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MISSILES IN THE MIDDLE EAST: A NEW THREAT TO STABILITY

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Surface-to-surface missiles (SSMs)[1] have begun to assume a central role in the military forces of the Middle East. Not only do 10 countries in the region possess them, but five countries are trying to develop their own independent missile capabilities.

In the early 1988 "War of the Cities," Iran and Iraq together fired more than 500 ballistic missiles at each other. Virtually all of the missiles were aimed at urban areas with the intent of attacking civilians; the results were devastating. This willingness to fire hundreds of SSMs at civilian targets indicates the extent to which these weapons have become an acceptable means of waging war in the Middle East.

Saudi Arabia's secret acquisition in early 1988 of long-range Chinese DF-3 ballistic missiles (U.S. designation CSS-2) further underscores the importance of SSMs. Most experts believe that these missiles are so inaccurate that they have little military value when armed with conventional warheads. Nevertheless, the Saudis took substantial political risks to acquire them.

Concern for the proliferation of ballistic missiles stems from two characteristics that distinguish them from other weapons and invest them with a dangerous potential to destabilize the already volatile Middle East:

• **SSMs travel long distances in a very short period of time.** In just five minutes, for example, the Soviet-made Scud-B can fly its full 280-km range. By comparison, a typical jet fighter might take 20-25 minutes to fly the same distance.

• **No defenses exist to protect against ballistic missiles once they have been launched.** Thus, barring mechanical failure, every missile fired will reach its target.

These capabilities raise the possibility that SSMs could be used to launch devastating "out of the blue" surprise attacks.

Today, most of the ballistic missiles in the Middle East are too ineffective to be used in this role. However, several countries in the region are seeking to obtain or develop more accurate missiles with more powerful warheads that can be fired in large quantities. During the early 1990s, several countries in the Middle East will acquire highly effective SSMs.

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The capabilities provided by this new generation of missiles will almost certainly destabilize the region. The incentives to preempt a feared attack will grow, and the costs of absorbing an attack will increase.

This trend becomes especially disturbing given the growing interest in the Middle East in chemical, biological, and nuclear weapons, and the evident desire in many countries to arm their ballistic missiles with these unconventional weapons. By the 1990s, a large number of countries in the region will be able to fire salvos of missiles armed with chemical weapons, and several may have biological and nuclear capabilities as well.

In response to these dangers, the United States should urgently pursue two policy options:

• **The development of anti-tactical ballistic missile (ATBM) systems to defend against SSMs:** ATBM systems will reduce the threat of ballistic missiles, thereby enhancing regional stability. To speed delivery of ATBM systems, U.S. support for R&D efforts with our allies in the Middle East and elsewhere is critical.

• **Arms control efforts to limit the spread of technologies needed to produce ballistic missiles:** The Missile Technology Control Regime (MTCR), an agreement negotiated in 1987 between the U.S. and other Western countries to restrict the export of technologies needed to build ballistic missiles, provides the basis for such controls. Efforts to enlist Soviet and Chinese participation in curbing the spread of missile technology are essential. More sophisticated missiles are dependent on access to a variety of advanced technologies. Through such a control regime, it may still be possible to significantly slow the spread of such weapons and raise the costs of obtaining such systems.

MISSILES IN THE MIDDLE EAST

During the past 20 years, missiles have become an increasingly important component of the military forces in the Middle East. Ten countries in the region now have ballistic missiles: Algeria, Egypt, Iran, Iraq, Israel, Kuwait, Libya, Saudi Arabia, Syria, and South Yemen. Together, it appears these nations possess a total of about 300 missile launchers. While it is difficult to estimate accurately the number of missiles available to be fired from these launchers, the figure is unlikely to be under 1,200.[2] *(See Table, p. 11.)*

In the Middle East, ballistic missiles serve – at a minimum – as symbolic weapons. A reputation for military strength has come to depend on possession of ballistic missiles. Thus, even acquisition of inaccurate and unreliable missiles has become desirable.

However, SSM forces also have important military functions, often compensating for the lack of an effective air force. The Iranian air force, for example, is too small to fill a strategic bombing role, so the Iranians use missiles against Iraqi cities to retaliate for missile attacks on Iranian cities. Although both Iraq and Syria have large air forces, they are of poor quality. Syria probably cannot count on its air force to penetrate Israeli air defenses. By contrast, the Iraqi air force appears capable of easily penetrating Iranian air space and has the potential to inflict grievous damage on the Iranians. Yet, it is of dubious effectiveness and has never had the impact expected of it by Western military analysts. Therefore, both Syria and Iraq have turned to ballistic missiles as a substitute for air power.

