michael R. Gordon and Eric Schmitt, "Missile-Quality Russian Steel Was Nearly Smuggled to Iran," *The New York Times*, April 25, 1998, p. A1.

[35] CIA Director George Tenet quoted in Bill Gertz, "CIA Warns of Iran Missile Threat; Russian Technology Helps Speed Development, Tenet Says," *Washington Times*, January 29, 1998, p. 1; Gordon and Schmitt, "Missile-Quality Russian Steel Was Nearly Smuggled to Iran," p. A1.

[36] Andrew J. Pierre and Dmitri V. Trenin, eds., *Russia in the World Arms Trade* (Washington, D.C.: Carnegie Endowment, 1997).

[37] Stephen J. Blank makes the case that Moscow, seeing no immediate threat of war from potential enemies like China, India or Iran for eight to 10 years, feels no inhibitions over selling them military technology. Blank, *Russia's Armed Forces on the Brink of Reform* (Carlisle, Pennsylvania: U.S. Army War College, Strategic Studies Institute, 1998), p. 12.

[38] Symposium on "Export Controls in the People's Republic of China," *The Monitor* 3/4 (Fall 1997/Winter 1988), pp. 17-34.

[39] Lisa Burgess, "U.S. Ties Business, Foreign Policy," *Defense News*, March 16, 1998, p. 12. In fairness it should be noted that nonproliferation is but one of the objectives of the NASA-Glavkosmos deal, which also facilitated the withdrawal of Russian troops from the Baltics and supports Russian involvement in the U.S.-led international space station.

[40] Tim Weiner, "U.S. Weighs Deal to Halt Missile-Gear Sales by China," *The New York Times*, March 19, 1998, p. A8; Bill Gertz, "Clinton Arms Official Cites Secrecy, Refuses to Comment on Missile Deal," *The Washington Times*, March 19, 1998, p. A3.

[41] Mitchell Reiss, *Bridled Ambition: Why Countries Constrain Their Nuclear Capabilities* (Baltimore: Johns Hopkins University Press, 1995).