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The Military Balance in the Middle East

The Impact of the Proliferation of Weapons of Mass Destruction on the Regional Balance

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Proliferation is one of the least understood aspects of the Middle East military balance, but it is also one of the most important. Conventional wars are certainly capable of destroying whole nations, particularly small ones like Israel, Jordan, and the emerging Palestinian entity. In the real world, however, the probable outcome of conventional warfare in any of the previous contingencies is likely to be limited -- at least in the sense that such wars are unlikely to escalate to levels of conflict which threaten the existence of one or more states, or produce massive civilian casualties.

The proliferation of weapons of mass destruction, however, poses a growing risk of wars that could threaten the major population centers of Israel and its Arab neighbors. Proliferation could destroy the very existence of Israel and change beyond all recognition the leadership and character of Iran and any Arab state that became involved in a large-scale exchange using biological or nuclear weapons.

The destruction of Saddam Hussein's regime in Iraq has removed one of the most dangerous proliferators in the region, but many proliferators remain. These include the nations shown in **Figure 10.1**. At the same time, this same table shows that the Middle East is only one region where nations are acquiring weapons of mass destruction, and that many other countries have the technology base to become proliferators. This raises the specter of the transfer of such weapons from outside the region or wars involving the forces of outside powers such as Pakistan.

The Nature of the Problem: The Weapons and Their Effects

Weapons of mass destruction are divided into four major categories: Chemical, biological, radiological, and nuclear (CBRN) weapons. In practice, radiological weapons that actually act as weapons of mass destruction, as distinguished from terror weapons that can attack and contaminate a relatively small area, are extremely difficult to manufacture and weaponize and such weapons are probably both beyond the current capabilities of Middle Eastern powers and lack the cost-effectiveness that will lead countries to pursue them.

As **Figure 10.2** shows, chemical, biological, and nuclear weapons also differ strikingly in terms of effectiveness, and their strengths and weakness. It is important to note that each different type of CBRN weapon differs sharply in its war fighting characteristics and lethality. Although all are called weapons of mass destruction, biological and nuclear weapons present by far the greatest threat.

Chemical weapons are the least lethal form of weapon of mass destruction, but are also the easiest to manufacture, weaponize, deploy, and use. There is no way to know what weapons given countries are developing or have deployed, but mustard gas, nerve agents, and blood agents seem most likely. **Figure 10.3** does, however, show the weapons most likely to be in regional military forces and their general characteristics. **Figure 10.4** shows how chemical weapons might be involved in combat, scarcely a theoretical possibility. Iraq prepared massive stockpiles of biological weapons during the end of the Iran-Iraq War and before the Gulf War of 1990.

Figure 10.5 shows the most likely form of biological weapons that may be deployed in the Middle East. This table does not include genetically modified agents, and assumes a moderate level of regional technological capability. If weapons are developed and transferred from more advanced countries, they could be much more lethal, harder to detect, and harder to treat.

Figure 10.6 shows the comparative lethality of chemical, biological, and nuclear weapons using the agents most likely to be used in a missile or line source attack. The differences between the lethality of different types of weapons is clear, although it should be noted that properly weaponized biological weapon are as lethal as fission nuclear weapons. **Figure 10.7** extends the comparisons in Figure 10.6 to show the relative area that would be covered by different types of weapons and how increases in the yield of nuclear weapons affect the lethality of the weapon.

The broad characteristics of nuclear weapons are well understood, and a detailed discussion of design issues is beyond the scope of this analysis. Several factors should, however, be kept in mind:

- The physics and design aspects of conventional nuclear weapons are well understood, but actual production of fissile material, and creating small, efficient, and reliable weapons remains at the limits of the state of the art in applied engineering and systems integration in most countries.

- Building small and efficient conventional gun or implosion weapons requires a high level of engineering and design skill and highly enriched material. Creating large weapons, with unpredictable yields and lower reliability, can use material with much lower levels of enrichment.

- Advanced warheads probably may require actual testing, but advances in the state of the art in simulation and measurement increasingly mean that nuclear weapons can be designed with a high probability of effectiveness using implosion and gun testing without fissile material.

- Yields above 20 kilotons require advanced weapons designs known as “boosted” weapons, with some of the design characteristics of thermonuclear weapons. These may be beyond the state of the art for any nation other than Israel. This does, however, present serious problems for some delivery systems like missiles, which may not be accurate enough to deliver a regular fissile weapon within the area where it has high effectiveness.

- Similarly, yields much about 200 kilotons require thermonuclear weapons – which are still extremely difficult technical challenges -- and long-range missiles may be inaccurate or unreliable to the point where such yields are required.

- There are no simple ways to summarize radiation and fall out effects, but lowering the height of burst of a weapon can radically increase fall out and long term radiation and contamination effects at the cost of reducing blast and thermal effects.

At the same time, the kind of lethality data presented in **Figures 10.4** to **Figure 10.7** can exaggerate the threat posed by such weapons. The models for making such calculations have dubious credibility, both in terms of estimating terms of prompt and long-term effects. Chemical weapons have never achieved anything like the lethality in practice that they have in theory and there have been no actual uses of modern biological weapons in warfare. The nuclear effects models assume flat open areas, and have limited credibility in estimating long-term effects against humans and the environment.

The actual process of weaponization is critical in determining effectiveness. Even the most lethal agent or weapon can be ineffective if a bomb or warhead design is not highly advanced, and does not operate perfectly in actual use. The reliability and accuracy of the delivery system, the quality of targeting, and the choice of targets are also critical factors. Many developing countries lack the systems integration, command and control, and tactical capabilities to both develop and deploy effective forces using weapons of mass destruction, and most may lack the strategic and tactical skills to employ them effectively in sophisticated attacks.

It should also be noted that ballistic missiles often receive undue attention as if they were the only major delivery systems for such weapons. Aircraft, helicopters, artillery, and covert delivery are all effective methods of delivering such weapons. Missiles are only one of many possible delivery systems and often not the most effective.

The Proliferators, Their Motives, and Warfighting Issues

Many Middle Eastern states have not proliferated, or have resisted the temptation to deploy such weapons. At the same time, there are strong regional incentives to proliferate – at least to the point of developing the capability to rapidly manufacture and deploy some form of weapon of mass destruction. These incentives include:

- Prestige
- Deterrence

- War fighting
- Lessons of Iran-Iraq War and Gulf War: Missiles and weapons of mass destruction have been used against military and civilian targets.
- Arms race with neighbors: Algeria-Libya-Morocco, Egypt-Israel-Syria, Iran-Iraq-Southern Gulf.
- Inability to know the future enemy, characterize risk.
- The "greater Middle East" — growing overlap of arms races listed above, plus impact of North Korea and India-Pakistan arms race.
- Deterrence and safeguards: No way to know the scale of the efforts of key threats and other major regional actors.
- Intimidation
- Alternative to expensive conventional investments
- Compensate for conventional weakness and cost of conventional weapons.
- "Glitter Factor"
- Limit or attack US and others outside power projection options
- Create existential threat
- Force arms control; react to absence of meaningful arms control regimes.
- Momentum of arms race/respond to proliferation elsewhere
- State, proxy, or private terrorism.
- Exploit lack of effective civil and critical facility defense and anti-tactical ballistic missile defense capabilities.

Proliferation already shapes the regional military balance in ways that affect both the peacetime balance of power and influence, the structure of regional deterrence, and options for future war fighting:

- Israel relies on nuclear weapons, deterrence, and "soft strike" preemption.
- Iran has chemical and probably biological weapons, nuclear effort continues.
- Iraq's massive pre-Gulf War efforts gave it a major "break out" effort the moment UN and US containment efforts ceased and may give a successor some break out capability in spite of the Iraq War.
- Syria has significant chemical warfare capabilities and will soon acquire significant biological capabilities — if it does not have them.
- Libyan chemical effort continues.
- Algerian and Egyptian efforts uncertain.
- Saudi Arabia is studying options as a result of its CSS-2 replacement planning.
- Terrorists, extremists, and "proxies" are also making efforts to acquire such capabilities.

This, in turn, has already created the following unstable mix of possible combinations of adversaries and contingencies:

- Iran versus Iraq
- Iraq versus Southern Gulf, US, and/or Israel
- Israel versus Syria
- Iran versus Southern Gulf, US, and/or Israel

- Libyan and Algerian wild cards
- Vestigial Yemeni use of gas
- Saudi Arabia joins the club in reaction to Iranian and Iraqi proliferation, changing the nature of war fighting involving the Southern Gulf.
- The US extends deterrence, compellance, and/or retaliation in reaction to an attack on an Arab ally or Israel.
- Egypt joins the club after arms control efforts fail, and finds itself involved against Iraq or dragged into confrontation with Israel.

There are a number of warfighting options where proliferation could affect the balance:

- Covert-indirect, unconventional warfare, "terrorism"
- Surprise attack to support conventional war fighting
- Avoid conventional defeat
- Pose political threat - intimidation
- Regional Deterrence - threatened or illustrative use
- Attack power projection facilities
- Counterproliferation
- Extended deterrence
- Controlled escalation ladder
- Asymmetric escalation/escalation dominance
- "Firebreaks"
- Launch on warning/launch under attack
- Seek to force conflict termination
- Destroy enemy as state
- Martyrdom
- Alter strategic nature of on-going conflict

These lists illustrate the fact that there is no way to know how each proliferating nation has or will develop its war fighting doctrine, war plans, safety procedures, leadership control procedures, release doctrine and procedures, targeting doctrine and capabilities, civil defense capabilities, and damage estimation and assessment capabilities. It seems unlikely that most leadership elites will consider major existential risks or behave recklessly except under extreme crisis conditions. However, risk-taking and miscalculation are long-standing historical realities and warfighting analysis that is based on scenarios and actions that seem prudent in peacetime can be terribly misleading.

The following factors need to be considered:

- The WMD arms race is multipolar and cuts across subregions, making it difficult to contain the scope of conflicts.
- Technologies are new and there is little or no combat experience; operations research and exercises are difficult.
- Acquisition does not mean war planning; policy statements do not mean war planning, doctrine does not mean war planning.

- Lies, denial, and covert efforts make it extremely difficult to predict opposing force and enemy actions.
- Impossible to predict ride out capability and survival of retaliatory forces in many cases, possible "use or lose" reaction.
- War fighting concepts are likely to lack clear structure and be highly volatile in terms of enemy, targets, and crisis behavior.
    - Only a few leadership and military elites — such as Egypt and Israel — have shown a concern with highly structured strategic planning in the past.
    - Iran-Iraq and Gulf Wars have demonstrated missiles and weapons of mass destruction will be used, and that escalation can be unpredictable.
    - Israeli actions in 1967 and attack on Osirak, Egyptian and Syrian attack on Israel in 1973, demonstrate regional focus on surprise and preemption.
    - Iraq has already demonstrated regional concern with launch on warning, launch under attack options. Syria probably has some option of this kind.

- Concentration of population and leadership in single or a few urban areas makes existential attacks possible and attractive.
    - Covert, terrorist, and proxy attacks are increasingly possible, particularly using biological weapons.
- Employment is unlikely to be irrational or reckless, but restraint in attacking civilian targets or mass employment against armed forces may be limited. Regimes also take existential risks in escalating if they feel they are likely to lose power. The use of proxies and unconventional delivery means may well be improvised without warning.

The region has at least some leaders who believe in personal rule, are impatient with technical details, and may be poorly prepared for crises when they do occur. The region's military experts also tend to be far more interested in acquiring new weapons than the details of employing them, and it may be difficult for many countries to estimate weapons reliability and effects -- particularly when weapons development is covert. Restraint and rational deterrence in peacetime could quickly turn into uncontrolled escalation in a major crisis -- particularly if leaders were confronted with the perceived need to preempt or a "use or lose" contingency. It is important to note that while some states may be proliferating, they may not yet have decided exactly how these weapons that they are producing are to be used.

Many countries do not articulate detailed war plans and employment doctrine beyond the prestige of acquiring such weapons, broad threats, and efforts to intimidate their neighbors and the West. Even where nations appear to articulate a strategy of deterrence or employment, this may often consist more of words than detailed war fighting capabilities. Most proliferating nations will engage in concealment, denial, and compartmentation -- focusing more on the acquisition and development effort than employment. Targeting plans, test and evaluation, and understanding of lethality will be limited. Joint warfare concepts will rarely be articulated, and doctrine will not be practiced.

CBRN forces will often be covert or compartmentalized from other forces, and under the direct control of ruling elites with little real military experience. Separate lines of C^4I/BM reporting directly to the leadership will be common. Actual weapons may be held separately from delivery systems and by special units chosen more for loyalty than capability. Any actual employment will be crisis-driven, and utilization and escalation will be more a product of the attitudes and decisions of a narrow ruling political elite than any part of the military command chain. Risk taking will often be leader-specific and based on perceptions of a crisis shaped more by internal political attitudes than an objective understanding of the military situation.

The covert nature of proliferation also makes it almost impossible for any nation to be sure its opponent has actually reduced its weapons to zero, and the very nature of bio-technology means that no presently conceivable arms control regime can deny states in the region a steadily growing "break out" capability to build and use bioweapons capable of decimating an opponent's capital city, potentially disrupting its government and threatening its existence as a state. This makes it essential to consider is the threat of terrorist use of weapons of mass destruction.

All of these factors could, in the worst case, lead to the use of chemical and biological weapons in areas of dense population. The easily accessible agents as well as the multitude of dense population centers in the Middle East make these scenarios increasingly probable. While many of the examples provided in this table include scenarios regarding states, it is important to note that many possibilities of a terrorist attack using these weapons:
Unconventional and terrorist delivery of weapons of mass destruction can offer major advantages.
Powers like Iran and Syria have used terrorists and extremists as proxies in attacking neighbors.
Biological warfare -- the easiest way to achieve extremely high lethalities -- is best conducted in this manner.
Past terrorist attacks have shown it can take months to years to firmly characterize the enemy, and this is particularly true when terrorism has indirect or direct support from a state like Libya, Syria, or Iran. "Plausible deniability" may exist indefinitely and a state subject to an existential attack has no meaningful way to retaliate.

Changes in Technology

As **Figure 10.8** shows, advances in technology present growing problems for both achieving regional military stability and for arms control at every level. While there have been no breakthroughs in the production of fissile material, there is a vast amount of fissile material in the former Soviet Union, and more and more countries could produce an aircraft-deliverable nuclear device in a matter of a few months or years if they could buy weapons grade material. The very nature of biotechnology means all of the countries in the Middle East are steadily acquiring the capability to make extremely lethal dry storable biological weapons, and can do so with fewer and fewer indicators in terms of imports of specialized technology, with more use of dual-use or civilian production facilities, and in smaller spaces. In most cases, their civil infrastructure will provide the capability to create such weapons without dedicated major military imports.

As **Figure 10. 9** shows, these changes in technology affect both defense and offense. Long-range ballistic missile systems are being deployed in Iran and Syria, as well as Israel; better strike fighters with performance capabilities superior to yesterday's bombers are becoming commonplace. The kind of cruise missile technology suited to long-range delivery of both nuclear and biological weapons against area targets like cities is becoming available to nations like Egypt, Iran, Iraq, Israel, and Syria. While improved air defenses and theater ballistic missile defenses -- such as Patriot, Arrow, and THAAD -- offer a potential countermeasure to such delivery systems, the peace process also will create more open borders and more civilian commercial traffic of a kind that makes it easier to use unconventional delivery means.

These technical developments create new uncertainties for war fighting and arms control. Nations that are just beginning to acquire a few nuclear weapons or serious biological weapons tend to see wars involving such weapons in terms of threats to enemy population centers and have little option other than to strike or concede if intimidation fails. They also tend to try to keep their capabilities covert, and remove them from their normal political decision making process. This can lead to rapid massive escalation or surprise attacks -- particularly if a given side fears preemption, structures its forces to launch under attack, and/or seeks to strike before its opponent can bring its retaliatory forces and air and missile defenses to full readiness. Fewer weapons do not mean greater stability and security, and they almost inevitably mean counter-value targeting.

As the East-West arms race has shown, there is no easily definable stopping point in terms of either technology or weapons numbers. Broadening the number and type of weapons to allow strikes against military targets creates an incentive to be able to strike as many targets as possible. Obtaining the option to strike at tactical military targets lowers the threshold of escalation and may lead a given side to be more willing to attack. Reducing the vulnerability of steadily larger inventories of weapons and delivery systems may lead to a loss of control, or more lethal plans to preempt or launch under attack. Larger forces potentially increase the risk that weapons directed against military targets will hit population centers, and while the Middle East may not be filled with "one bomb" states, it is definitely filled with "few bomb" states. Further, a state under existential attack by one neighbor may lash out against other states -- a pattern Iraq has already exhibited by launching missile attacks against Israel during the Gulf War.