Two main types of missiles are currently in use in the Middle East. First, there are unguided rockets with ranges of 40-70 km, the best known of which is the ubiquitous Soviet-supplied Frog-7 now available to seven countries: Algeria, Egypt, Iraq, Kuwait, Libya, Syria, and South Yemen. In addition, Brazil has supplied Iraq and Libya with Astros II rockets (68-km range); Iran has built the Oghab rocket (40-km range); and Israel has the MAR-290 system (40-km range).

Even though they are often considered battlefield support weapons, these missiles have sufficient range to attack strategic targets because of the proximity of cities and military installations to hostile borders. Syria, for example, fired Frog rockets at northern Israel during the opening days of the 1973 Arab-Israeli War; Iraq has fired Frogs at Iranian cities; and Iran routinely uses Oghab rockets against Iraqi cities.

In addition to the short-range, unguided rockets, the Middle East boasts a number of longer-range missiles that carry guidance systems of varying degrees of sophistication. Some, like the Soviet SS-21s supplied to Syria, are highly accurate and usually can land within 50 meters of a target. Others, like the Chinese DF-3

missiles shipped to Saudi Arabia, are very inaccurate, usually landing two or three kilometers from the target. The maximum range of the missiles also varies considerably. SS-21s can reach only about 100 km; while Chinese DF-3s have a maximum range of more than 2,000 km.

The Soviet Union was the first country to export longer-range missiles to the region in the 1960s, and it remains the major supplier. It has sent 280-km range Scud-B missiles to Egypt, Iran, Iraq, Libya, Syria, and South Yemen, as well as SS-21 missiles to Syria and possibly Iraq. In addition, there have been unconfirmed reports that Moscow has shipped SS-12 Scaleboard missiles (900-km range) to Iraq.

Until recently, the only other major supplier of missiles to the Middle East was the United States, which sent Israel Lance missiles with a range of 100 km. However, the U.S. has consistently refused to sell Pershing missiles to Israel or any SSMs to Saudi Arabia.

China has begun to emerge as a major supplier of ballistic missiles to the Middle East. In addition to the DF-3 missiles sent to Saudi Arabia, the Chinese are believed to have sold missiles and missile technology to Iran, and they may be negotiating the sale of missiles to other countries in the region, including Syria.

MISSILE DEVELOPMENT PROGRAMS IN THE MIDDLE EAST

Because of the practical and symbolic value of ballistic missiles, at least five countries in the Middle East (Egypt, Iran, Iraq, Israel and Libya) are working to increase the size of their arsenals and are trying to obtain more sophisticated missiles with greater range, accuracy, and destructive power. These local development programs are supplemented by cooperative efforts with countries in other parts of the world. Money from the Middle East also is funding missile development programs in other Third World countries.

- Egypt has three separate programs, including a joint project with Argentina to develop a 900-km range missile.

- Iran claims to have three programs, including a bombardment missile with a 120-130-km range that it intends to mass produce.

- Iraq has two programs, both modifications of the Soviet Scud-B with greater range: the al-Husayn (650-km range) and the al-Abbas (900-km range). In addition, Iraq is funding missile development projects in Argentina and possibly Brazil.

- Israel has two programs, the short-range MAR-290 artillery rocket and the Jericho, whose latest version has a range in excess of 1,000 km.

- Libya has a small missile development program staffed by German scientists once associated with OTRAG, a German organization that tried to develop a commercial space-launch vehicle in the late 1970s and early 1980s. Libya is reportedly funding the development of long-range missiles in Brazil.

All of these countries now have well-established missile development organizations, and it is likely that political, military, and bureaucratic imperatives will lead to the development and deployment of increasingly capable weapons with greater accuracy, longer ranges, and more lethal warheads.

It is only a matter of time before these countries acquire significant inventories of accurate missiles armed with highly lethal warheads. The precursor of this new generation of missiles is the Soviet-built SS-21 missile supplied to Syria in 1983. It has a CEP (circular error probable) of about 50 meters and can be armed with new generation warheads more effective than the unitary high explosive warheads found on older missiles. This makes them sufficiently effective to be used against point targets, such as air bases, surface-to-air missile batteries or radar sites. The only weakness of this missile is its 100-km range, which is too short for many strategic purposes.

The Syrians had hoped to acquire SS-23 missiles from the Soviet Union, a missile comparable in accuracy and lethality to the SS-21 but with a considerably longer range. For a variety of reasons, however, the Soviet Union refused to supply the SS-23 to Syria, and the superpower INF missile treaty prohibits both parties from supplying missiles of that type to other countries. Hence, in the future, Middle East armies will have to rely on other Third World countries for the development of long-range missiles. Argentina, Brazil, and China all appear willing to work with countries in the Middle East to develop such weapons, but it may

be a few years before the missiles are actually delivered.

THE LETHALITY OF BALLISTIC MISSILES

The effectiveness of a ballistic missile depends on its range, accuracy and warhead. Although greater range does not make a missile more destructive, it does increase the size of the area that can be attacked. A longer range also enhances the operational flexibility of a missile, allowing it to be fired from a greater number of sites dispersed over a wider area. This enhances survivability by complicating enemy efforts to locate launch sites and by making it more difficult to mount retaliatory air raids against missile launchers.