Covert and Terrorist attacks and the Risk of "Superterrorism

As **Figure 10.10** shows, however, it is also dangerous to view proliferation, and the technologies involved, in terms of advanced weapons and regular military forces. The advances in proliferation also aid terrorists, states in conducting covert attacks, and the potential use of extremist or terrorist movements as proxies for regional powers. Moreover, the kind of scenarios outlined in Figure 10.10 illustrate how difficult it could be to identify the attacker in some scenarios, and the risk deception and false flags will be used to try to direct any response towards other movements or states.

The CIA has issued unclassified reports that make it clear that such threats are not theoretical. The CIA reported in June 2003 that,[1]

> Al-Qaeda and associated extremist groups have a wide variety of potential agents and delivery means to choose from for chemical, biological, radiological, or nuclear (CBRN) attacks. Al-Qaeda's end goal is the use of CBRN to cause mass casualties; however, most attacks by the group—and especially by associated extremists—probably will be small scale, incorporating relatively crude delivery means and easily produced or obtained chemicals, toxins, or radiological substances. The success of any al-Qaeda attack and the number of ensuing casualties would depend on many factors, including the technical expertise of those involved, but most scenarios could cause panic and disruption.
>
> * Several groups of mujahadeen associated with al-Qaeda have attempted to carry out "poison plot" attacks in Europe with easily produced chemicals and toxins best suited to assassination and small-scale scenarios. These agents could cause hundreds of casualties and widespread panic if used in multiple simultaneous attacks.
>
> * Al-Qaeda is interested in radiological dispersal devices (RDDs) or "dirty bombs." Construction of an RDD is well within its capabilities as radiological materials are relatively easy to acquire from industrial or medical sources. Osama Bin Laden's operatives may try to launch conventional attacks against the nuclear industrial infrastructure of the United States in a bid to cause contamination, disruption, and terror.
>
> * A document recovered from an al-Qaeda facility in Afghanistan contained a sketch of a crude nuclear device.
>
> * Spray devices disseminating biological warfare (BW) agents have the highest potential impact. Both 11 September attack leader Mohammad Atta and Zacharias Moussaoui expressed interest in crop dusters, raising our concern that al-Qaeda has considered using aircraft to disseminate BW agents.
>
> * Analysis of an al-Qaeda document recovered in Afghanistan in summer 2002 indicates the group has crude procedures for making mustard agent, sarin, and VX.

The CIA reported in November 2003 that,[2]

> The threat of terrorists using chemical, biological, radiological, and nuclear (CBRN) materials remained high. Many of the 33 designated foreign terrorist organizations and other nonstate actors worldwide have expressed interest in CBRN. Although terrorist groups probably will continue to favor long-proven conventional tactics such as bombings and shootings, the arrest of ricin plotters in London in January 2003 indicated that international mujahadeen terrorists were actively plotting to conduct chemical and biological attacks.
>
> Increased publicity surrounding the anthrax incidents since the September 11 attacks has highlighted the vulnerability of civilian and government targets to CBRN attacks.
>
> One of our highest concerns is al-Qaeda's stated readiness to attempt unconventional attacks against us. As early as 1998, Osama Bin Laden publicly declared that acquiring unconventional weapons was "a religious duty."
>
> Individuals from terrorist groups worldwide undertook poison training at al-Qaeda-sponsored camps in Afghanistan and have ready access to information on chemical, biological, radiological, and to some extent, even nuclear weapons, via the Internet, publicly available scientific literature, and scientific conferences, and we know that al-Qaeda was working to acquire some of the most dangerous chemical agents and toxins. A senior Bin Laden associate on trial in Egypt in 1999 claimed his group had chemical and biological weapons. Documents and equipment recovered from al-Qaeda facilities in Afghanistan show that Bin Laden had a more sophisticated unconventional weapons research program than was previously known.

> We also know that al-Qaeda has ambitions to acquire or develop nuclear weapons and was receptive to any outside nuclear assistance that might become available. In February 2001, during the trial on the al-Qaeda bombings of the American Embassies in Tanzania and Kenya, a government witness—Jamal Ahmad Fadl—testified that al-Qaeda pursued the sale of a quantity of purported enriched uranium (which in fact probably was scam material) in Sudan in the early 1990s.
>
> We assess that terrorist groups are capable of conducting attacks using crude radiological dispersal devices—i.e., ones that would not cause large-scale casualties, even though they could cause tremendous psychological effects, and possibly create considerable economic disruption as well. This type of threat first appeared in November 1995 when Chechen rebels placed a package containing radioactive cesium on a bench in Moscow's Izmailovo Park. In addition, we are alert to the very real possibility that al-Qaeda or other terrorist groups might also try to launch conventional attacks against the chemical or nuclear industrial infrastructure of the United States to cause panic and economic disruption.

This raises the following issues regarding "superterrorism" and the effect it may have on the military future of the region:

- The role of covert warfare, proxy warfare, independent non-state actors.
- The dangers posed by the fact that the conventional military strength of the US and its allies creates a growing incentive for both proliferation and covert/indirect attack.
- The ability of both states and non-state actors to use CBRN weapons in a variety of new methods of attack.
- The risk that terrorist and extremist movements may develop or gain access to weapons of mass destruction.
- While many analysts focus on the nuclear worst case, chemical and biological weapons are easier to manufacture and obtain.
- Commercial technologies like cell phones, GPS navigation systems, advanced timers, and local weather models can greatly increase the effectiveness and lethality of covert and terrorist attacks.
  - What forms of superterrorism are possible that do not involve weapons of mass destruction?
  - Information warfare attacks on critical systems?
- Man-portable and light precision weapons attacks on critical facilities like power plants, water/desalination plants/grids, high-rise closed buildings and mall complexes?
- What form of arms control is relevant in dealing with covert, proxy, and terrorist attacks?
- Can a regime be established to monitor the possible use of CBRN and superterrorist weapons and attacks, limit the ability to conduct covert attacks, and identify the state or non-state attacker?
- What level of control on technology transfer is possible and relevant? To what extent can the flow of relevant technologies be controlled to either state or non-state actors.

Arms Control Issues

While many countries in the Middle East seek arms control as a method of defense, others see it as hindering their potential power and influence in the region. Further difficulties exist in the political arena, where signing a treaty might be seen as "giving in" to other nations or as a weakness in the leader signing it. The following factors affect the pursuit of arms control and counterproliferation:

- Egyptian-Israeli dispute has paralyzed ACRS and all near-term progress.
- NPT aids in early to mid-phases of proliferation. Transfer of technology for fuel cycle.

- IAEA inspection and "visits" to declared facilities help, but can also be manipulated to disguise proliferation.
- Dual use technology now allows states to carry out virtually all aspects of weapons design and manufacture -- including simulated tests.
- In spite of Iraq's grandiose effort, the ability to carry out all aspects of nuclear proliferation except acquiring fissile materials is becoming steadily cheaper, smaller in scale, and easier to conceal.
- The CWC only affects signer countries and large efforts or those disclosed through SIGINT; it cannot prevent development and assembly of up to several hundred weapons and warheads.
- The steady expansion of petrochemical, industrial process plants, and insecticide plants will make it progressively easier to produce chemical weapons without extensive imports of tell tale feedstocks.
- The technology to purify and stabilize mustard and nerve agents is now well known, as is the need for more lethal warhead technology. All major proliferators have nerve gas technology.
- The BWC has no enforcement provisions and no near to mid-term prospects of acquiring them.
- Advances in biotechnology, food processing systems, and pharmaceuticals mean all regional states will soon be able to covertly mass produce dry storage biological weapons in optimal aerosol form.
- The MTCR slows things down and is very valuable, but it has not prevented any determined regional actor from getting missiles.
- All credible regional proliferators already have long-range strike aircraft and a wide range of unconventional delivery options.
- Only a broadly based UNSCOM/IAEA effort of the kind going on in Iraq -- supported by even more intrusive inspection and higher levels of technology -- can really enforce arms control, and it might not work for biological weapons.

Figure 10.11 shows that many Middle Eastern states are parties to arms control agreements designed to prevent or limit proliferation. In practice, however, the preceding risks pose critical problems for global arms control regimes like the Nuclear Non-Proliferation Treaty and Biological Weapons Convention, and are a serious problem with the Chemical Weapons Convention.

Figure 10.12 summarizes the continuing technological duel between the detection and concealment of weapons of mass destruction. It illustrates the fact that arms control is often an extension of war, or at least the struggle to acquire military power, by other means.

Figure 10.3 lists the major risks in regional arms control, and shows the broader limits to the ability of such agreements in providing verifiable military security. It shows that effective arms control, must rely on intrusive technical means and unimpeded, sudden challenge inspection. Even then, it is far from clear that any regional arms control agreement can offer absolute assurance, no matter how many countries may be included or how demanding the proposed inspection system may be.

Broader Approaches to Counterproliferation

Yet, it is again important not to exaggerate the impact of "worst case" risks or their probability. Such possibilities do not alter the basic rules of rational behavior. Arms control can also be mixed with broader based counter-proliferation efforts of the kind described in **Figures 10.13**.

The following factors affect such counter proliferation efforts:

- No one area of focus can be effective.
- There is no present prospect that any combination of arms control and active/passive counter proliferation can fully secure the region, any state in the region, or Western power projection forces.
- However, a synergistic effort blending arms control, containment, preemptive options, deterrence, retaliation, and civil defense should offer significant stability.

- There is no present prospect that such stability can be offered without at least tacit US threats to retaliate with nuclear weapons.
- Such policies cannot work by enforcing restraint on friends without enforcing them on enemies. There is no near to mid-term prospect that Israel can give up nuclear weapons.
- Creeping proliferation will follow the line of least resistance.
- There is no present prospect that any combination of measures can defend against biological warfare, and many proposed forms of counter-proliferation act as incentive to develop biological weapons and use unconventional means of delivery.
- Theater missile defense will be meaningless without radical improvements in defense against air attacks, cruise missiles, and unconventional means of delivery.

Figure 10.14 gives some examples of possible counterproliferation policies that states in the Middle East would need in order to achieve some form of arms control in the region. In addition, there will need to be force improvements to regulate any possible agreements and weapons development. These could result in major budgetary problems for each of the countries participating in such efforts.

Country by Country Threat Analysis

Figures **10.15** to **10.22** attempt to summarize the state of proliferation by country. The reader should understand, however, that any unclassified assessment at this level of details is extremely uncertain.

Figures 10.23 to 10.24 show that the failure to find stockpiles of weapons of mass destruction in Iraq, and the uncertainties surrounding proliferation in Iran and North Korea, have shown that there are major problems in current intelligence and collection capabilities to deal with this aspect of the military balance. The uncertainties in intelligence collection capability are summarized in **Figure 10.23**, and the uncertainties in analysis capability are summarized in **Figure 10.24**.

Figure 10.1
Who Has Weapons of Mass Destruction?

Country	Type of Weapon of Mass Destruction		
	Chemical	Biological	Nuclear
	East-West		
Britain	Breakout	Breakout	Deployed
France	Breakout	Breakout	Deployed
Germany	Breakout	Breakout	Technology
Sweden	-	-	Technology
Russia	Residual	Residual	Deployed
US	Residual	Breakout	Deployed
	Middle East		
Algeria	Technology	Technology	Interest
Egypt	Residual	Breakout	-
Israel	Breakout	Breakout	Deployed
Iran	Deployed?	Breakout	Technology
Iraq	Destroyed	Destroyed	Destroyed
Libya	Deployed?	Research	-
Syria	Deployed	Technology?	-
Yemen	Residual	-	-
	Asia and South Asia		
China	Deployed?	Breakout?	Deployed
India	Breakout?	Breakout?	Deployed
Japan	Breakout	Breakout	Technology
Pakistan	Breakout?	Breakout?	Deployed
North Korea	Deployed	Deployed	Deployed (?)
South Korea	Breakout?	Breakout	Technology
Taiwan	Breakout?	Breakout	Technology
Thailand	Residual	-	-
Vietnam	Residual	-	-
	Other		
Argentina	-	-	Technology
Brazil	-	-	Technology
South Africa	-	-	Technology

Figure 10.2

Strengths and Weaknesses of Weapons of Mass Destruction

Chemical Weapons:

Destructive Effects: Poisoning skin, lungs, nervous system, or blood. Contaminating areas, equipment, and protective gear for periods of hours to days. Forcing military units to don highly restrictive protection gear or use incapacitating antidotes. False alarms and panic. Misidentification of the agent, or confusion of chemical with biological agents (which may be mixed) leading to failure of defense measures. Military and popular panic and terror effects. Major medical burdens which may lead to mistreatment. Pressure to deploy high cost air and missile defenses. Paralysis or disruption of civil life and economic activity in threatened or attacked areas.

Typical Military Targets: Infantry concentrations, air bases, ships, ports, staging areas, command centers, munitions depots, cities, key oil and electrical facilities, desalinization plants.

Typical Military Missions: Killing military and civilian populations. Intimidation. Attack of civilian population or targets. Disruption of military operations by requiring protective measures or decontamination. Area or facility denial. Psychological warfare, production of panic, and terror.

Military Limitations: Large amounts of agents are required to achieve high lethality, and military and economic effects are not sufficiently greater than careful target conventional strikes to offer major war fighting advantages. Most agents degrade quickly, and their effect is highly dependent on temperature and weather conditions, height of dissemination, terrain, and the character of built-up areas. Warning devices far more accurate and sensitive than for biological agents. Protective gear and equipment can greatly reduce effects, and sufficiently high numbers of rounds, sorties, and missiles are needed to ease the task of defense. Leave buildings and equipment reusable by the enemy, although persistent agents may require decontamination. Persistent agents may contaminate the ground the attacker wants to cross or occupy and force use of protective measures or decontamination.

Biological Weapons

Destructive Effects: Infectious disease or biochemical poisoning. Contaminating areas, equipment, and protective gear for periods of hours to weeks. Delayed effects and tailoring to produce incapacitation or killing, treatable or non-treatable agents, and be infectious on contact only or transmittable. Forcing military units to don highly restrictive protection gear or use incapacitating vaccines antidotes. False alarms and panic. High risk of at least initial misidentification of the agent, or confusion of biological with chemical agents (which may be mixed) leading to failure of defense measures. Military and popular panic and terror effects. Major medical burdens, which may lead to mistreatment. Pressure to deploy high cost air and missile defenses. Paralysis or disruption of civil life and economic activity in threatened or attacked areas.

Typical Military Targets: Infantry concentrations, air bases, ships, ports, staging areas, command centers, munitions depots, cities, key oil and electrical facilities, desalinization plants. Potentially fare more effective against military and civil area targets than chemical weapons.

Typical Military Missions: Killing and incapacitation of military and civilian populations. Intimidation. Attack of civilian population or targets. Disruption of military operations by requiring protective measures or decontamination. Area or facility denial. Psychological warfare, production of panic, and terror.

Military Limitations: Most wet agents degrade quickly, although spores, dry encapsulated agents, and some toxins are persistent. Effects usually take some time to develop (although not in the case of some toxins). Effects are unpredictable, and are even more dependent than chemical weapons on temperature and weather conditions, height of dissemination, terrain, and the character of built-up areas. Major risk of contaminating the wrong area. Warning devices uncertain and may misidentify the agent. Protective gear and equipment can reduce effects. Leave buildings and equipment reusable by the enemy, although persistent agents may require decontamination. Persistent agents may contaminate the ground the attacker wants to cross or occupy and force use of protective measures or decontamination. More likely than chemical agents to cross the threshold where nuclear retaliation seems justified.

Nuclear Weapons

Destructive Effects: Blast, fire, and radiation. Destruction of large areas and production of fall out and contamination -- depending on character of weapon and height of burst. Contaminating areas, equipment, and protective gear for periods of hours to days. Forcing military units to don highly restrictive protection gear and use massive amounts of decontamination gear. Military and popular panic and terror effects. Massive medical burdens. Pressure to deploy high cost air and missile defenses. Paralysis or disruption of civil life and economic activity in threatened or attacked areas. High long-term death rates from radiation. Forced dispersal of military forces and evacuation of civilians. Destruction of military and economic centers, and national political leadership and command authority, potentially altering character of attacked nation and creating major recovery problems.

Typical Military Targets: Hardened targets, enemy facilities and weapons of mass destruction, enemy economy, political leadership, and national command authority. Infantry and armored concentrations, air bases, ships, ports, staging areas, command centers, munitions depots, cities, key oil and electrical facilities, desalinization plants.

Typical Military Missions: Forced dispersal of military forces and evacuation of civilians. Destruction of military and economic centers, and national political leadership and command authority, potentially altering character of attacked nation and creating major recovery problems.

Military Limitations: High cost. Difficulty of acquiring more than a few weapons. Risk of accidents or failures that hit friendly territory. Crosses threshold to level where nuclear retaliation is likely. Destruction or contamination of territory and facilities attacker wants to cross or occupy. High risk of massive collateral damage to civilians if this is important to attacker.