Because missiles carry only a relatively small payload, usually 500-1,000 kg of explosives, they must be extremely accurate if used against point military positions or those protected by earth works and concrete. However, even inaccurate missiles can be effective against military targets that are spread over a large area, like equipment storage sites. They also have proved to be effective as terror weapons against civilian population centers.

Most of the missiles currently available in the Middle East are so inaccurate that they can be used only to attack targets that cover large areas. This makes them suitable mainly for terror strikes against civilian areas, unless they are armed with chemical or nuclear warheads.[3]

It is difficult to assess the destructiveness of missiles against cities. The 500-600 kg warheads carried by most missiles are small, only a fraction of the weight of the payload of a modern attack aircraft.[4] For example, to deliver the same ordnance as a single aircraft flying one mission might take as many as eight Frog-7s or four Scud-Bs. It would take 10 Iraqi al-Husayn missiles, which have warheads of only 180-190 kg of explosives, to equal the payload carried by a single F-16.

But because of their unique characteristics, the destructiveness of tactical ballistic missiles cannot be measured in such a simplistic fashion. The missiles fly at a very high speed, up to three times the speed of sound in the case of a Scud-B, which greatly magnifies their destructive potential. Also, many of the missiles have a considerable mass apart from the warhead that can do a great deal of damage on impact.[5]

This has been confirmed by experience during the Iran-Iraq War. Missiles have caused tremendous damage, seemingly out of all proportion to the size of the warheads used. In some cases, entire streets of shops and houses have been destroyed. In other instances, reinforced concrete skyscrapers have been devastated by missile strikes. Typically, missiles leave craters at least 10 meters wide and several meters deep.

RATES OF FIRE

The effectiveness of missile attacks also depends on the number of missiles that can be fired at the intended target. Even if individual missiles can inflict considerable damage, only the collective impact of a large number of missiles can influence the course of a war.

The Iran-Iraq war has demonstrated that countries can readily obtain additional supplies of missiles once they fire their initial inventories. At the start of the war in 1980, Iraq was reported to possess only 12 Scud-B launchers and probably had no more than 36 missiles; Iran had no Scud missiles at all. Yet, during the past eight years, the two combatants have fired more than 400 Scud-type missiles at each other, at least 300 by Iraq and over 110 by Iran.

When used in such large quantities, ballistic missiles can have a devastating effect. But to a large extent, SSMs have proven to be valuable for both Iran and Iraq thanks to the extended length of the Gulf war. During a short war, low rates of fire would likely prevent any country in the Middle East from firing more than a fraction of the missiles used in the Gulf. In the 1973 war, for example, the Syrians could launch no more than 7 missiles a day. Since 1980, the Iraqis have never fired more than 11 missiles in one day, nor more than 7 missiles during any 12-hour period.

Most of the missiles suffering from slow rates of fire are longer-range SSMs. By contrast, shorter-range missiles can be fired much more quickly. The Iranians, for instance, claim to have fired up to 32 Oghab missiles in a single day. Even in a short conflict, therefore, missiles can have a critical impact on the course of a war.

MORE LETHAL WARHEADS

There are disturbing signs that countries in the Middle East are attempting to provide their missiles with more effective warheads, including chemical, biological, and nuclear weapons.

Most missiles currently available in the region are armed with conventional, high explosive warheads. Generally, these are so-called unitary warheads, weighing 500-1,000 kg. New warheads are incorporating modern submunitions, a trend that will accelerate in the next few years. Typical of this new generation of weapons, Egypt's Sakr-80 rocket can deliver cluster munitions or minelets to ranges of 80 km.

The greatest area of concern, however, is the likely proliferation of warheads equipped with unconventional munitions. Iraq has used chemical weapons in attacks on both military and civilian targets, and Iran is reported to have employed chemicals as well. The Iranians clearly worry that the Iraqis may launch chemical attacks on major cities, including Tehran. It is likely that both countries are working on chemical warheads for their growing arsenals of ballistic missiles.

Other countries in the region are also expanding their chemical warfare programs. The Syrians are the most advanced, having already built a factory to manufacture nerve gas and enhanced the chemical defenses of their military forces. It is known that the Syrians have developed a chemical warhead filled with nerve gas, probably Tabun, for their Scud-B missiles. The Libyans also have indicated a keen interest in chemical warfare and reportedly have obtained chemical warheads for their Soviet-supplied missiles.

In addition to chemical munitions, biological warfare is a looming threat. Both Syria and Iraq are believed to have acquired facilities to develop biological agents. Missiles are a possible delivery mechanism for these biological weapons.