Source: Adapted by the Anthony H. Cordesman from Office of Technology Assessment, Proliferation of Weapons of Mass Destruction: Assessing the Risks, U.S. Congress OTA-ISC-559, Washington, August, 1993, pp. 56-57.

Figure 10.3

Major Chemical Agents[3]

NERVE AGENTS: Agents that quickly disrupt the nervous system by binding to enzymes critical to nerve functions, causing convulsions and/or paralysis. May be ingested, inhaled, and absorbed through the skin. Very low doses cause a running nose, contraction of the pupil of the eye, and difficulty in visual coordination. Moderate doses constrict the bronchi and cause a feeling of pressure in the chest, and weaken the skeletal muscles and cause filibration. Large doses cause death by respiratory or heart failure. Reaction normally occurs in 1-2 minutes. Death from lethal doses occurs within minutes, but artificial respiration can help and atropine and the oximes act as antidotes. The most toxic nerve agents kill with a dosage of only 10 milligrams be minute per cubic meter, versus 400 for less lethal gases. Recovery is normally quick, if it occurs at all, but permanent brain damage can occur:

Tabun (GA)
Sarin (GB) - nearly as volatile as water and delivered by air. A dose of 5 mg/min/m^3 produces casualties, a respiratory dose of 100 mg/min/m3 is lethal. Lethality lasts 1-2 days.
Soman (GD)
GF
VR-55 (Improved Soman) A thick oily substance which persists for some time.
VK/VX - a persistent agent roughly as heavy as fuel oil. A dose of 0.5 mg/min/m^3 produces casualties, a respiratory dose of 10 mg/min/m3 is lethal. Lethality lasts 1-16 weeks.

BLISTER AGENTS: Cell poisons that destroy skin and tissue, cause blindness upon contact with the eyes, and which can result in fatal respiratory damage. Can be colorless or black oily droplets. Can be absorbed through inhalation or skin contact. Serious internal damage if inhaled. Penetrates ordinary clothing. Some have delayed and some have immediate action. Actual blistering normally takes hours to days, but effects on the eyes are much more rapid. Mustard gas is a typical blister agent and exposure of concentrations of a few milligrams per meter over several hours generally at least causes blisters and swollen eyes. When the liquid falls onto the skin or eyes it has the effect of second or third degree burns. It can blind and cause damage to the lungs leading to pneumonia. Severe exposure causes general intoxication similar to radiation sickness. HD and HN persist up to 12 hours. L, HL, and CX persist for 1-2 hours. Short of prevention of exposure, the only treatment is to wash the eyes, decontaminate the skin, and treat the resulting damage like burns:

` Sulfur Mustard (H or HD) A dose of 100 mg/min/m^3 produces casualties, a dose of 1,500 mg/min/m3 is lethal. Residual lethality lasts up to 2-8 weeks.
Distilled Mustard (DM)
Nitrogen Mustard (HN)
Lewisite (L)
Phosgene Oxime (CX)
Mustard Lewisite (HL)

CHOKING AGENTS: Agents that cause the blood vessels in the lungs to hemorrhage, and fluid to build-up, until the victim chokes or drowns in his or her own fluids (pulmonary edema). Provide quick warning though smell or lung irritation. Can be absorbed through inhalation. Immediate to delayed action The only treatment is inhalation of oxygen and rest. Symptoms emerge in periods after exposure of seconds up to three hours:

Phosgene (CG)
Diphosgene (DP)
PS Chloropicrin
Chlorine Gas

BLOOD AGENTS: Kill through inhalation. Provide little warning except for headache, nausea, and vertigo. Interferes with use of oxygen at the cellular level. CK also irritates the lungs and eyes. Rapid action and exposure either kills by inhibiting cell respiration or it does not -- casualties will either die within seconds to minutes of exposure or recover in fresh air. Most gas masks have severe problems in providing effective protection against blood agents:

- Hydrogen Cyanide (AC) A dose of 2,000 mg/min/m^3 produces casualties, a respiratory dose of 5,000 mg/min/m3 is lethal. Lethality lasts 1-4 hours.
- Cyanogen Chloride (CK) A dose of 7,000 mg/min/m^3 produces casualties, a respiratory dose of 11,000 mg/min/m3 is lethal. Lethality lasts 15 minutes to one hour.

TOXINS: Biological poisons causing neuromuscular paralysis after exposure of hours or days. Formed in food or cultures by the bacterium clostridium Botulinum. Produces highly fatal poisoning characterized by general weakness, headache, dizziness, double vision and dilation of the pupils, paralysis of muscles, and problems in speech. Death is usually by respiratory failure. Antitoxin therapy has limited value, but treatment is mainly supportive:

Botulin toxin (A) Six distinct types, of which four are known to be fatal to man. An oral dose of 0.001 mg is lethal. A respiratory dose of 0.02 mg/min/m^3 is also lethal.

DEVELOPMENTAL WEAPONS: A new generation of chemical weapons is under development. The only publicized agent is perfluoroisobutene (PFIB), which is an extremely toxic odorless and invisible substance produced when PFIB (Teflon) is subjected to extreme heat under special conditions. It causes pulmonary edema or dry-land drowning when the lungs fill with fluid. Short exposure disables and small concentrations cause delayed death. Activated charcoal and most existing protection equipment offers no defense. Some sources refer to "third" and "fourth" generation nerve gasses, but no technical literature seems to be available.

CONTROL AGENTS: Agents which produce temporary irritating or disabling effects which in contact with the eyes or inhaled. They cause flow of tears and irritation of upper respiratory tract and skin. They can cause nausea and vomiting: can cause serious illness or death when used in confined spaces. CN is the least toxic gas, followed by CS and DM. Symptoms can be treated by washing of the eyes and/or removal from the area. Exposure to CS, CN, and DM produces immediate symptoms. Staphylococcus produces symptoms in 30 minutes to four hours, and recovery takes 24-48 hours. Treatment of Staphylococcus is largely supportive:

Tear
Chlororacetophenone (CN)
O-Chlorobenzyl-malononitrile (CS)
Vomiting: Cause irritation, coughing, severe headache, tightness in chest, nausea, vomiting:
Adamsite (DM)
Staphylococcus

INCAPACITATING AGENTS: Agents, which normally cause short-term illness, psychoactive effects, (delirium and hallucinations). Can be absorbed through inhalation or skin contact. The psychoactive gases and drugs produce unpredictable effects, particularly in the sick, small children, elderly, and individuals who already are mentally ill. In rare cases they kill or produce a permanent psychotic condition. Many produce dry skin, irregular heart beat, urinary retention, constipation, drowsiness, and a rise in body temperature, plus occasional maniacal behavior. A single dose of 0.1 to 0.2 milligrams of LSD-25 will produce profound mental disturbance within a half-hour that lasts 10 hours. The lethal dose is 100 to 200 milligrams:

BZ
LSD
LSD Based BZ
Mescaline
Psilocybin
Benzilates

.

Figure 10.4

Typical Warfighting Uses of Chemical Weapons

Mission	Quantity
Attack an infantry position: Cover 1.3 square kilometers of territory with a "surprise dosage" attack of Sarin to kill 50% of exposed troops.	216 240mm rockets (e.g. delivered by 18, 12 tube Soviet BM-24 rocket launchers, each carrying 8 kilograms of agent and totaling 1,728 kilograms of agent.
Prevent launch of enemy mobile missiles: Contaminate a 25 square kilometer missile unit operating area with 0.3 tons of a persistent nerve gas like VX per square kilometer.	8 MiG-23 or 4 Su-24 fighters, each delivering 0.9 ton of VX (totaling 7.2 tons.
Immobilize an air base: Contaminate a 2 square kilometer air base with 0.3 tons of VX twice a day for 3 days.	1 MiG-23 with six sorties or any similar attack aircraft.
Defend a broad front against large scale attack: Maintain a 300 meter deep strip of VX contamination in a front of a position defending a 60 kilometer wide area for 3 days.	65 metric tons of agent delivered by approximately 13,000 155-mm artillery rounds.
Canalize 1st and 2nd Echelon attacking forces: Force attacking Or retreating forces into fixed lines of movement. Guard flanks. Disrupt rear area operations.	8 MiG-23 or 4 Su-24 fighters, each delivering 0.9 ton of VX (totaling 7.2 tons.
Terrorize population: Kill approximately 125,000 unprotected civilians in a densely populated (10,000 square kilometer) city.	8 MiG-23 or 4 Su-24 fighters, each delivering 0.9 ton of VX (totaling 7.2 tons) under optimum conditions.

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

Figure 10.5

Biological Weapons that May Be in the Middle East

Disease	Infectivity	Transmissibility	Incubation Period	Mortality	Therapy
Viral					
Chikungunya fever	high?	none	2-6 days	very low (-1%)	none
Dengue fever	high	none	5-2 days	very low (-1%)	none
Eastern equine encephalitis	high	none	5-10 days	high (+60%)	developmental
Tick borne encephalitis	high	none	1-2 weeks	up to 30%	developmental
Venezuelan equine encephalitis	high	none	2-5 days	Low (-1%)	developmental
Hepatitis A	-	-	15-40 days	-	-
Hepatitis B	-	-	40-150 days	-	-
Influenza	high	none	1-3 days	usually low	available
Yellow fever	high	none	3-6 days	up to 40%	available
Smallpox (Variola)	high	high	7-16 days	up to 30%	available
Rickettsial					
Coxiella Burneti (Q-fever)	high	negligible	10-21 day	Low (-1%)	antibiotic
Mooseri		-	-	6-14 days	- -
Prowazeki	-	-	6-15 days	-	-
Psittacosis	high	moderate-high	4-15 days	Mod-high	antibiotic
Rickettsi (Rocky mountain spotted fever)	high	none	3-10 days	up to 80%	antibiotic
Tsutsugamushi	-	-	-	-	-
Epidemic typhus	high	none	6-15 days	up to 70%	antibiotic/vaccine
Bacterial					
Anthrax (pulmonary)	mod-high	negligible	1-5 days	usually fatal	antibiotic/vaccine
Brucellosishigh	none	1-3 days	-25%	antibiotic	
Cholera	low	high	1-5 days	up to 80%	antibiotic/vaccine
Glanders	high	none	2-1 days	usually fatal	poor antibiotic
Meloidosis	high	none	1-5 days	usually fatal	moderate antibiotic
Plague (pneumonic)	high	high	2-5 days	usually fatal	antibiotic/vaccine
Tularemia	high	negligible	1-10 days	low to 60%	antibiotic/vaccine
Typhoid fever	mod-high	mod-high	7-21 days	up to 10%	antibiotic/vaccine
Dysentery	high	high	1-4 days	low to high	antibiotic/vaccine
Fungal					
Coccidioidomycosis	high	none	1-3 days	low	none
Coccidiodes Immitis	high	none	10-21 days	low	none
Histoplasma Capsulatum		-	-	15-18 days	- -
Norcardia Asteroides	-	-	-	-	-
Toxins[a]					
Botulinum toxin	high	none	12-72 hours	high neromusc-	vaccine lar paralysis
Mycotoxin	high	none	hours or days	low to high	?
Staphylococcus	moderate	none	24-48 hours	incapacitating	?

a. Many sources classify as chemical weapons because toxin are chemical poisons.

Source: Adapted by Anthony H. Cordesman from Report of the Secretary General, Department of Political and Security Affairs, Chemical and Bacteriological (Biological) Weapons and the Effects of Their Possible Use, New York, United Nations, 1969, pp. 26, 29, 37-52, 116-117; Jane's NBC Protection Equipment, 1991-1992; James Smith, "Biological Warfare Developments," Jane's Intelligence Review, November, 1991, pp. 483-487.

Figure 10.6

The Comparative Effects of Biological, Chemical, and Nuclear Weapons Delivered Against a Typical Urban Target in the Middle East

Using missile warheads: Assumes one Scud sized warhead with a maximum payload of 1,000 kilograms. The study assumes that the biological agent would not make maximum use of this payload capability because this is inefficient. It is unclear this is realistic.

	Area Covered in Square Kilometers	Deaths Assuming 3,000-10,000 people Per Square Kilometer
Chemical: 300 kilograms of Sarin nerve gas with a density of 70 milligrams per cubic meter	0.22	60-200
Biological 30 kilograms of Anthrax spores with a density of 0.1 milligram per cubic meter	10	30,000-100,000
Nuclear:		
One 12.5 kiloton nuclear device achieving 5 pounds per cubic inch of over-pressure	7.8	23,000-80,000
One 1 megaton hydrogen bomb	190	570,000-1,900,000

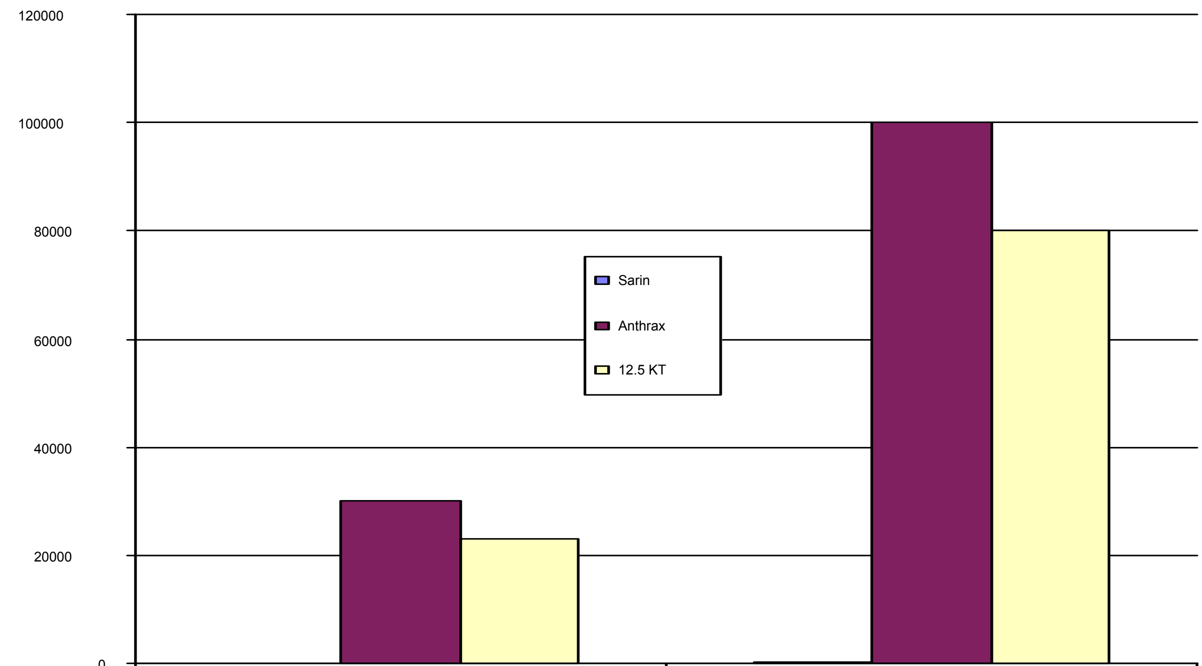
Using one aircraft delivering 1,000 kilograms of Sarin nerve gas or 100 kilograms of anthrax spores: Assumes the aircraft flies in a straight line over the target at optimal altitude and dispensing the agent as an aerosol. The study assumes that the biological agent would not make maximum use of this payload capability because this is inefficient. It is unclear this is realistic.

	Area Covered in Square Kilometers	Deaths Assuming 3,000-10,000 people Per Square Kilometer
Clear sunny day, light breeze		
Sarin Nerve Gas	0.74	300-700
Anthrax Spores	46	130,000-460,000
Overcast day or night, moderate wind		
Sarin Nerve Gas	0.8	400-800
Anthrax Spores	140	420,000-1,400,000
Clear calm night		
Sarin Nerve Gas	7.8	3,000-8,000
Anthrax Spores	300	1,000,000-3,000,000

Source: Adapted by the Anthony H. Cordesman from Office of Technology Assessment, Proliferation of Weapons of Mass Destruction: Assessing the Risks, US Congress OTA-ISC-559, Washington, August, 1993, pp. 53-54.