The danger of nuclear-tipped missiles is an increasingly worrisome possibility. It has long been assumed that the Israelis deployed nuclear weapons on their Jericho missiles. Pakistan is reported to have missiles that could be fitted with nuclear devices produced by the Pakistani nuclear program. More recently, it has been feared that Saudi Arabia intended to fit nuclear devices to its Chinese DF-3 missiles.

Therefore, it is not just the emergence of missiles that threatens to destabilize the regional military balance. Development of the unconventional weapons described above greatly magnifies the danger of the ballistic missile threat.

THE IMPACT OF BALLISTIC MISSILES ON THE IRAN-IRAQ WAR

The Gulf war provides a laboratory for analyzing the growing use of SSMs as legitimate weapons in the Middle East. Since the start of the war, Iran and Iraq have fired more than 875 SSMs, almost all of which were aimed at cities. Although both countries recognize that the war will not be won by missile attacks, they believe that SSMs are highly effective terror weapons. Because of the demoralizing effect of missile attacks, both countries have made ballistic missiles increasingly important components of their military strategies. Not only have they located foreign countries willing to supply missiles, but they have also obtained the technical assistance needed to develop missiles on their own.

The missile war has already gone through four distinct phases and is about to enter a fifth. During the first phase (September 1980 to March 1985), only Iraq possessed SSMs. The Iraqis fired 150-200 missiles at Iranian cities, resulting in more than 1,500 deaths and 7,000 injuries. In March 1985, the missile war entered a second phase, with Iran launching Scud-B missiles obtained from Libya. Even though the Iraqis launched more than 80 missiles in retaliation, there was considerable strategic importance to the 14 Iranian missiles fired between March and May 1985. In the third phase of the missile war (June 1986 to February 1988), Iran fired small numbers of missiles at Iraqi cities, but instead of retaliating with missile attacks, Iraq preferred to respond with air strikes.

The fourth phase of the missile war, the third "War of the Cities," began on February 29, 1988, and lasted for 52 days. Both Iran and Iraq lobbed large numbers of missiles at each other's population centers. The Iraqis relied primarily on their new al-Husayn missile, and the Iranians fired Scud-B and Oghab missiles. By mid-April the Iraqis had fired about 190 al-Husayn missiles at Iran, with Iran responding with 80 Scud-B missiles and about 250

Oghab rockets.

Urban areas were especially hard hit. Iraqi missiles killed at least 2,000 people, wounded more than 4,000 and forced a large portion – 25-60 percent – of Tehran's population of 10 million to flee to safer ground. The third "War of the Cities" was a victory for the Iraqis, and the Iranians appear to have been caught off-guard by the quantity of al-Husayn missiles Iraq was able to fire.

Iraq's Future Plans: Iraq was clearly pleased with the success of its al-Husayn missile and has developed a second modification of the Scud-B. Test fired for the first time in April 1988, the new version – known as the al-Abbas – has a range of 900 km. It is likely that the al-Abbas carries a warhead similar in weight to the al-Husayn, though its more powerful engine should make it possible to carry a larger pay-load.

The Iraqis have provided the funding for the Condor 3 missile being developed by Egypt and Argentina and will certainly be an early recipient. It has been rumored that they are also interested in the Brazilian SS-300 and MB/EE missiles, but there are no indications that they have actually reached any agreements with the Brazilians.

Iran's Future Plans: Iran, which apparently has three separate development programs underway, is determined to develop a missile manufacturing capability. Iranian efforts began in 1985 and have since been given a high priority by military authorities. Although information is scanty, it appears that Iran has begun production of Oghab missiles.

The Iranians also want to make the Scud-B, but (despite claims from Iran to the contrary) there are no signs that they have been able to manufacture this missile. However, Iran has been working on this program for three years and may have made enough progress to start production within the next year. Tehran is probably receiving technical assistance from China.

The third Iranian missile program is an unnamed system of 130-km range. Unlike the other systems, this particular missile is a new weapon not currently operational elsewhere. Probably not developed by the Iranians themselves, this new missile is most likely a version of a Chinese missile. As of April 1988, it was in the late stages of development, and there are indications that a small number have been fired at the Iraqi city of al-Amarah. It appears, however, that the program has run into difficulties, and the missile has not worked as expected. The Iranians may not have been able to achieve the expected ranges, and existing versions may be able to reach only 120 km.

The Iranians have high expectations for their newest missile, declaring their goal to manufacture 10-20 per day. Given the numbers of Oghab rockets fired during March and April 1988, an average of about 6 daily, it is possible that the Iranians may be able to produce 5-10 per day once kinks in the system have been ironed out.

The Next Phase: Past experience indicates that the current lull in the missile war will come to an end, and that the next stage will witness battles even more vicious than the last. The Iranians are unlikely to initiate a new "War of the Cities" until they possess substantial stocks of new missiles. Since this will take a considerable period of time, missile strikes probably will not resume until late 1988 or early 1989. Should the attacks resume in this way, one can expect a total of at least 500 missiles to be fired by the two combatants, with casualties in the range of 5,000-10,000 civilians.

THE IMPACT OF BALLISTIC MISSILES ON THE ARAB-ISRAELI CONFLICT

Ballistic missiles pose a somewhat different problem in the context of the Arab-Israeli conflict. Acutely sensitive to the development of capabilities by potential adversaries that could make a surprise attack possible, Israeli military planners are deeply concerned about the proliferation of ballistic missiles throughout the Middle East. These weapons offer an attacker the potential to launch a devastating first strike.

Despite the obvious dangers, however, the Israeli military has taken a cautious view of the threat. According to Dan Shomron, Israel's Chief of Staff, surface-to-surface missiles "cannot decide a war," and the Israelis believe that an integrated program of deterrence, civil defense, and defensive and offensive measures against missile launchers can minimize the danger from missile attack.

The Threat: The availability of ballistic missiles in large quantities in the hands of Israel's potential adversaries poses five main

problems for Israeli military planners.

• **Israel's small size places all its strategic targets within range of missile attacks,** including, in many cases, attacks by short-range missiles.

• The number of high value military targets of strategic importance is relatively limited, and **it would be necessary to incapacitate only a few critical facilities to achieve important results.**

• **Israel's population centers and industrial facilities are concentrated** in only a few critical areas along the narrow coastal strip, making them easy targets for missile attacks.

• **Israel's sensitivity to casualties,** especially among civilians, tends to increase the fear of missile attacks.

• **The mobilization system that provides the bulk of Israeli military manpower is susceptible to disruption** from attacks on civilian areas and equipment storage sites.

As long as enemy missile forces were small, these vulnerabilities were not very important. Today, however, countries in the Middle East have large numbers of missiles at their disposal, and the quantities will continue to grow.

Syria, Israel's main military adversary, has built a large missile force equipped with 54 launchers for Scud-B, Frog-7, and SS-21 missiles. It is not known how many missiles the Soviet Union has provided Syria, but it is likely that they now possess about 200.

Fired from positions inside Syria, these missiles can hit all of Israel, except for the very southern tip of the country near Eilat. Experience from the Iran-Iraq war suggests that if these missiles were fired at population centers, an average of 10-15 people would die for each missile fired. Hence, if the Syrians were able to fire all their missiles at Israel, between 1,500 and 3,500 civilians would be killed.

The acquisition of long-range missiles by Iraq and Saudi Arabia makes it possible for both countries to attack Israel from positions inside their own territory. The Iraqi al-Husayn missile has sufficient range to hit anywhere in Israel if fired from launch sites in western Iraq. It is not known how many of these missiles the Iraqis possess, but their ability to fire 190 of them within a period of only five weeks suggests that they try to keep a large number available. Similarly, Saudi Arabia's Chinese-supplied DF-3 missiles have sufficient range to hit targets anywhere in Israel even from their bases south of Riyadh.

Other countries in the region could participate in missile attacks only if they redeployed their shorter range missiles to locations where they could reach Israel. Thus, Libya would have to move its more than 100 missile launchers to sites in Syria or Jordan.

Responses: Israel has adopted a number of measures in response to ballistic missile proliferation, with the main goal being to deter missile strikes aimed at population centers. If deterrence fails, defenses have been erected to protect against the destructive effects of the missiles and retaliatory offensive options have been developed. The Israeli measures include:

• Destruction of missile launchers;

• Retaliatory attacks against enemy economic and political targets;

• Comprehensive civil defense protection for the entire civilian population;

• Hardening of critical military installations;

• Development of antitactical ballistic missile systems.

Destruction of ballistic missile launchers: It is harder to find and destroy missile launchers than often assumed. Missiles of the types used in the Middle East are fired from wheeled or tracked launchers which are easy to move from one spot to another. Normally, these launch vehicles are kept in heavily protected bunkers, which they leave only when a missile is to be fired. Thus, the launchers are vulnerable only when they are moving to firing positions, and during the pre-firing preparation time after reaching the launch site. The vehicles leave the launch site immediately after the missiles are fired.

Although it can be assumed that a high priority will be given to the detection of missile launchers, it will not be easy to find and destroy them in the short periods of time available. Remotely piloted vehicles equipped with cameras can fly continuously above known missile storage bunkers to look for launching vehicles as they leave to fire their missiles. Unfortunately, even this technique may not be fool-proof. Decoy trucks that appear identical to

real launch vehicles could be built; smoke and other screening systems could mask the bunkers from external observation; and the missiles could be fired at night to limit the ease with which the launchers could be observed.

Missile launchers will be easiest to find immediately after firing a missile, since Israel has the ability to detect the missiles in flight and to determine the firing location. Thus, a counter-strike against the launchers must be mounted within only a few minutes since they will be moved as quickly as possible after a launch.