Figure 10.7

The Relative Killing Effect of Chemical vs. Biological Weapons of Mass Destruction for a 1,000 Kilogram Bomb or Warhead



	Low	High
Sarin	60	200
Anthrax	30000	100000
12.5 KT	23000	80000

The Thermal and Blast Effects of Nuclear Weapons - Radius of Effect in Kilometers

Yield in Kilotons	Metals Vaporize	Metals Melt	Wood Burns	3rd Degree Burns	5 psi/ 160 mph Winds	3 psi/ 116 mph Winds
10	0.337	0.675	1.3	1.9	1.3	1.6
20	0.477	0.954	1.9	2.7	2.0	2.5
50	0.754	1.6	3.0	4.3	2.7	3.3
100	1.0	2.0	4.3	5.7	3.5	4.3
200	1.5	2.8	5.7	8.0	4.5	5.4

Source: Adapted by Anthony H. Cordesman from the Royal United Services Institute, Nuclear Attack: Civil Defense, London, RUSI/Brassey's, 1982, pp. 30-36.
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Figure 10.8

Technological Developments and Imperatives 2010-2020

Missiles and Other Delivery Systems

- Satellite targeting and weather models, GPS launch location data.
- Cheap cruise missiles, drones, aircraft conversions
- Indigenous production of medium to long-range solid fuel designs and high payload, multi-stage liquid-fueled designs. "Add a stage" range extensions.
- Widespread deployment of systems with high range-payloads and very high terminal velocities. Some "smart" warhead technology for penetration and terminal guidance.
- Hardened or mobile launch facilities, large numbers of dispersed systems.
- Rapid launch with minimal warning indicators.
- Mobile, rapidly replaceable separate warheads. Easy conversion and concealment.
- Advanced computer modeling and simulation, test range facilities. Reduced testing requirements.
- Strike Aircraft with some stealth features.
- Advanced warhead and munitions designs with sophisticated fusing and dissemination systems.
- Highly sophisticated covert delivery systems and "terrorist" devices.

Chemical Weapons

- Rapid, often covert, precursor production. Complex precursor assembly combinations.
- Stable binary nerve agents for persistent and non-persistent agents.
- Rapid production of mustard and other incapacitating agents.
- Weapons with mixed agents or "cocktails" to help defeat antidotes and protection systems.
- "Breakout" facilities for rapid conversion to production.
- Effective cluster warheads and bombs, with reliable fusing and dissemination systems.
- Widespread deployment of systems with high range-payloads and very high terminal velocities. Some "smart" warhead technology for penetration and terminal guidance.
- Advanced weather and targeting data. Computer modeling of attack contours.
- Highly sophisticated covert delivery systems and "terrorist" devices.

Biological Weapons

- Genetic engineering – generational change capability to weaponize new weapons, defeat vaccines, detection, and protection systems.
- Widespread deployment of dry, storable agents.
- Ability to rapidly convert civilian pharmaceutical, fermentation, and other facilities.
- Possible ability to weaponize infectious agents like Ebola.
- Ability to use complex cocktails of different biological weapons to defeat warning, detection, treatment, and protection.
- Lethality of small nuclear weapons.
- Advanced warhead and munitions designs with sophisticated fusing and dissemination systems. Line source dissemination systems.
- Rapidly convertible warheads and bombs.
- Advanced weather and targeting data. Computer modeling of attack contours.

- Highly sophisticated covert delivery systems and “terrorist” devices. Ability to delay effect of weapon.

Nuclear Weapons

- Widespread understanding of complex weapons designs and access to key computer modeling data.
- Reduced need for fissile material and sharply reduced weapon weight.
- Can reduce or eliminate need for testing.
- High speed, high capacity centrifuge capability.
- Power reactors can be rapidly converted or cannibalized?
- Indigenous design and production of explosive lenses, initiators, and boosting technology.
- Advanced computer modeling and simulation. Ability to use non-fissile material for most testing purposes.
- Advanced warhead designs with sophisticated fusing. Controlled height of burst and enhanced radiation weapons. Safe use of weapons near own and friendly territory.
- Advanced weather and targeting data. Computer modeling of fall out contours.
- Highly sophisticated covert delivery systems and “terrorist” devices.

Figure 10.9

Technological Developments and Imperatives 2010-2020: Counterproliferation and Defensive Options

"Defensive" systems can protect:

- **Missile and greatly improved air defenses.**
- **Major improvements in chemical and biological detection and warning.**
- **Some improvement in treatment and protection systems.**
- **Civil defense options.**

"Defensive" systems can also threaten:

- **Greatly improved access to satellite surveillance systems, ability to piggyback on any arms inspection efforts to ease targeting burden.**
- **Widespread access to long-range precision-guided strike systems and some ability to hit hardened targets.**
- **Possible access to small covert sensors and detection systems.**
- **Long-range UAVs, RPVs.**
- **Possible improvement in Sigint/Comint systems.**

Figure 10.10

Unconventional Attacks Using Weapons of Mass Destruction: Scenario Examples

- A radiological powder is introduced into the air conditioning systems of Saudi high-rise buildings or tourist hotels. Symptoms are only detected over days or weeks and public warning is given several weeks later. The authorities detect the presence of such a power, but cannot estimate its long-term lethality and have no precedents for decontamination. Tourism collapses, and the hotels eventually have to be torn down and rebuilt.
- A Country X-backed terrorist group smuggles parts for a crude gun-type nuclear device into Israel or bought in the market place. The device is built in a medium sized commercial truck. A physics student reading the US Department of Defense weapons effects manual maps Tel Aviv to maximize fall out effects in an area filled with buildings with heavy metals and waits for a wind maximizing the fall out impact. The bomb explodes with a yield of only 8 kilotons, but with an extremely high level of radiation. Immediate casualties are limited but the long-term death rate mounts steadily with time. Peace becomes impossible and security measures become Draconian. Immigration halts and emigration reaches crisis proportions. Israel as such ceases to exist.
- Several workers move drums labeled as cleaning agents into a large shopping mall, large public facility, subway, train station, or airport. They dress as cleaners and are wearing what appear to be commercial dust filters or have taken the antidote for the agent they will use. They mix the feedstocks for a persistent chemical agent at the site during a peak traffic period. Large-scale casualties result, and Draconian security measures become necessary on a national level. A series of small attacks using similar “binary” agents virtually paralyze the economy, and detection is impossible except to identify all canisters of liquid.
- Immunized terrorists visit a US carrier or major Marine assault ship during the first hours of visitor’s day during a port call in the Middle East. They are carrying Anthrax powder in bags designed to make them appear slightly overweight. They slowly scatter the powder as they walk through the ship visit. The immediate result is 50% casualties among the ship’s crew, its Marine complement, and the visitors that follow. The US finds it has no experience with decontaminating a large ship where Anthrax has entered the air system and is scattered throughout closed areas. After long debates over methods and safety levels, the ship is abandoned.
- A Country X-backed terrorist group seeking to “cleanse” a nation of its secular regime and corruption introduces a modified type culture of Ebola or a similar virus into an urban area. It scatters infectious cultures in urban areas for which there is no effective treatment. By the time the attack is detected, it has reached epidemic proportions. Medical authorities rush into the infected area without proper protection, causing the collapse of medical facilities and emergency response capabilities. Other nations and regions have no alternative other than to isolate the nation or center under attack, letting the disease take its course.
- A Country X-backed terrorist group modifies the valves on a Japanese remote-controlled crop-spraying helicopter which has been imported legally for agricultural purposes. It uses this system at night or near dawn to spray a chemical or biological agent at altitudes below radar coverage in a line-source configuration. Alternatively, it uses a large home-built RPV with simple GPS guidance. The device eventually crashes undetected into the sea or in the desert. Delivery of a chemical agent achieves far higher casualties than any conventional military warhead. A biological agent is equally effective and the first symptoms appear days after the actual attack — by which time treatment is difficult or impossible.
- A truck filled with what appears to be light gravel is driven through the streets of Riyadh, Kuwait City, Tehran, or Tel Aviv during rush hour or another maximum traffic period. A visible powder does come out through the tarpaulin covering the truck, but the spread of the powder is so light that no attention is paid to it. The driver and his assistant are immunized against the modified form of Anthrax carried in the truck which is being released from behind the gravel or sand in the truck. The truck slowly quarters key areas of the city. Unsuspected passersby and commuters not only are infected, but also carry dry spores home and into other areas. By the time the first major symptoms of the attack occur some 3-5 days later, Anthrax pneumonia is epidemic and some septicemic Anthrax has appeared. Some 40-65% of the exposed population dies and medical facilities collapse causing serious, lingering secondary effects.
- A Country X-backed terrorist group scatters high concentrations of a radiological, chemical, or biological agent in various areas in a city, and trace elements into the processing intakes to the local water supply. When

the symptoms appear, the terrorist group makes its attack known, but claims that it has contaminated the local water supply. The authorities are forced to confirm that water is contaminated and mass panic ensues.

- Immunized terrorists carry small amounts of Anthrax or a similar biological agent onto a passenger aircraft like a B-747, quietly scatter the powder, and deplane at the regular scheduled stop. No airport detection system or search detects the agent. Some 70-80% of those on the aircraft die as a result of symptoms that only appear days later.
- Several identical nuclear devices are smuggled out of the FSU through Afghanistan or Central Asia. They do not pass directly through governments. One of the devices is disassembled to determine the precise technology and coding system used in the weapon's PAL. This allows users to activate the remaining weapons. The weapon is then disassembled to minimize detection with the fissile core shipped covered in lead. The weapon is successfully smuggled into the periphery of an urban area outside any formal security perimeter. A 100 kiloton ground burst destroys a critical area and blankets the region in fall out.
- The same device is shipped to Israel or a Gulf area in a modified standard shipping container equipped with detection and triggering devices that set it off as a result of local security checks or with a GPS system that sets it off automatically when it reaches the proper coordinates in the port of destination. The direct explosive effect is significant, but "rain out" contaminates a massive local area.
- Country X equips a freighter or dhow to spread Anthrax along a coastal area in the Gulf. It uses a proxy terrorist group, and launches an attack on Kuwait City and Saudi oil facilities and ports. It is several days before the attack is detected, and the attacking group is never fully identified. The form of Anthrax involved is dry and time encapsulated to lead to both massive prompt casualties and force time-consuming decontamination. Country X not only is revenged, but also benefits from the resulting massive surge in oil prices.
- A Country X-backed terrorist group scatters small amounts of a biological or radiological agent in a Jewish area during critical stages of the final settlement talks. Near panic ensures, and a massive anti-Palestinian reaction follows. Israeli security then learns that the terrorist group has scattered small amounts of the same agent in cells in every sensitive Palestinian town and area, and the terrorist group announces that it has also stored some in politically sensitive mosques and shrines. Israeli security is forced to shut down all Palestinian movement and carry out intrusive searches in every politically sensitive area. Palestinian riots and exchanges of gunfire follow. The peace talks break down permanently.
- Country X equips dhows to spread Anthrax. The dhows enter the ports of Kuwait as commercial vessels — possibly with local or other Southern Gulf registrations and flags. It is several days before the attack is detected, and the resulting casualties include much of the population of Abu Dhabi and government of the UAE. The UAE breaks up as a result, no effective retaliation is possible, and Iran achieves near hegemony over Gulf oil policy.
- A Country X-backed terrorist group attempting to drive Western influence out of Saudi Arabia smuggles a large nuclear device into Al Hufuf on the edge of the Ghawar oil field. It develops a crude fall out model using local weather data which it confirms by sending out scouts with cellular phones. It waits for the ideal wind, detonates the devices, shuts down the world's largest exporting oil field, and causes the near collapse of Saudi Arabia.
- Alternatively, the same group takes advantage of the security measures the US has adopted in Saudi Arabia, and the comparative isolation of US military personnel. It waits for the proper wind pattern and allows the wind to carry a biological agent over a Saudi airfield with a large US presence from an area outside the security perimeter. The US takes massive casualties and has no ability to predict the next attack. It largely withdraws from Saudi Arabia.
- A freighter carrying fertilizer enters a Middle Eastern port and docks. In fact, the freighter has mixed the fertilizer with a catalyst to create a massive explosion and also carries a large amount of a chemical, radiological, and/or biological agent. The resulting explosion destroys both the immediate target area and scatters the chemical or biological weapon over the area.
- A large terrorist device goes off in a populated, critical economic, or military assembly area — scattering mustard or nerve gas. Emergency teams rush in to deal with the chemical threat and the residents are evacuated. Only later does it become clear that the device also included a biological agent and that the

response to this "cocktail" killed most emergency response personnel and the evacuation rushed the biological agent to a much wider area.

Figure 10.11

The Status of Major Arms Control Agreements

Country	Geneva Protocol	NNPT	BWC	CWC	Treaty of Pelindaba*	CTBT
North Africa						
Algeria	R	R	-	R	R	SRR
Libya	R	R	A	-	S	-
Morocco	R	R	S	R	R	S
Tunisia	R	R	R	R	S	S
Near/Middle East						
Egypt	R	R	S	-	S	SRR
Israel	R	-	-	S	NA	SRR
Jordan	R	R	R	A	NA	R
Lebanon	R	R	R	-	NA	-
Syria	R	R	S	-	NA	-
Gulf						
Bahrain	R	R	A	R	NA	S
Iran	R	R	R	R	NA	SRR
Iraq	R	R	R	-	NA	-
Kuwait	R	R	R	R	NA	S
Oman	-	R	R	R	NA	-
Qatar	R	R	R	R	NA	R
UAE	-	R	S	S	NA	S
Yemen	R	R	R	S	NA	S
Periphery						
Ethiopia	R	R	R	R	S	S
Eritrea	-	R	-	-	S	-
Sudan	R	R	-	-	S	-
India	R	-	R	R	NA	NSRR
Pakistan	R	-	R	R	NA	NSRR

R = Ratified, S = Signed, A = Acceded, NA = Not Applicable, SRR = Signed – Ratification Required, and NSRR = Not signed – Ratification Required
*** African Nuclear Weapons Free Zone Treaty**

Source: State Department

Figure 10.12

The Changing Technology of Detection and Concealment

Changes in Concealment

- **Counter-Satellite: Covered buildings, monitor overhead coverage, deception (including media/commercial satellites), conversion of existing facilities, dual use facilities.**
- **Counter EW/ELINT/ESSM: Secure encryption, line of sight, pulse code modulation.**
- **Breakout versus openly deploy or stockpile.**
- **Cell-like structures.**
- **Parallel programs.**
- **Computer simulation backed by limited tests.**
- **C4I/BM/sensor advances, rather than hardware.**

Changes in Detection

- **Near advanced satellite imaging.**
- **Use of UAVs. Micro UAVs.**
- **New unattended sensors: soil and water.**
- **Non-encryption agreements.**
- **Challenge inspection.**
- **Sensors that can see through shelters, inspect underground facilities.**

Figure 10.13

Major Risks in Regional Arms Control

- **Does not affect non-state or terrorist groups except to degree reduces ability of states to transfer such weapons. However, also acts as an incentive to states to carry out covert development or attacks on their own or use terrorist or extremist groups as proxies.**
- **"Breakout": Technology allows sudden or covert break out of weapons production and delivery capability – particularly in terms of biological weapons.**
- **"Squeezing the balloon": Limiting one area of proliferation simply increases activity in another.**
- **"Liar's contest": Accept agreements that do not intend to honor. Carry out covert efforts and deny them. Obtain access to technology and equipment.**
- **"Only the honest suffer:" Limit moderate states, but fail to contain and deter rogue or high-risk states. License technology transfer to nations that claim to comply, but do not.**
- **"War fighting risk": Create a covert climate of proliferation involving sudden activation of forces with limited planning and/or control, higher risk of misunderstandings, accidents, unnecessary preemption, launch under and through attack, and escalation.**
- **"Existential minimalism": Reducing weapons to minimal levels creates an added use or lose risk, leads to countervalue (civilian casualties and damage)/existential threats and targeting.**
- **"Destabilizing truth": Added transparency, inspection, declarations either stimulate arms race or lead to constantly increasing pressure to reveal or reduce more.**
- **"Climate of illusions": Inspection, verification, declarations give the impression of added transparency and stability without being trustworthy.**
- **"Conventional paradox": Reducing or constraining weapons of mass destruction increases risk of conventional war.**
- **"Nth Weapon" problem in trying to eliminate all weapons when a few concealed nuclear or biological weapons can produce existential damage.**
- **"Valid Paranoia": Can encourage covert delivery and strikes, use of third parties and terrorists.**
- **"Arms control is an extension of war by other means": Well, yes!**

Figure 10.14

Key Force Improvements Affecting Counterproliferation Policy

- *Detection and characterization of biological and chemical agents*. This initiative is intended to accelerate the fielding of stand-off and point detection and characterization systems by up to six years. It also addresses the integration of sensors into existing and planned carrier platforms, emphasizing man-portability and compatibility with UAVs.
- *Detection, characterization, and defeat of hard, underground targets*. The US is seeking new sensors, enhanced lethality, and penetrating weapons to increase the probability of defeating the target while minimizing the risk of collateral damage.
- *Detection, localization and neutralization of weapons of mass destruction inside and outside the US*. The US is seeking to identify and evaluate systems, force structures, and operational plans to protect key military facilities and logistic nodes, and conduct joint exercises to improve the capability to respond to potential biological and chemical threats.
- *Development and deployment of additional passive defense capabilities for US forces, including development and production of biological agent vaccines*. This program will develop and field improved protective suits, shelters, filter systems, and equipment two to five years faster than previously planned. It also restores funding to the development of improved decontamination methods.
- *Support for weapons of mass destruction related armed control measures include strengthening the NNPT, CTB, and BWC*. They include establishing a COCOM successor regime, and improving controls on exports and technology by strengthening the MTCR, Nuclear Suppliers Group and Australia Group.
- *Missile defense capabilities, with primary emphasis on theater ballistic missile defenses.* This activity involves improvements in active and passive defenses, attack operations, and improvements in BM/C4I as well as the deployment of theater missile defenses. The primary focus, however, is on anti-ballistic missile defenses, and in the near-term, this involves the development of the Patriot Advanced Capability Level-3 (PAC-3/ERINT), Navy area theater missile defense (Aegis), and theater high altitude area defense (THAAD).
- *Publicized counterstrike options.* Options ranging from a convincing declared capability to conduct precision mass air and missile strikes with conventional weapons that can devastate user states to use of nuclear weapons escalating to the destruction of population centers.
- *New force tailored to dealing with terrorist and unconventional threats.* New intelligence and tracking systems dedicated to the prevention of mass terrorism, and tailored special forces to detect and attack terrorist groups and deal with unconventional uses of weapons of mass destruction.