In 1973, the Syrian military was able to fire missiles from positions located only a few thousand meters from the front lines. Yet, the Israelis never located or destroyed the launchers.

Today, Israel's reconnaissance systems are now considerably more sophisticated and they should be able to detect missiles as they are fired. Attacking the launchers remains difficult, however, because of the time required to organize a reaction and reach the target. This is especially true for long-range missiles, since it takes more than five minutes for a high performance aircraft to fly only 100 km. This should be enough time for a launch vehicle with a well-trained crew to depart the firing site.

For these reasons, it will take time for the Israeli military to destroy launch vehicles. Destruction of launchers, however, does not destroy reserve missiles. To stop all missile attacks, it will be necessary to put every single launcher out of action.

Retaliation: Israeli military officials have made it clear that attacks against populated areas will provoke immediate retaliatory strikes against economic and political targets. This policy was first developed during the 1973 war, when Syria's Frog rockets fired at air bases in northern Israel hit agricultural settlements. In response, Israel mounted a strategic bombing campaign against Syria, including attacks on oil storage tanks, the oil refinery at Latakia, and power stations. Fewer than 100 combat sorties were needed to inflict heavy damage on the Syrians. The Israelis are likely to retaliate in a similar fashion in a future conflict, striking critical economic and political facilities.

Given that most strategic targets in Iraq and Saudi Arabia are located far from Israel, it will be more difficult for the Israelis to retaliate in response to missiles fired from most strategic targets in those two countries. Nevertheless, both Iraq and Saudi Arabia possess a large number of vulnerable economic and military installations, and neither has sufficient strength to defend all potential targets from attack. As the Israelis demonstrated in the 1981 attack on Iraq's Osiraq nuclear reactor, the Israeli Air Force is able to mount highly destructive raids from a considerable distance.

Civil defense: Israel maintains one of the world's most elaborate civil defense programs. All buildings are required to have bomb shelters, and the entire population has been provided with gas masks and other chemical defensive gear. Such measures can minimize casualties, but may not reduce them to acceptable levels. The speed with which missiles travel will provide little warning time and many people will be caught in exposed positions when the missiles land. In addition, missiles may penetrate conventional bomb shelters, which are not designed to stop massive objects traveling at supersonic speeds.

Hardening of military facilities: The Israelis have spent a considerable amount of money constructing passive defenses to protect critical facilities. This has made many vital facilities largely invulnerable to missile attack. Certain kinds of installations, however, are not easy to protect. Equipment storage sites, support facilities, and defense factories cannot easily be protected behind concrete and remain vulnerable.

Antitactical missile defenses: Although existing anti-aircraft missiles can be modified to provide a limited ability to shoot down ballistic missiles, they do not offer a satisfactory defense against SSMs. Israel is currently developing an anti-tactical ballistic missile system (ATBM), which would include two hyper-velocity missiles capable of shooting down tactical ballistic missiles: the medium-range Arrow (developed by Israel Aircraft Industries) and the short-range AB-3-10 (developed by Rafael). The U.S. and Israel have agreed to an 80-20 cost-sharing formula for the development of the Arrow, Washington's portion of which has been determined to be $128 million. But despite the support of Secretary of Defense Carlucci, Pentagon red-tape has held up approval of contracts for Arrow development, leaving the project stranded in bureaucratic limbo. As a result, Israel's ATBM system, which at best probably would not be operational until the early 1990s, is sorely strapped for funds. Israel, therefore, will have to rely mainly on other

methods to deter or minimize the danger of missile attacks.

It should be kept in mind, however, that the Israelis often announce their possession of particular weapons or technologies only after they already have a particular capability. Thus, it is possible that Israel may field an operational ATBM system with limited capabilities. This could involve upgrades of existing systems, such as the American-made Hawk surface-to-air missiles or the Israeli-made Barak air defense missile.

PROSPECTS FOR THE FUTURE

In recent years, ballistic missiles have come to play an increasingly important role in the military forces of the Middle East. The number of countries possessing SSMs has increased, and the size of the missile inventories has grown substantially. In short:

- Ballistic missiles are now considered necessary components of the arsenals of military powers in the Middle East. **Ten countries in the region now operate missile forces.**

- **Five countries in the region have established missile development programs,** and several others are known to be interested in obtaining more sophisticated missiles from foreign suppliers.

- Most ballistic missiles now available in the region are relatively inaccurate, making them unsuitable for use against hardened military targets. **They are, however, highly effective when attacking large urban centers.**

- The widespread use of ballistic missiles during the Iran-Iraq war has made them an accepted instrument of war in the region, and **they are now routinely used as terror weapons against civilian populations.**

- Countries in the region now possess only a small quantity of missiles with sufficient accuracy to strike point military targets. **Most of the missiles will be effective against military targets only if armed with chemical warheads.**

Events are moving rapidly, however, and radical changes can be expected in the next few years. In that time, unless some action is taken to control proliferation, the following developments are likely to take place:

- **A new generation of ballistic missiles will be widely available.** In comparison with most of the existing missiles, these new weapons will be considerably **more accurate,** will carry **more lethal** warheads, and will have **longer ranges.**

- **Ballistic missiles will be acquired in substantial quantities,** and will be designed to make it possible to fire a large number in relatively short periods of time.

- **Chemical warheads will be widely available,** and biological warheads may also appear.

Should these developments come to pass, the Middle East will become increasingly unstable. The accuracy and lethality of the new missiles will make potent surprise attacks possible and even inviting. The missiles will be able to destroy or damage critical military installations, giving an attacker a potentially decisive edge. Neutralization of air bases, radar installations, command and control facilities, and equipment storage sites will reduce the effectiveness of defenses, as will attacks on reinforcing combat units moving to the frontlines. Under such conditions, the incentives to preempt a feared attack will grow as the costs of absorbing an attack will increase.

These developments will have a particularly dangerous impact on the Arab-Israeli military balance. At present, the situation is reasonably stable, since the costs of initiating a conflict are clearly higher than the potential benefits of preemption. This will change in the 1990s, especially if Syria acquires large inventories of accurate, long-range missiles. The availability of such weapons may tempt the Syrians to initiate an attack, and the danger that the Syrians will attack may make the Israelis more inclined to preempt.

In response, the U.S should urgently support two policy options to enhance stability in the region by reducing the dangers of the potential proliferation of a new generation of SSMs.

Support development of anti-tactical ballistic missile (ATBM) systems: Such weapons will be able to intercept and destroy SSMs in flight. Without American support, this technology will not be available in the mid-1990s, when it will be needed to deal with the new generation of highly accurate, extremely lethal missiles.

The development of ATBM technology in the U.S. has been retarded by a lack of interest by the Department of Defense, and especially by the Department of Army, which is responsible for such programs. Although Secretary Carlucci and the Strategic Defense Initiative Organization (SDIO) have encouraged ATBM efforts, Pentagon bureaucracy has posed hurdles to ATBM development. The Intermediate Nuclear Forces (INF) agreement, which prohibits the US and the USSR from possessing medium-range missiles, has made the Department of Defense even less interested in ATBM systems.

Unfortunately, neglecting ATBM could pose particularly severe problems for America and its allies. Missiles of the type prohibited by the INF agreement have been routinely used in large numbers by Iraq in recent months, and the number of such missiles deployed in the region will continue to grow. Should the U.S. have to intervene in the Middle East, our potential adversaries are likely to be armed with large numbers of ballistic missiles.

For our allies in the region, the availability of an effective ATBM system in the 1990s may be essential. In order to ensure that the Middle East remains stable, it will be necessary to ensure that no country feels compelled to launch pre-emptive strikes in order to avoid the consequences of a surprise attack.

Enhance the Missile Technology Control Regime: Washington should emphasize efforts to control the proliferation of ballistic missiles. The development of more sophisticated missiles will depend on access to a variety of advanced technologies. Although it will not be possible to prevent proliferation of more capable missiles, it may be possible to significantly slow the spread of such weapons and to raise the costs of obtaining these systems.

A first step was taken in 1987, when the Missile Technology Control Regime (MTCR), to restrict the export of ballistic missile technology to the Third World, was agreed upon by the U.S. and several other Western countries.

The U.S. should work to encourage other countries to join the MTCR, with special efforts to solicit the participation of the Soviet Union and China, the major exporters of ballistic missiles to the Middle East. Indeed, Moscow may have a growing incentive to support efforts to slow the proliferation of SSMs, given that missiles in the Middle East have sufficient range to threaten its security. U.S. negotiators should aggressively pursue the promising discussions on missile technology control held with the Soviets at the May Moscow Summit.

The willingness of China to export missiles and missile technology poses particular problems. The U.S. must make clear to the Chinese that the profligate export of SSMs is severly detrimental to the stability of the Middle East and to the interests of the United States and may carry costs in terms of the bilateral relationship.

In addition to international efforts, U.S. agencies must diligently ensure American commercial and industrial compliance with controls on the export of missile technology. At the same time as the U.S. is trying to restrict third-country supply of sophisticated missile technology to the Middle East, loopholes in licensing regulations and lax oversight can permit U.S. firms to sell that technology directly.

ENDNOTES

[1] In this paper, SSMs are defined as any ground-to-ground rocket or missile with a range of 40 km or more. This includes some shorter-range unguided weapons, like the Soviet Frog-7 rockets, that are technically not missiles but are analytically grouped with missile systems. Missiles like the Chinese Silkworm are excluded because they are primarily intended to attack ships.