Figure 10.15

Possible Counterproliferation Policies

- Dissuasion to convince non-weapons of mass destruction states that their security interests are best served through not acquiring weapons of mass destruction.
- Denial to curtail access to technology and materials for weapons of mass destruction through export controls and other tools.
- Arms control efforts to reinforce the Nuclear Non-Proliferation Treaty, Biological and Chemical Weapons Conventions, nuclear free zones, conventional arms treaties that stabilize arms races, confidence and security building measures, and Anti-Ballistic Missile Treaty clarification efforts to allow US deployment of advanced theater ballistic missile defenses.
- Region-wide arms control agreements backed by intelligence sharing and ruthless, intrusive challenge inspection without regard for the niceties of sovereignty.
- International pressure to punish violators with trade sanctions to publicize and expose companies and countries that assist proliferators, and to share intelligence to heighten awareness of the proliferation problem.
- Defusing potentially dangerous situations by undertaking actions to reduce the threat from weapons of mass destruction already in the hands of selected countries -- such as agreements to destroy, inspect, convert, monitor, or even reverse their capabilities.
- Military capabilities to be prepared to seize, disable, or destroy weapons of mass destruction in time of conflict.
- Improve tracking and detection of sales, technology transfer, research efforts, extremist groups.
- Defensive capabilities, both active (theater missile defenses) and passive (protective gear and vaccines) that will mitigate or neutralize the effects of weapons of mass destruction and enable US forces to fight effectively even on a contaminated battlefield.
- Declared and convincing counterstrike options ranging from conventional strikes devastating a user nation’s economy, political structure and military forces to the use of nuclear weapons against the population centers of user nations and groups.

Figure 10.16

Algeria's Search for Weapons of Mass Destruction

Delivery Systems

- 28 Su-24 long-range strike aircraft.
- 28 MiG-23BN fighter ground attack aircraft.
- Tube artillery and multiple rocket launchers.
- Possible modification of Soviet SS-N-2B Styx.

Chemical Weapons

- Possible development. No evidence of deployed systems.

Biological Weapons

- Some low-level research activity.
- No evidence of production capability.

Nuclear Weapons

- Deliberately sought to create a covert nuclear research program under military control with Chinese support.
- Secretly built a research reactor (Es Salam) at the Ain Oussera nuclear research facility. This was announced to be a 10-15 megawatt reactor using heavy water and low enriched uranium. The size of its cooling towers, however, indicated it might be as large as 60 megawatts. It was also located far from population centers, had no visible electric generating facilities and was defended by SA-5s. There were also indications Algeria might be constructing a facility to separate out weapons grade plutonium.
- In May 1991, following the exposure of the reactor by US intelligence, Algeria agreed to place the reactor under IAEA safeguards. As early as December 1993, Algerian officials pledged adherence to the NPT, and on January 12, 1995, Algeria formally acceded to the Treaty. On March 30, 1996, Algeria signed a comprehensive IAEA safeguards agreement providing for IAEA inspections of all of Algeria's nuclear facilities and IAEA technical assistance to Algeria. The agreement went into effect on January 7, 1997.
- Algeria signed a "second stage" agreement of nuclear cooperation with China on June 1, 1996. According to an October 1996 "letter of intent", China was to assist Algeria with the construction of facilities for the research and production of radioactive isotopes for use in the medical, industrial, and agricultural sectors. China and Algeria intend to move into a third phase of cooperation under which China will share the know-how to enable Algeria to operate hot cells in the facility (mentioned previously) at the Es Salam compound. These hot cells would give Algeria the capability to separate plutonium from spent fuel. Algeria claims that the hot cells are intended for the purpose of producing medical isotopes, and the US is reportedly "satisfied" that the hot cells will be operated under IAEA safeguards.
- While it appears that the government is cautiously expanding Algeria's civil nuclear research program in compliance with the NPT, uncertainties about the long-term goals of the nuclear research program and Algeria's political future make the program a potential threat. The possibility remains that Algeria could continue its civil program and then suddenly announce its intention to withdraw from the NPT 90 days hence and "go nuclear" quickly. This would be pursuant to Article Ten of the NPT.
- Algeria has uranium deposits west of Tamanrasset in southeast Algeria, has a 1 megawatt reactor (Nur) at Draria on the coast east of Algiers, and has hot cells for the production of radioactive isotopes at Draria.
- A Spanish paper, El Pais, made an unconfirmed claim on August 23, 1998 that Spain's military secret service, the CESID, had issued a report that said that Algeria will be able in two years to produce military-

grade plutonium, a key ingredient for making atomic weapons. The report is said to have concluded that Algeria, had forged ahead with a nuclear program with Chinese and Argentine technical support that far exceeded its civilian needs, despite having signed the international nuclear non-proliferation treaty. The report is said to have been submitted to the Spanish government in July and to have sounded a warning of the danger involved if Algeria decided to divert its nuclear program to military purposes. The report indicated that the nuclear complex at Birine, 250 km (155 miles) south of Algiers, already had a heavy-water reactor in operation capable of producing weapons-grade plutonium. The CESID report stated that Algeria "has all the installations needed to carry out activities linked to the complete cycle for the creation of military plutonium" by the end of the century, the newspaper said. CESID concluded that if the Algerian government decided to change its current policy of not acquiring atomic weapons, "the knowledge gathered by a significant team of technicians and scientists, in addition to the availability of facilities ... will place this country in the position of initiating a program of military purposes."

Figure 10.17

Libya's Search for Weapons of Mass Destruction

- By mid-March 2004, Libya seemed to have transferred all technical data, material, and weapons production equipment for its nuclear weapons program to the US and allowed full IAEA inspection. It also seemed to have transferred most or all of its chemical weapons program and missiles with a range over 150 kilometers.
- Libya claimed to have ended its efforts to acquire weapons of mass destruction and long range missiles in November 2003, and agreed to International Atomic Energy Agency inspection of its nuclear facilities in December 2003, as well as inspection of it's other WMD sites by the international community. On December 19, 2003, President Bush and Prime Minister Blair announced that Libyan leader Moammar Qadaffi had agreed to surrender all CBRN programs and activities and give up Libya's efforts to develop nuclear weapons. This followed some nine months of secret negotiations and two secret visits by US and British experts to Libya.
- In response to Libya's actions and Qadaffi's statement that Libya would seek to take part in "building a new world free from WMD and from all forms of terrorism," the US rescinded the ban on travel and business activities to and in the country.[4] Business activity has been temporarily limited to companies who had holdings in Libya prior to the implementation of sanctions. The US invited Libya to establish an Interests Section in Washington, D.C., to coordinate humanitarian efforts, efforts to eliminate WMD, and with an eye to greater diplomatic contacts in the future. On February 28, a contingent from the US Agency for International Development and the department of Health and Human Services arrived in Libya. This group acted as consultants on a variety of health care related issues.

Delivery Systems

- FROG-7 rocket launchers with 40-kilometer range.
- Deployed 80 Scud B launchers with 190 mile range in 1976, but could not successfully operate system. Many of the launchers and missiles sold to Iran.
- According to press reports Libya has confirmed that it has Scud-C missiles in its inventory, and that these missiles have a range of 750 km to 800 km. This would confirm Israeli assertions in 1999-2000 that Libya had received the same Scud-C variants that were shipped to Syria.[5]
- Fired Scud missiles against the Italian island of Lampadusa in 1987.
- Purchased SS-N-2C and SSC-3 cruise missiles. Little operational capability.
- Pursued other missile development programs with little success.
- There are unconfirmed reports of some Libyan interest in the Iranian Shahab 3 program.
- Reports has developed a liquid-fueled missile with a range of 200 kilometers. No evidence of deployment.
- Other reports indicate development of Al-Fatih solid-fueled missile with 300-450 mile range reported to have been under development with aid of German technical experts, but no signs of successful development.
    - Other indigenous programs include the Al-Jadid, which is thought to be based on or related to the Scud C (Hwasong 6)
    - The Al-Fajr program to produce solid-fueled rockets of about 300 km range is thought to have ended.
- Libya has a number of combat aircraft that could be used to deliver CBRN weapons. They include:
    - 6 Tu-22 bombers with minimal operational capability.
    - 6 Su-24MK long-range strike fighters. These are operational and have with limited refueling capability using C-130s.
    - 30 Mirage 5D/DE and 14 Mirage 5DD fighter ground attack aircraft.

- 14 Mirage F-1AD fighter ground attack aircraft.
- 40 MiG-23BN Flogger F and 15 MiG-23U fighter ground attack.
- A total of 53 Su-20 and Su-22 Fitter E, J. F fighter ground attack aircraft.

- Possible short range and tactical delivery systems include tube artillery and multiple rocket launchers.
- Numerous allegations have been made regarding foreign assistance to Libya's missile program. Organizations from a number of nations have been implicated, including Serbia, Ukraine, China, India, Iran, Argentina, Brazil, Germany, Taiwan and most frequently, North Korea.
- The CIA estimated in January 1999 that, Libya continued to obtain ballistic missile-related equipment, materials, and technology during the first half of 1998. Outside assistance is critical to keeping its fledgling ballistic missile development programs from becoming moribund.
    - June 1999, unconfirmed reports that Libya attempted to import blueprints, manuals and 148 crates of production equipment for Scud B and Scud C missiles.[6]
    - Libya reported to be smuggling Scud components from Hontex in Southern China which were being shipped from Taiwan via BA to Malta in November 1999. The parts include elements for the rocket propulsion system. The shipment was said in 32 crates disguised as automobile parts.
- Reports of Libyan acquisition of production equipment for Scud C missiles and subsequent installation at Rabta and Tarhuna.[7]
- Conflicting reports regarding Libyan purchase, assembly and/or manufacture of North Korean No Dong missiles seem to have sharply exaggerated Libyan activity:
- Reports in early 2000 cite the Spanish intelligence agency CESID as claiming Libya was in the process of procuring No Dong missiles from North Korea.
- A senior analyst at the state-sponsored think-tank, the Korean Institute of Defense Analysis reported in 2001 that Libya had purchased and received 50 No Dong missiles. Analyst claims his report was based on data from the Korean Defense Ministry and the US Defense Intelligence Agency.[8]
- Israeli intelligence sources claim that Libya had received two shipments of No Dong missiles, launchers and North Korean technicians by 2002.
- The Italian foreign intelligence agency indicates in 2002 that Libya lacked a strong ballistic missile capability and that it was extremely unlikely that Libya had managed to acquire complete No Dong missiles.
- US CIA and DoD reports indicate in 2002 that Libya has been seeking a medium-range capability, but was likely to remain heavily dependant on foreign assistance and had not yet been able to obtain complete No Dong missiles. Additionally, US sources are cited as claiming that Libya and North Korea were still in negotiations for future shipments of technology, hardware and production equipment.
- *Jane's Intelligence Review* estimated in 2003 that Libya possessed a missile inventory of 210-405 missiles as follows:[9]
- 0-5 Al Fatah prototypes with one or two launchers
- 150-250 Scud B with 60-70 Transporter-Erector-Launcher (TEL) units
- 50-100 Scud C (Hwasong 6) with 6-12 TELs
- 10-50 No Dong missiles with 7 mobile launchers and an unknown number of rail and fixed launchers.
- The Center for Nonproliferation Studies at the Monterey Institute of International Studies has compiled a chronology of North Korean assistance to Libya through 2003[10]:

Date	Item(s)	Remarks
Early 1990s	Missile production technology	North Korea reportedly assists Libya in establishing a Scud production facility near Tripoli.

1990s	Unknown number of Scud-B and Scud-C missiles	
1999 June	Blueprints for the Scud-B and Scud-C; 148 crates of machinery for missile production, including: heavy duty steel presses, a plate bending machine, torroidal air bottles, and two sets of theodolites	Intercepted; North Korea ship *Ku Wŏl San* detained by India and returns to North Korea without delivering cargo.
1999 November	Scud and No Dong missile components	Intercepted by British customs at Gatwick Airport; shipment was bound for Tripoli
2000	50 No Dong missiles, seven TELs, and nine North Korean missile technicians	No Dong and launcher delivery begins in July—part of $600 million deal signed in October 1999.
2000	No Dong missiles and TELs	Unconfirmed; North Korean firm Ch'ongchon'gang reportedly delivers 50 No Dong missiles and seven TELs to Syria. Missiles possibly procured on behalf of Iraq, Egypt and Libya for $600 million.

- The CIA reported in November 2003 that, "The suspension of UN sanctions in 1999 allowed Libya to expand its efforts to obtain ballistic missile–related equipment, materials, technology, and expertise from foreign sources. During the first half of 2003, Libya continued to depend on foreign assistance—particularly from Serbian, Indian, Iranian, North Korean, and Chinese entities—for its ballistic missile development programs. Libya's capability therefore may not still be limited to its Soviet-origin Scud-B missiles. With continued foreign assistance, Libya will likely achieve an MRBM capability—a long-desired goal—probably through direct purchase from North Korea or Iran."
- Although Libya is not a signatory to the Missile Technology Control Regime (MTCR), it has agreed to dispose of any missiles with more than 300 km range and 500 kg payload, and seems to have complied.
    - This agreement permits Libya to keep its Scud-B and FROG-7 missiles.
    - Libya would be required to dispose of the inventory of Scud-C missiles they have admitted to, and seems to have done so.
    - Libya has not directly confirmed, so far, that they possess any No-Dong missiles. If Libya has any of these, then they too will have to be dismantled.[11]
- Unconfirmed reports suggest that as late as September 23003, North Korea had been encouraging Iran to sell Libya it's 1,300-1,500 km Shahab-3 missile and launchers. These reports indicate that Libya and Iran had been in negotiation over purchase of a less advanced model than the Shahab-3 missile. As of the date of the report no deal appeared imminent.[12]
- Unconfirmed reports tend to suggest that there was a great deal of cooperation between Iran, Egypt, Libya and North Korea on issues pertaining to ballistic missiles.[13]
- When nuclear material was shipped to the United States for cataloging and destruction, the materials inventoried also included missile guidance sets for longer-range missiles.[14]

Chemical Weapons

- Libya has acceded to the CWC on January 6, 2004 (entry into force on February 5, 2004). Libya had previously asserted that it would not sign the CWC as long as other states have nuclear weapons.
    - Libya has until 2007 to comply with the CWC's deadline for destruction of the materials.[15]
- May have some stocks of nerve agents Sarin and Tabun, blister agents Mustard Gas and Lewisite, and the choking agent Phosgene.
- May have used mustard gas delivered in bombs by AN-26 aircraft in final phases of war against Chad in September 1987. Libya asserts that it has never used chemical weapons and the Organization for the Prohibition of Chemical Weapons has never found enough evidence to send an investigation team to Chad.[16]
- Pilot plant near Tripoli has been producing small amounts of chemical weapons since early 1980s.
    - Are probably two other small research/batch production facilities.
- Main nerve and mustard gas production facilities in an industrial park at chemical weapons plant at Rabta. This plant can produce both the poison gas and the bombs, shells, and warheads to contain it. Are probably two other research facilities.
- Rabta Plant seems to have started test runs in mid-1988. It is a 30 building facility defended by SAM batteries and special troops. Has sheltered underground areas.
    - Libya has acquired large stocks of feedstocks for mustard gas like thiodiglycol, and precursors for nerve gas, and extensive amounts have been sent to Rabta. Though Libyan scientists could produce mustard gas domestically, reports indicate that the production of nerve gas required the help of foreign governments or corporations.[17]
    - At least 100 metric tons of blister and nerve agents have been produced at Rabta since the late 1980s, but production rate has been very low and plant is either not successful or is not being utilized because of fear of attack.
    - The plant would have a capacity of 100 metric tons per year if operated at full capacity.
    - Fabricated fire at Rabta in 1990 to try to disguise the function of plant and fact was operating.
    - German courts have convicted a German national in October 1996, for selling Libya a computer designed for use in chemical weapons programs and helping Libya to import equipment to clean the waste emissions from poison gas production from India using an Irish dummy corporation.
- Additional major chemical weapons plant in construction in extensive underground site near Tarhunah, a mountainous area 65 kilometers southeast of Tripoli, but few recent signs of activity.
    - Tarhunah has been designed to minimize its vulnerability to air attack and has twin tunnels 200-450 feet long, protected by 100 feet of sandstone above the tunnels and a lining of reinforce concrete. This is far beyond the penetration capabilities of the US GBU-27B and GBU-28 penetration bombs. The GBU-28 can penetrate a maximum of 25-30 meters of earth or 6 meters of concrete.
- Libya rejected the proposal of President Mubarak that it open the Tarhuna facility to third country inspection to prove it was not a chemical weapons facility in April 1996.
- South African chemical warfare experts thought to have sold their expertise to Libya during the mid-1990s.
- Reports of construction of another sheltered major facility near Sabha, 460 miles south of Tripoli.
- Reports of Chinese, North Korean, German, Swiss, and other European technical support and advisors.
- Reports of shipments of chemical weapons to Syria and Iran do not seem valid.
- Other confirmed preliminary reports indicate that Libya maintained stocks of precursors for other chemical agents.
    - The CIA estimated in January 1999 that Libya remains heavily dependent on foreign suppliers for precursor chemicals and other key CW-related equipment. UN sanctions continued to severely limit that

support during the first half of 1998. Still, Tripoli has not given up its goal of establishing its own offensive CW capability and continues to pursue an independent production capability for the weapons.