[2] The number of missiles was calculated by combining actual inventories, when known, with rough estimates based on the apparent Soviet practice of supplying an average of 3 missiles per missile launcher. This probably underestimates the actual figure – at least one source has claimed that just the Iraqis had between 200 and 1,000 missiles in May 1988.

[3] A typical missile, like the Soviet Scud-B, has a CEP of about 1,000 meters, meaning that about half of the missiles will fall inside a circle with a radius of 1,000 meters. Although some of the missiles have greater accuracy, others are even more inaccurate. Most authorities think that the Chinese DF-3 missiles sold to Saudi Arabia have a CEP of no better than 2,000 meters. By comparison, modern fighters can drop conventional bombs filled with high explosives with an accuracy of 5 to 15 meters.

[4] Fighter-bombers, like the F-4 Phantom or the F-16, can carry two bombs weighing about 1,000 kg each.

[5] German tests of the V-2 rocket, which is a predecessor of the Soviet Scud missile, revealed that even without carrying a warhead the missile could create a crater 30 to 40 feet in diameter and 10 to 15 feet deep.

MISSILE DEVELOPMENT IN THE MIDDLE EAST

Country	Missile	Source	Status	Launchers	Range (km)	Comments
ALGERIA	Frog 4/7	USSR	in service	20	70	
EGYPT	Sakr-80	Egypt	entering service	?	80	Frog-7 replacement developed in Egypt, probably with assistance from Western Europe.
	Condor-3	Argentina/ Egypt	under development	?	800	Argentina is developing this missile with Egyptian assistance and Iraqi funds; Egypt may have test fired a missile in 1987; Condor is expected to enter service around 1990.
	Scud-B	USSR/ Egypt/ N. Korea	in production	9	280	Scud-Bs originally obtained from the Soviet Union in 1973; Egypt is now working with North Korea to produce the Scud-B.
	Frog-7	USSR	in service	12	70	To be replaced by the Sakr-80.
IRAN	Oghab	China/ Iran	in service	?	40	Originally obtained from China in 1986, the Iranians have fired at least 350 since Dec. 1986; probably now under production in Iran.
	Scud-B	Libya/Syria? N. Korea/Iran?	in service	3?	280	Iran claims it is now producing the Scud-B.
	130-km	Iran	under development?	?	130	May be in final stages of development.
IRAQ	al-Husayn	Iraq/Egypt East Germany/ N. Korea?	in service	6?	650	Test fired in August 1987; About 190 were fired at Iran during March-April 1988; Developed with assistance from Egypt, East Germany and possibly North Korea.
	al-Abbas	Iraq+?	entering service	?	900	A further enhancement of the al-Husayn test fired in April 1988.
	Scud-B	USSR	in service	20	280	
	Frog-7	USSR	in service	30	70	
	SS-12	USSR	in service?	?	900	Reportedly delivered in 1984; some may have been fired in early 1988.
	SS-21	USSR	in service?	?	100	Reportedly delivered, but no confirmation.
ISRAEL	Jericho	Israel	in service	?	1,000 +	
	Lance	USA	in service	12	100	Supplied in late 1970s
	MAR-290	Israel	in service	?	40	
KUWAIT	Frog-7	USSR	in service	4	70	Supplied in 1981.

MISSILE DEVELOPMENT IN THE MIDDLE EAST

Country	Missile	Source	Status	Launchers	Range (km)	Comments
LIBYA	Frog-7	USSR	in service	48	70	
	Scud-B	USSR	in service	80	280	
	OTRAG*	Libya/ West Germany	under development	–	?	
	** In early 1980s, German firm OTRAG permitted to use launch facilities at Sebha in southern Libya. Reportedly, Libya was to receive a ballistic missile system. Although the arrangement with OTRAG fell apart, individuals associated with that organization remained in Libya. According to one account a missile production facility has been completed.*					
	MB/EE	Brazil	under development	–	up to 1,000	Libya reportedly has agreed to fund development of a family of ballistic missiles in Brazil.
SAUDI ARABIA	DF-3A	China	entering service	?	under 3,000	An estimated 25-50 missiles have been supplied.
SYRIA	SS-21	USSR	in service	12	100	
	Scud-B	USSR	in service	18	280	
	Frog-7	USSR	in service	24	70	
	M-series**	China	under negotiation	–	?	
	*** Syria is reportedly talking to China about obtaining M-series missiles. The first of the M family to be revealed by the Chinese was shown in 1986, and it was reported to have a 200-600 km range. In early 1988, the M11 was revealed; it has a 120-150 km range, although some sources put the figure at 290 km.*					
SOUTH YEMEN	Frog-7	USSR	in service	12	70	
	Scud-B	USSR	in service	6	280	
	SS-21	USSR	in service?	?	100	Reportedly identified at recent parade.

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