- The CIA reported in November 2003 that, "Libya…remained heavily dependent on foreign suppliers for CW precursor chemicals and other key related equipment. Following the suspension of UN sanctions, Tripoli reestablished contacts with sources of expertise, parts, and precursor chemicals abroad, primarily in Western Europe. Libya has indicated—as evidenced by its observer status at the April 2003 Chemical Weapons Convention Review Conference and previous Convention Conferences of States Parties—a willingness to accede to the CWC. Such efforts are consistent with steps that Tripoli is taking to improve its international standing. Tripoli still appeared to be working toward an offensive CW capability and eventual indigenous production."

- Approximately one month after Colonel Qadaffi's declaration that Libya would give up its CBRN programs, British and American teams representing agencies such as the Defense Threat and Reduction Agency arrived in Libya to prepare for operations.[18]
- Coincident with the formal accession of Libya to the CWC on February 5th, 2004, experts from the Organisation for the Prohibition of Chemical Weapons (the supervising body of the CWC) began operations in Libya. This group of approximately a dozen joined teams of British and American experts already in country to supervise the technical aspects of compliance with CWC requirements that all materials Libyan stocks be declared by March 5, 2004.[19]
- The experts from the OPCW will be responsible for technical supervision of the prohibited materials. The American and British personnel will be responsible for the verifiable destruction of forbidden material.[20]
  - Prohibited materials include not only stocks of chemical weapons, but chemical-capable weapons, equipment necessary to the manufacture of chemical weapons.
- Preliminary reports indicate that Libya destroyed stocks that included 23 tons of mustard gas, some of it weaponized in the form of air-deliverable bombs.
  - Very low quality weapons designs with poor fusing and lethality.
  - Additional holdings include a facility to produce more mustard gas, as well as equipment sufficient to build a second chemical weapons production facility.[21]
  - Destroyed 3,300 unfilled chemical weapon bomb assemblies.
- The Organization for the Prohibition of Chemical Weapons will build a facility within Libya to destroy the mustard gas.[22]

Biological Weapons

- Some early research activity.
- No evidence of serious development or production capability.
- The CIA reported in November 2003 that, "Evidence suggested that Libya also sought dual-use capabilities that could be used to develop and produce BW agents."
- Although a state party to the BTWC, Libya did not submit any materials per established Confidence Building Measures from 1997-2002.
- Investigations of Libya's biological weapons program were still ongoing in early 2004. Dual-use facilities are of particular interest.

Nuclear Weapons

- Has sought to create a development and production capability.
- Historical background:
  - Unsuccessfully attempted to buy nuclear weapons from China in the 1970s.
  - Qadaffi called for Libyan production of nuclear weapons on April 29, 1990.

- Explored for uranium, but no active mines or uranium mills.
- 10 megawatt, Soviet-supplied nuclear research reactor at Tajura acquired from the USSR in 1970s. Operates under IAEA safeguards.
- Discussions with Russia over cooperation on nuclear power resulted in an agreement to upgrade the Tajura facility. Ongoing discussions about providing a power reactor.
- Had plan to build at 440 megawatt, Soviet-supplied reactor near the Gulf of Sidra in the 1970s, but canceled project.
- Ratified NPT is 1975. Declares all facilities under IAEA safeguards.
- Continued to train nuclear scientists and technicians abroad.
- Shifted focus in 1980s and 1990s to acquiring nuclear weapons designs and centrifuge designs and equipment from Pakistan.

- This situation has changed strikingly since the fall of 2003:
- The US and Britain intercepted a German freighter, the *BBC China*, bound for Libya at the Italian port of Taranto on October 4 2003. The freighter was intercepted with help from the German government. The specific centrifuges intercepted were manufactured by a third party in Malaysia, based on Pakistani designs and then shipped to Libya. This was the first action under a new Proliferation Security Initiative, which was an 11-nation agreement to stop the shipment of materials carried banned material for CBRN programs and long-range missile programs.
  - A total of 5 containers to Libya was seized following allegations it contained certain components for 'centrifuge.' The containers were sent by BSA Tahir from Dubai. Several items inside the container that is said to be components of a 'centrifuge' are as follows :

Description	Part Numbers	Total
Casing	4	2,208
Molecular Pump	5	2,208
Top spacer	6	608
Positioner	8	10,549
Top end	9	1,680
Crash Ring	12	2,208
Stationary Tube	59	1,056
Clamp holder	73	400
Flange	77	4,525

  - All the above items, were made of 'quality aluminum' and were in wooden boxes with the SCOPE logo. This was part of the 'transshipment' delivered by SCOPE to Aryash Trading Company, Dubai. The shipment of the items or components by Bsa Tahir to Libya via the vessel *BBC China* was outside the knowledge of the management of SCOPE.
  - The intercepted centrifuges were maraging steel designs based on a German design stolen and copied by Pakistan, and manufactured for Libya by a third party in Malaysia.[23]
  - These discoveries, combined with Libya's desired to reshape its image as a rogue state, fully free itself of international sanctions, and obtain foreign investment and technology for its economy led it to state it would give up all of its long-range missile and CBRN programs.
- On December 19, 2003, President Bush and Prime Minister Blair announced that Libyan leader Muammar Qaddafi had agreed to surrender all CBRN programs and activities and give up Libya's efforts to develop nuclear weapons. This followed some nine months of secret negotiations and two secret visits by US and British experts to Libya.
- On December 22, 2003, Libya agreed to allow IAEA inspectors to examine the country's nuclear program.

- Libya's past compliance with arms control treaties has been a major issue, but seems to be changing:
    - The CIA reported in November 2003 that, "An NPT party with full-scope IAEA safeguards, Libya continued to develop its nuclear infrastructure. The suspension of UN sanctions provided Libya the means to enhance its nuclear infrastructure through foreign cooperation and procurement efforts. Tripoli and Moscow continued talks on cooperation at the Tajura Nuclear Research Center and a potential power reactor deal. Such civil-sector work could have presented Libya with opportunities to pursue technologies also suitable for military purposes. In addition, Libya participated in various technical exchanges through which it could have tried to obtain dual-use equipment and technology that could have enhanced its overall technical capabilities in the nuclear area. Although Libya made political overtures to the West in an attempt to strengthen relations, Libya's assertion that Arabs have the right to nuclear weapons in light of Israel and its nuclear program—as Qadhafi stated in a televised speech in March 2002, for example—and Tripoli's continued interest in nuclear weapons and nuclear infrastructure upgrades raised concerns."
    - Libya signed the Comprehensive Test Ban Treaty in 2001, but did not ratify the treaty until January 6, 2004.
    - Under the auspices of the agreement the Comprehensive Test Ban Treaty Organization maintains a radionuclide monitoring station at Misratah to observe compliance with the provisions of the agreement.
    - Libya indicated in 2003 that it would sign the Additional Protocols to the Nuclear Non-Proliferation Treaty. Until the treaty is legally in force, they will voluntarily comply with its provisions.
    - British and American experts (from the US Department of Energy, Los Alamos Laboratories, the Defense Threat Reduction Agency, among other places) are cooperating with IAEA inspectors. The 10 IAEA inspectors will have "a role, but only with the technical aspects" of confirming Libyan compliance.[24] So far inspection teams have visited from ten to dozens of nuclear sites.
    - The first flight shipping materials from Libya was a chartered 747 from Libya to Dulles and is thought to have carried back Libyan designs for a warhead. Reportedly, the designs were found wrapped in plastic bags from an Islamabad dry cleaner[25]. This is thought to be further confirmation of the links between Dr. A. Q. Kahn and the proliferation of nuclear weapons. The design found was based on a Chinese design from the 60's and is for a simple implosion device.[26] The warhead, as designed, weighs some 500 kg and is approximately 80 cm in diameter.
    - Libya does not posses a delivery system sufficient to carry such a device; however, missiles currently in service with Iran and North Korea could carry such a warhead.
- Other developments related to Libya's decision to give up its CBRN weapons include:
    - Unconfirmed reports indicate that on December 30, 2003, Libya sent some 150 Pakistanis back to Pakistan from Libya on a special charter flight.[27]
    - Reports that the US has shipped some 55,000 pounds of material to the Oakridge National Laboratory on two C-17s in late mid-late January 2004.
    - The first shipment contained, among other things the "most sensitive" documentation associated with Libya's nuclear program. The second flight, arriving on January 26th, included among other things, uranium hexafluoride and centrifuge parts.
    - The discovery that Libya began the purchase of components for the less-efficient aluminum centrifuges in the late 1990s. After acquiring the parts for about 100 centrifuges, they began to focus on a more sophisticated high-performance centrifuges made from maraging steel, based on a German design acquired by Pakistan. Libya had acquitted parts for thousands by the time of the December 19th, 2003 declaration.[28]
        - Some of this material was still in packing crates had had not been assembled.
    - During the 1980's a number of sources reported that Libya obtained more than 450 tons of yellowcake from Niger, and transferred 150 tons to Pakistan. The remaining 300 tons could produce 30 kg of HEU. The whereabouts of the yellowcake is not entirely certain at this point.[29]
        - Some unconfirmed reports suggest that some of the Niger yellowcake had been used jointly by Libya and Iraq. These reports continue on to suggest that Qadaffi opted to sacrifice his WMD program to

prevent American investigations from revealing that the Iraqi and Libyan uranium had continued to reside in Libya for use by both countries.[30]

- These reports then go on to assert that the December 29, 2003 visit of Libyan officials to Niamey, the Niger capital, while undertaken for ostensibly normal purposes, was in fact to ensure that there would be no leaks from Niger on the details of the uranium exports to Libya.[31]

- Weapons experts found large amounts of equipment used in making enriched uranium, the essential ingredient in nuclear weapons. That discovery helped expose a rogue nuclear trading network that officials say funneled technology and parts to Libya as well as Iran and North Korea. A central figure in the network, Pakistani metallurgist Abdul Qadeer Khan, acknowledged in a televised confession last month that he had passed nuclear secrets to others.

- On February 15, 2004, the *Washington Post* reported that the US had discovered that the nuclear weapons designs Libya obtained through a Pakistan had come from a smuggling network that originated in China. The bomb designs and other papers turned over by Libya to the included text in Chinese, with detailed, step-by-step instructions for assembling a 1,000 pound implosion-type nuclear bomb that could fit atop a large ballistic missile. The device was similar to a weapon known to have been tested by China in the 1960s. Although of an older design, the bomb design is a moderate-sized implosion device that uses use precision-timed conventional explosives to squeeze a sphere of fissile material and trigger a nuclear chain. Pakistan's first nuclear test in 1998 involved a more modern design than the one sold to Libya.

  - The documents included technical instructions for manufacturing components for the device. The package of documents was turned over to U.S. officials in November following Libyan leader Moammar Qadaffi's decision to renounce weapons of mass destruction and open his country's weapons laboratories to international inspection.

  - The documents were "copies of copies of copies." The primary documents were entirely in English, while a few ancillary papers contained Chinese text. The package also included open-literature articles on nuclear weapons from U.S. weapons laboratories, officials familiar with the documents stated.

  - Although most essential design elements were included, some key parts were missing. The Post reported that investigators speculated that the missing papers could have been lost, or were being withheld pending additional payments. Libyan scientists claimed they had not seriously studied them and were unaware that anything was missing.

  - The IAEA reported on February 20, 2004 that Libya produced small amounts of plutonium, and assembled a small set of gas centrifuges for producing enriched uranium, with the goal of producing 10,000 more. The IAEA inspectors had visited 18 sites in Libya, and found that plutonium was produced in “very small quantities” at the Tajura National Research Center.

  - The IAEA also finds that Libya imported 2,263 tons of uranium ore concentrate between 1978 and 1981, and acquired Uranium Hexaflouride in 1985, 2000, and 2001 – a material used in producing HEU.

  - It conducted secret uranium conversion experiments on a small scale in the 1980s, and received a portable conversion facility in 1986, and stored the modules in locations around Tripoli. It did not conduct tests until 2002.

  - Libya worked on domestic efforts to produce HEU during the 1980s and early 1990s, with foreign technical assistance. In 1997, it ordered 20 assembled centrifuges, and components for 200 more. In September 200, Libya ordered 10,000 centrifuges based on more advanced designs. The components began to arrive in December 2002, and further deliveries were on the ship intercepted in October 2003.

  - On February 20, 2004 the Malaysian police issue a report on the smuggling of nuclear weapons components to Libya. The report confirms the details of Libyan proliferation found by the IAEA and notes that:

  - In November 2003, representatives from the CIA and MI6 contacted their Malaysian counterparts to tell them about some of the activities of AQ Khan and Bsa Tahir, a close associate of the Pakistani nuclear scientist.

- Alleged that a Pakistani nuclear arms expert was involved in the "onward proliferation of Pakistani nuclear technology to third countries, notably Libya."
- Tahir used a front company to "produce components for the centrifuge unit for the uranium enrichment programme."
- Bsa Tahir, a Sri Lankan businessman based in Dubai was a trusted and close confidante of the arms expert and was actively involved in supplying centrifuge components for Libya's uranium-enrichment program; and made use of SCOPE, a subsidiary of Scomi Group BHD, a company involved in the petroleum services industry. As a subsidiary, SCOPE is also involved in precision engineering services which involves the production of components for a variety of equipments including parts for cars, petroleum and gas.
- BSA Tahir alleged that his involvement with the nuclear expert started sometime in 1994/1995. That year, the latter had asked BSA Tahir to send two containers of used centrifuge units from Pakistan to Iran. Bsa Tahir organized the transshipment of the two containers from Dubai to Iran using a merchant ship owned by a company in Iran. Bsa Tahir said the payment for the two containers of centrifuge units, amounting to about USD$3 million was paid in UAE Dirham currency by the Iranian. The cash was brought in two briefcases and kept in an apartment that was used as a guesthouse by the Pakistani nuclear arms expert each time he visited Dubai.
- Libya had contacted the nuclear arms expert in 1997 to obtain help and expertise in the field of uranium-enrichment centrifuge. Several meetings between the arms expert and representatives from Libya took place:
- Meeting in Istanbul sometime in 1997. During this meeting, the nuclear arms expert was accompanied by Bsa Tahir while Libya was represented by Mohamad Matuq Mohamad and another person known only as Karim. During this meeting, the Libyans asked the arms expert to supply centrifuge units for Libya's nuclear program; and
- Between 1998 and 2002. During this time, several meetings were held between the arms expert, accompanied by Bsa Tahir and the Libyans headed by Mohamad Matuq Mohamad. One discussion was held in Casablanca, Morocco and several discussions in Dubai.
- Around 2001, the nuclear arms expert informed Bsa Tahir that a certain amount of UF6 (enriched uranium) was sent by air from Pakistan to Libya. Bsa Tahir could not remember the name of the Pakistan Airlines which transported the uranium;
- Year 2001/2002. The nuclear arms expert informed Bsa Tahir that a certain number of centrifuge units were sent to Libya directly from Pakistan by air. There is a possibility that the design of the centrifuge units that were sent were of the P1 model, i.e. a Dutch designed model;
- Project Machine Shop 1001. This was a project to set up a workshop in Libya to make centrifuge components which could not be obtained from outside Libya. The machines for the workshop were obtained from Spain and Italy. Bsa Tahir said the middleman involved in this project was Peter Griffin, a British citizen who is believed to have once owned Gulf Technical Industries (GTI) based in Dubai. Peter Griffin is said to be retired and living in France. The management of GTI has been taken over by his son Paul Griffin. Bsa Tahir also said that the plans for the Machine Shop 1001 was prepared by Peter Griffin.
- The full pattern of European support involved Late Heinz Mebus, an engineer. He is alleged to have been involved in discussions between the nuclear arms expert and Iran to supply centrifuge designs about 1984/85. Gotthard Lerch, a German citizen residing in Switzerland. Gotthard Lerch once worked for Leybold Heraeus, a German company that is alleged to have produced vacuum technology equipment. Gotthard Lerch is alleged to have tried to obtain supplies of pipes for the Machine Shop 1001 Project by sourcing from South Africa but failed to obtain it even though payment had been made by Libya earlier. Gunas Jireh, a citizen of Turkey who had once worked for the German company Siemens. Gunas Jireh is alleged to have supplied aluminum casting and dynamo to Libya at the request of the nuclear arms expert; Selim Alguadis, a citizen of Turkey. Also said to be an engineer. Alleged to have supplied electrical cabinets and power supplier-voltage regulator to Libya. Two weeks after action against the ship BBC China in Taranto, Italy on 4 Oct 2003.

- Bsa Tahir is alleged to have arranged the transshipment of electrical cabinets and power supplier-voltage regulator to Libya through Dubai on behalf of Selim Alguadis. Peter Griffin, a citizen of the United Kingdom, who has business interests in Dubai and currently residing in France. Alleged to have supplied the lay-out plan for the Machine Shop 1001 as a workshop to enable Libya to produce centrifuge; About 2001/2002, Peter Griffin is alleged to have supplied a lathe machine to Libya for the Machine Shop 1001 Project. After that Peter Griffin arranged to send 7 to 8 Libyan technicians to Spain, twice, to attend courses on how to operate the machine.

- At the same time, Peter Griffin is said to have supplied an Italian–made furnace to Libya for the workshop. Usually, lathe machines are used to make cylindrical objects, while the furnace is essential in the process of heating and refining during the manufacture of certain components; Friedrich Tinner, mechanical engineer, alleged to have had dealings with the nuclear arms expert since 1980s. Friedrich Tinner was reported to have prepared certain centrifuge components, including safety valves, and he sourced many of the materials that were made in several companies in Europe. Friedrich Tinner did not keep the stock himself but arranged for the supply to reach Dubai and then on to Libya. Friedrich Tinner is also the President of CETEC, a company in Switzerland; and Urs Friedrich Tinner is the son of Friedrich Tinner. Urs Tinner is a consultant arranged by Bsa Tahir to set up the SCOPE factory in Shah Alam. He was actively involved in the manufacturing operations in the SCOPE factory.

- Bsa Tahir claimed that together with the seized components on board *BBC China* on October 4, 2003, was a consignment sent by Gunas Jireh, a Turkish national who supplied 'aluminum casting and dynamo' to Libya for its 'machine shop 1001' project. These items were delivered through DUBAI using the services of TUT Shipping (TS) via vessel *BBC China*. It is surprising that the consignment from Gunas Jireh direct to Libya was allowed without any action; and two weeks after action taken against *BBC China*, Bsa Tahir claimed to have arranged a 'transshipment of electrical cabinet and power supplier-voltage regulator' to Libya through Dubai on behalf of Selim Alguadis. These transshipment too arrived in Libya without any obstruction and this is unusual. Selim Alguadis is said to have known AQK since the 1980s'.

Figure 10.18

Egypt's Search for Weapons of Mass Destruction

Delivery Systems

- Began three major design programs based on the V-2 missile in the 1950s, with help from German scientists. Tested two missiles by 1965: A 350 kilometer range al-Zafir and a 600 kilometer range Al Kahir. A 1,500-kilometer range Ar-Ra'id was designed but never tested. These missiles were liquid-fueled aging designs and development ceased around 1967.
- Cooperated with Iraq in paying for development and production of "Badr 2000" missile with a 750-1,000 kilometer range. This missile is reported to be a version of the Argentine Condor II or Vector missile. Ranges were reported from 820-980 kilometers, with the possible use of an FAE warhead.
    - Egyptian officers were arrested for trying to smuggle carbon materials for a missile out of the US in June 1988.
    - Covert US efforts seem to have blocked this development effort.
    - The Condor program seems to have been terminated in 1989-1990.
- Has Scud B TELs and missiles with approximately 100 missiles with 300 kilometers range.
- Reports have developed plant to produce an improved version of the Scud B, and possibly Scud C, with North Korean cooperation.
    - North Korean transfers include equipment for building Scud body, special gyroscope measuring equipment and pulse-code modulation equipment for missile assembly and testing.
    - Unconfirmed reports in June 1996 that has made major missile purchase from North Korea, and will soon be able to assemble such missiles in Egypt. Seven shipments from North Korea reported in March and April.
    - Other unconfirmed reports that Egypt had another liquid-fueled missile under development known as 'Project T' with an estimated range of 450 kilometers. It is believe to be an extended-range Scuds designed with North Korean assistance. These unconfirmed reports indicate Egypt may have as many as 90 Project T missiles.
    - Media reports that US satellites detected shipments of Scud C missile parts to Egypt in February-May, 1996 — including rocket motors and guidance devices — do not seem correct. The Scud C has a range of roughly 480 kilometers.
    - The CIA reported in June 1997, that Egypt had acquired Scud B parts from Russia and North Korea during 1996.
- The CIA reported in January 1999 that Egypt continues its effort to develop and produce the Scud B and Scud C and to develop the two-stage Vector short-range ballistic missiles (SRBMs). Cairo also is interested in developing a medium-range ballistic missile (MRBM). During the first half of 1998, Egypt continued to obtain ballistic missile components and associated equipment from North Korea. This activity is part of a long-running program of ballistic missile cooperation between these two countries.
- US suspects Egypt is developing a liquid-fueled missile called the Vector with an estimated range of 600-1200 kilometers.
- FROG 7 rocket launch units with 40 kilometers range.
- Cooperation with Iraq and North Korea in developing the Saqr 80 missile. This rocket is 6.5 meters long and 210 mm in diameter, and weighs 660 kilograms. It has a maximum range of 50 miles (80 kilometers) and a 440 pound (200 kilogram) warhead. Longer range versions may be available.
- AS-15, SS-N-2, and CSS-N-1 cruise missiles.

- 28 F-4E fighter ground attack aircraft.
- 20 Mirage 5E2 fighter ground attack.
- 53 Mirage 2000EM fighters.
- 33 F-16A/B and 174 F-16C/D fighters
- Multiple rocket launcher weapons.
- Tube artillery
- The Center for Nonproliferation Studies at the Monterey Institute of International Studies has compiled a chronology of North Korean assistance to Egypt through 2003[32]:

Date	Item(s)	Remarks
1987	Technical assistance for Scud-B production plant	
1989	Scud-B parts, improved missile components, such as guidance systems	Information from retired Israeli Brigadier General Aharon Levran.
Early 1990s	Scud-C missile production technology	North Korea reportedly helps Egypt set-up Scud-C production facility outside of Cairo.
1996 March-April	Seven shiploads of equipment and materials for producing Scud-C missiles	Could have included steel sheets for Scuds and support equipment, rocket engines and guidance systems. Possible assistance for producing Scud-C TELs.
1997	Several shipments of equipment for Scud-C production	
1999 July	Specialty steel	Probably maraging steel; shipped by Chinese firm in Hong Kong.
1999-2001	50 to 300 missile experts	
2000	No Dong missiles and TELs	Unconfirmed; North Korean firm Ch'ongchon'gang reportedly delivers 50 No Dong missiles and seven TELs to Syria. Missiles possibly procured on behalf of Iraq, Egypt and Libya for $600 million.
2001	24 to 50 No Dong engines	Unconfirmed; some reports claim that delivery occurred in the first half of 2001, but others claim engines have yet to be delivered. Egypt insists that missile cooperation with North Korea ended in 1996.

Chemical Weapons

- Produced and used mustard gas in Yemeni civil war in 1960s, but agents may have been stocks British abandoned in Egypt after World War II. Effort was tightly controlled by Nasser and was unknown to many Egyptian military serving in Yemen.
- Completed research and designs for production of nerve and cyanide gas before 1973.
- Former Egyptian Minister of War, General Abdel Ranny Gamassay stated in 1975, that, "if Israel should decide to use a nuclear weapon in the battlefield, we shall use the weapons of mass destruction that are at our disposal."
- Seems to have several production facilities for mustard and nerve gas. May have limited stocks of bombs, rockets, and shells. Unconfirmed reports suggest that Egypt had developed VX nerve gas.
- Unconfirmed reports of recent efforts to acquire feedstocks for nerve gas. Some efforts to obtain feedstocks from Canada. May now be building feed stock plants in Egypt.
- Industrial infrastructure present for rapid production of cyanide gas.
- Egypt is thought to have an offensive chemical warfare capability, but the extent of this capability is unknown.

Biological Weapons

- Research and technical base.
- Unconfirmed Israeli sources allege that Egypt has pursued research into anthrax, plague, botulinum toxin, and Rift Valley fever virus for military purposes, but no other open-source data confirms these allegations.
- Egypt is thought to have a significant microbiological capability, but no substantiated, open-source evidence exists that suggests Egypt has pursued biological weapons.
- No evidence of major organized research activity.

Nuclear Weapons

- Research and technical base.
- Egypt currently operates two research reactors, both of which are under IAEA safeguards.
  - A 2 MW Soviet built reactor 40 km from Cairo which started operation in 1961
  - A 22 MW Argentine reactor at the Ishas facility, 60 km from Cairo, started operation in 1997. The Argentine reactor is thought to be capable of producing as enough plutonium for one weapon each year.[33]
- Numerous discussions over the years with the US, China and other nations for large-scale power generation facilities. No current agreements for construction of power reactors.
- No evidence of major organized research activity for development of a usable weapon.

- President Mubarak did say in October 1998, that Egypt could acquire nuclear weapons to match Israel's capability if this proves necessary,[34] "If the time comes when we need nuclear weapons, we will not hesitate. I say 'if' we have to because this is the last thing we think about. We do not think of joining the nuclear club." This speech was more an effort to push Israel towards disarmament talks, however, than any kind of threat.
- Mubarak also said that Israel "enhances its military expenditure and develops its missile systems that are used for military purposes. It knows very well that this will not benefit it or spare it from harm. Its efforts to use the help of foreign countries will plunge the region into a new arms race which serves nobody's interests." Egypt has supported the indefinite extension of the NNPT, has long been officially committed to creating a nuclear weapons-free zone in the Middle East, and had advocated an agreement that would ban all weapons of mass destruction from the region

Figure 10.19

Israel's Search for Weapons of Mass Destruction

Delivery Systems

- There are convincing indications that Israel has deployed nuclear-armed missiles on mobile launchers. Most outside sources call the first of these missiles the "Jericho I", but Israel has never publicly named its long-range missile systems.
    - These missiles were near-copies of the two-stage, solid-fueled, French MD-620 missile. Some reports claim the first 14 were built in France.
    - A number of sources indicate that Israel deployed up to 50 "Jericho I" (YA-1) missiles on mobile launchers in shelters in the hills southwest of Jerusalem, with up to 400 miles range with a 2,200 pound payload, and with possible nuclear warhead storage nearby. (Some reports give the range as 500 kilometers.)
    - Israel is thought to have conventional, chemical and nuclear warheads for the Jericho I.
    - The current deployment of the "Jericho I" force is unclear. Some sources say it has been phased out for the Jericho II missile.[35]
- Israel has since gone far beyond the Jericho I in developing long-range missile systems. It has developed and deployed the "Jericho II" (YA-2).
    - The "Jericho II" began development in the mid-1970s, and had its first tests in 1986.[36] Israeli carried out a launch in mid-1986 over the Mediterranean that reached a range of 288 miles (460 kilometers). It seems to have been tested in May 1987. A flight across the Mediterranean reached a range of some 510 miles (820 kilometers), landing south of Crete.[37] Another test occurred on September 14, 1989.
    - Israel launched a missile across the Mediterranean that landed about 250 miles north of Benghazi, Libya. The missile flew over 800 miles, and US experts felt it had a maximum range of up to 900-940 miles (1,450 kilometers) — which would allow the Jericho II to cover virtually all of the Arab world and even the Southern USSR[38]
    - The most recent version of the missile seems to be a two-stage, solid-fueled missile with a range of up to 900 miles (1,500 kilometers) with a 2,200 pound payload.
    - Commercial satellite imaging indicates the Jericho II missile may be 14 meters long and 1.5 meters wide. Its deployment configuration hints that it may have radar area guidance similar to the terminal guidance in the Pershing II and probably has deployed these systems.
    - Some Jericho IIs may have been brought to readiness for firing during the Gulf War.
    - Israel began work on an updated version of the Jericho II no later than 1995 in an effort to stretch its range to 2,000 km. At least part of this work may have begun earlier in cooperation with South Africa.
- Israel has done technical work on a TERCOM type smart warhead. It has examined cruise missile guidance developments using GPS navigation systems. This system may be linked to a submarine launch option.
- Israel is also seeking technology to improve its accuracy, particularly with gyroscopes for the inertial guidance system and associated systems software.
- Israel is actively examining ways to lower the vulnerability of its ballistic missiles and nuclear weapons. These include improved hardening, dispersal, use of air-launched weapons, and possible sea-basing. Israel seems especially interested in basing ballistic missiles in Israel's Dolphin-class submarines.
- There are also reports that Israel is developing a Jericho III missile, based on a booster it developed with South Africa in the 1980s.
    - The tests of a longer-range missile seem to have begun in the mid-1980s.[39]A major test of such a booster seems to have taken place on September 14, 1989, and resulted in extensive reporting on such cooperation in the press during October 25 and 26, 1989.

- It is possible that that both the booster and any Israeli-South African cooperation may have focused on satellite launches.[40] Since 1994, however, there have been are numerous reports among experts that Israel is seeking a missile with a range of at least 4,800 kilometers, and which could fully cover Iran and any other probable threat.
- *Jane's* estimates that the missile has a range of up to 5,000 kilometers and a 1,000 kilogram warhead. This estimate is based largely on a declassified DIA estimate of the launch capability of the Shavit booster that Israel tested on September 19, 1988.[41]

- Reports of how Israel deploys its missiles differ.
  - Initial reports indicated that 30-50 Jericho I missiles were deployed on mobile launchers in shelters in the cases southwest of Tel Aviv. A source claimed in 1985, that Israel had 50 missiles deployed on mobile erector launchers in the Golan, on launchers on flat cars that could be wheeled out of sheltered cases in the Negev. (This latter report may confuse the rail transporter used to move missiles from a production facility near Be'er Yaakov to a base at Kefar Zeharya, about 15 kilometers south of Be'er Yaakov.)
  - More recent reports indicate that Jericho II missiles are located in 50 underground bunkers carved into the limestone hills near a base near Kefar Zeharya. The number that are on alert, command and control and targeting arrangements, and the method of giving them nuclear warheads has never been convincingly reported.[42]
  - *Jane's Intelligence Review* published satellite photos of what it said as a Jericho II missile base at Zachariah (God remembers with a vengeance) several miles southeast of Tel Aviv in September 1997.[43] According to this report, the transport-erector-launcher (TEL) for the Jericho II measures about 16 meters long by 4 meters wide and 3 meters high. The actual missile is about 14 meter long and 1.5 meters wide. The TEL is supported by three support vehicles, including a guidance and power vehicle. The other two vehicles include communications vehicle and a firing control vehicle. This configuration is somewhat similar to that used in the US Pershing II IRBM system, although there are few physical similarities.
  - The photos in the article show numerous bunkers near the TEL and launch pad, and the article estimates a force of 50 missiles on the site. It also concludes that the lightly armored TEL would be vulnerable to a first strike, but that the missiles are held in limestone caves behind heavy blast-resistant doors. It estimates that a nuclear-armed M-9 or Scud C could destroy the launch capability of the site. [44]
  - The same article refers to nuclear weapons bunkers at the Tel Nof airbase, a few kilometers to the northwest. The author concludes that the large number of bunkers indicates that Israel may have substantially more nuclear bombs than is normally estimated – perhaps up to 400 weapons with a total yield of 50 megatons. [45]
- 76 F-15, 232 F-16, 20 F-4E, and 50 Phantom 2000 fighter-bombers capable of long-range refueling and of carrying nuclear and chemical bombs.
- Israel bought some Lance missile launchers and 160 Lance missiles, with 130 kilometers range, from the US in the 1970s. The US removed them from active duty during 1991-1994. The status of the Israeli missiles is unknown.
  - IISS reports that Israel currently has some 20 Lance launchers in storage.
  - The Lance has a range of 130 km with a 450 kg payload.
  - Reports indicate that Israel has developed conventional cluster munitions for use with the Lance rocket.
- Reports of a May 2000 test launch seem to indicate that Israel is developing a cruise missile with 1,500 km that can be launched from its new Dolphin-class, German-built submarines.[46]
  - It is believed that such a cruise missile, an extended-range, turbofan powered variant of the Popeye cruise missile, called the Popeye Turbo, can carry a nuclear warhead.
- There are reports of the development of a long-range, nuclear-armed version of Popeye with GPS guidance and of studies of possible cruise missile designs that could be both surface-ship and submarine based.

- Variant of the Popeye air-to-surface missile believed to have nuclear warhead.
- The MAR-290 rocket with 30 kilometers range is believed to be deployed
- MAR-350 surface-to-surface missile with range of 56 miles and 735 lb. payload believed to have completed development or to be in early deployment.
- Israel seeking super computers for Technion Institute (designing ballistic missile RVs), Hebrew University (may be engaged in hydrogen bomb research), and Israeli Military Industries (maker of "Jericho II" and Shavit booster).
- Israel current review of its military doctrine seems to include a review of its missile basing options, and the study of possible hardening and dispersal systems. There are also reports that Israel will solve its survivability problems by deploying some form of nuclear-armed missile on its new submarines.

Chemical Weapons

- Reports of mustard and nerve gas production facility established in 1982 in the restricted area in the Sinai near Dimona seem incorrect. May have additional facilities. May have capacity to produce other gases. Probable stocks of bombs, rockets, and artillery.
  - According to some reports, Israel revitalized its chemical warfare facilities south of Dimona in the mid-1980s, after Syria deployed chemical weapons and Iraq began to use these weapons in the Iran-Iraq War.
  - Extensive laboratory research into gas warfare and defense.
  - An El Al 747-200 cargo plane crashed in southern Amsterdam on October 4, 1992, killing 43 people in the apartment complex it hit. This led to extensive examination of the crash and the plane was found to be carrying 50 gallons on dimethyl methylphosphonate, a chemical used to make Sarin nerve gas. The chemical had been purchased from Solkatronic Chemicals in the US and was being shipped to the Israel Institute for Biological Research. It was part of an order of 480 pounds worth of the chemical. Two of the three other chemicals used in making Sarin were shipped on the same flight. Israel at first denied this and then claimed it was only being imported to test gas masks.[47]
- Israel may have the contingency capability to produce at least two types of chemical weapons and has certainly studied biological weapons as well as chemical ones. According to one interview with an Israeli source of unknown reliability, Israel has mustard gas, persistent and non-persistent nerve gas, and may have at least one additional agent.
  - Development of defensive systems includes Shalon Chemical Industries protection gear, Elbit Computer gas detectors, and Bezal R&D aircrew protection system.
  - Extensive field exercises in chemical defense.
  - Gas masks stockpiled, and distributed to population with other civil defense instructions during first Gulf War and the Iraq War.
  - Warhead delivery capability for bombs, rockets, and missiles, but none now believed to be equipped with chemical agents.
  - An unconfirmed October 4, 1998 report in the *Sunday Times* of London quotes military sources as stating that Israeli F-16s can carry out attacks using chemical and biological weapons produced at the Nes Ziona facility.[48]

Biological Weapons

- Extensive research into weapons and defense.
- Ready to quickly produce biological weapons, but no reports of active production effort.
- Israel has at least one major research facility with sufficient security and capacity to produce both chemical and biological weapons.[49] There are extensive reports that Israel has a biological weapons research facility at the Israel Institute for Biological Research at Nes Tona, about 12 miles south of Tel Aviv, and that this same facility also has worked on the development and testing of nerve gas. This facility has created enough public

concern in Israel so that the mayor of Nes Tona has asked that it be moved away from populated areas. The facility is reported to have stockpiled Anthrax and to have provided toxins to Israeli intelligence for use in covert operations and assassinations like the attempt on a Hamas leader in Jordan in 1997.[50]

 - The Israel Institute for Biological Research is located in a 14-acre compound. It has high walls and exceptional security, and is believed to have a staff of around 300, including 120 scientists. A former deputy head, Marcus Kingberg, served 16 years in prison for spying for the FSU.

- US experts privately state that Israel is one of the nations included in US lists of nations with biological and chemical weapons. They believe that Israel has at least some stocks of weaponized nerve gas, although they may be stored in forms that require binary agents to be loaded into binary weapons.
  - They believe that Israel has fully developed bombs and warheads capable of effectively disseminating dry, storable biological agents in micropowder form and has agents considerably more advanced than anthrax. Opinion differs over whether such weapons are actively loaded and deployed. Unconfirmed reports by the British *Sunday Times* claimed that IAF F-16s are equipped for strikes using both these weapons and chemical weapons.[51]

Nuclear Weapons

- Director of CIA indicated in May 1989, that Israel may be seeking to construct a thermonuclear weapon.
- Has two significant reactor projects: the 5 megawatt HEU light-water IRR I reactor at Nahal Soreq; and the 40-150 megawatt heavy water, IRR-2 natural uranium reactor used for the production of fissile material at Dimona. Only the IRR-1 is under IAEA safeguards.
- Dimona has conducted experiments in pilot scale laser and centrifuge enrichment, purifies UO_2, converts UF_6 and fabricates fuel for weapons purpose.
- Uranium phosphate mining in Negev, near Beersheba, and yellowcake is produced at two plants in the Haifa area and one in southern Israel.
- Pilot-scale heavy water plant operating at Rehovot.
  - *Jane's Intelligence Review* published an article in September 1997 which refers to nuclear weapons bunkers at the Jericho 2 missile base at Zachariah (God remembers with a vengeance) several miles southeast of Tel Aviv and at Tel Nof airbase, a few kilometers to the northwest. The author concludes that the large number of bunkers indicates that Israel may have substantially more nuclear bombs than is normally estimated – perhaps up to 400 weapons with a total yield of 50 megatons. [52]
- Estimates of numbers and types of weapons differ sharply.
  - Stockpile of at least 60-80 plutonium weapons.
  - May have well over 100 nuclear weapons assemblies, with some weapons with yields over 100 kilotons.
  - US experts believe Israel has highly advanced implosion weapons. Known to have produced Lithium-6, allowing production of both tritium and lithium deuteride at Dimona. Facility no longer believed to be operating.
  - Some weapons may be ER variants or have variable yields.
  - Total stockpile of up to 200-300 weapons is possible.
  - There exists a possibility that Israel may have developed thermonuclear warheads.
- Major weapons facilities include production of weapons grade Plutonium at Dimona, nuclear weapons design facility at Nahal Soreq (south of Tel Aviv), missile test facility at Palmikim, nuclear armed missile storage facility at Kefar Zekharya, nuclear weapons assembly facility at Yodefat, and tactical nuclear weapons storage facility at Eilabun in eastern Galilee.

Missile Defenses

- Patriot missiles with future PAC-3 upgrade to reflect lessons of the Gulf War.

- Arrow 2 two-stage ATBM with slant intercept ranges at altitudes of 8-10 and 50 kilometers speeds of up to Mach 9, plus possible development of the Rafal AB-10 close in defense missile with ranges of 10-20 kilometers and speeds of up to Mach 4.5. Taas rocket motor, Rafael warhead, and Tadiran BM/C4I system and "Music" phased array radar.
  - The Arrow 2 has been tested six times and the most recent test successfully intercepted a Sparrow missile. IAF sources claim that the Arrow 2 can intercept the Iranian Shahab missile series.[53]
  - Israel plans to deploy three batteries of the Arrow to cover Israel, each with four launchers, to protect up to 85% of its population. The first battery was deployed in early 2000 at the Palmuchim Air Force Base, south of Tel Aviv, with an official announcement declaring the system operational on March 12, 2000.
  - The second Arrow battery components are being assembled at Eim Shemer near Hadera.
  - The Arrow program has three phases:
    - Phase I: Validate Defense Concept and Demonstrate Pre-prototype Missile
      - Fixed price contract: $158 million
      - The US pays 80%, Israel pays 20%.
      - Completed in December 1982.
    - Phase II: Demonstrate Lethality, develop and demonstrate tactical interceptor and launcher.
      - Fixed price contract: $330 million.
      - The US pays 72%, Israel pays 28%.
      - Began in July 1991.
      - Successfully completed.
    - Phase III: Develop and integrate tactical system, conduct weapon system tests, and develop and implement interoperability.
      - Program cost estimated at: $616 million.
      - The US pays 48%, Israel pays 52%.
      - Began in March 1996.
      - System integration in progress.
    - The Arrow will be deployed in batteries as a wide area defense system with intercepts normally at reentry or exoatmospheric altitudes. Capable of multi-target tracking and multiple intercepts.
- Israel has designed the Nautilus laser system for rocket defense in a joint project with the USA. It has developed into the Theater High Energy Laser (THEL). The project has recently been expanded to include interception of not only short-range rockets and artillery, but also medium-range Scuds and longer-range missiles such as Iran's Shahab series.
- Israel is also examining the possibility of boost-phase defenses. The Rafael Moab UAV forms part of the Israeli Boost-phase Intercept System. This is intended to engage TBMs soon after launch, using weapons fired from a UAV. Moab would launch an improved Rafael Python 4 air-to-air missile. Range is stated as 80-100km depending on altitude of release.

Advanced Intelligence Systems

- Israeli space program to date:

Satellite	Launch Date	Status	Function
Ofeq 1	9/19/1988	Decayed 1/14/1989	Experimental
Ofeq 2	4/3/1990	Decayed 7/9/1990	Communications experiments.
Ofeq 3	4/5/1995	Decayed 10/24/2000	Reconnaissance/experimental?

Ofeq 4 (Eros A)	1/22/1998	Launch failed during second-stage burn	Reconnaissance/commercial imaging?
Eros A1	12/5/2000	In orbit	Reconnaissance/commercial imaging?
Ofeq 5	5/28/2002	In orbit	Reconnaissance

Note: This chart does not include Israel's commercial communications satellite ventures.

- The Shavit launched Israel's satellite payload on September 19, 1989. It used a three stage booster system capable of launching a 4,000 pound payload over 1,200 miles or a 2,000 pound payload over 1,800 miles. It is doubtful that it had a payload capable of intelligence missions and seems to have been launched, in part, to offset the psychological impact of Iraq's missile launches.
  - It is believed that the vehicle was launched for experimentation in generation of solar power and transmission reception from space; verification of system's ability to withstand vacuum and weightless conditions; data collection on space environment conditions and Earth's magnetic field.
- Ofeq 2 launched in April 3, 1990 — one day after Saddam Hussein threatens to destroy Israel with chemical weapons if it should attack Baghdad.
  - This vehicle used the Ofeq 1 test-bed. Little open-source information exists on this vehicle although it is believed to be a test-bed for communications experiments.
- Israel launched first intelligence satellite on April 5, 1995, covering Syria, Iran, and Iraq in orbit every 90 minutes. The Ofeq 3 satellite is a 495-pound system launched using the Shavit 1 launch rocket, and is believed to carry an imagery system. Its orbit passes over or near Damascus, Tehran, and Baghdad.
  - The Shavit 1 differs from the Shavit only in the use of a somewhat different first stage. This change has not significantly affected vehicle performance. The Ofeq 3 and all subsequent launches have used the Shavit 1.
  - Reports conflict regarding whether this was an experimental platform or Israel's first surveillance satellite. Although it is thought to carry visible and ultraviolet wavelength imaging technology, the resolution is thought to be on the order of feet. The relatively low resolution, combined with its orbit, suggest to some observers that the satellite was capable of producing imagery of limited military usefulness.
- On January 22, 1998, the Ofeq 4/Eros A satellite was launched. Due to a failure in the second-stage the satellite never made orbit. Reports conflict about whether this was a launch of a military reconnaissance satellite or was intended for producing commercial satellite imagery.
- The Eros A1 satellite was launched on December 5, 2000 on a Russian Start-1 rocket from Svobodny launch site. This satellite produces commercially available satellite images. At a basic level, multi-spectral images with resolutions of 1.8 meters can be obtained. Currently, image processing techniques can yield resolutions of 1 meter. This is expected to improve to 0.6~0.7 meter resolutions in the next year or two. Some reports indicate that the Israeli government is a primary consumer of EROS imagery.
  - The successor craft, the Eros B, will have a baseline ability to produce images with a panchromatic resolution of 0.87 meters and 3.5 meters for multi-spectral images. Launch on board a Russian vehicle is expected in early 2004.
- On May 28, 2002, the Ofeq 5 reconnaissance satellite was launched successfully.
- Development of the Ofeq 6 reconnaissance satellite has started for a 2007 launch.
- Agreement signed with the US in April 1996 to provide Israel with missile early warning, launch point, vector, and point of impact data.
- Israeli Aircraft Industries, the manufacturer of the Shavit series SLV, is developing the additional launchers to place satellites in polar orbits:
  - LK-A - For 350kg-class satellites in 240x600km elliptical polar orbits
  - LK-1 - For 350kg-class satellites in 700km circular polar orbits.
  - LK-2 - For 800kg-class satellites in 700km circular polar orbits.

- It is likely that these SLVs designed to place satellites in polar orbits could not be launched from Israel and would require an overseas launching site, such as the American site at Wallops Island.

Figure 10.20

Syria's Search for Weapons of Mass Destruction

Delivery Systems

- Possible short range and tactical delivery systems include:
  - 18 FROG-7 launchers and rockets.
  - Multiple rocket launchers and tube artillery.
- Syria has numerous aircraft that could be used to deliver a nuclear weapon or modified for use as a UAV. They include:
  - 20 Su-24 long range strike fighters.
  - 44-60 operational MiG-23BN Flogger F fighter ground attack aircraft.
  - 50 Su-22 fighter ground attack aircraft.[54]
- Four SSM brigades: 1 with FROG, 1 with Scud Bs, 1 with Scud Cs, and 1 with SS-21s.
  - Has 18 SS-21 launchers and at least 36 SS-21 missiles with 80-100 kilometers range. May be developing chemical warheads.
  - According to the May 1998 estimate of the Center for Nonproliferation Studies at the Monterey Institute of International Studies, Syria possessed 200 SS-21 Scarab missiles.[55]
  - Some experts believe some Syrian surface-to-surface missiles armed with chemical weapons began to be stored in concrete shelters in the mountains near Damascus and in the Palmyra region no later than 1986, and that plans have long existed to deploy them forward in an emergency since that date
  - Up to 12 Scud B launchers and 200 Scud B missiles with 310 kilometers range. Believed to have chemical warheads. Scud B warhead weighs 985 kilograms. The inventory of Scud B missiles is believed to be approximately 200.
  - The Monterey Institute of International Studies' Center for Nonproliferation Studies reports that the Chinese provided technical assistance to upgrade Scud B missiles in 1993.[56]
  - New long-range North Korean Scud Cs deployed
- *Jane's* cites an American Department of Defense document published in 1992 that is said to report that Syria had purchased 150 Scud C missiles.
  - Two brigades of 18 launchers each are said to be deployed in a horseshoe shaped valley. This estimate of 36 launchers is based on the fact there are 36 tunnels into the hillside. The launchers must be for the Scud C since the older Scud Bs would not be within range of most of Israel. Up to 50 missiles are stored in bunkers to north as possible reloads. There is a maintenance building and barracks.
  - Underground bunkers are thought to have sufficient storage for some 1,000 Scud-C missiles according to a fall 2002 article in the Middle East Quarterly.[57]
  - Estimates indicate that Syria has 24-36 Scud launchers for a total of 260-300 missiles of all types. The normal ratio of launchers to missiles is 10:1, but Syria is focusing on both survivability and the capability to launch a large preemptive strike.
  - The Scud Cs have ranges of up to 550-600 kilometers. They have a CEP of 1,000-2,600 meters. Nerve gas warheads using VX with cluster bomblets seem to have begun production in early 1997. Syria is believed to have 50-80 Scud C missiles.
  - A training site exists about 6 kilometers south of Hama, with an underground facility where TELs and missiles are stored.

- *Jane's* reports that "It was reported in early 1998 that Israeli intelligence experts had estimated that there were between 24 and 36 'Scud' launchers at most Syrian missile sites – far more launchers than previously estimated." Traditionally, armies deploying Scuds stock about 10 missiles per launcher. The higher number of Syrian launchers suggests a ratio closer to 2 missiles per launcher – this would enable Syria to launch a large first-wave strike before launchers were destroyed.
- Syria may be able to build the entire Scud B and Scud C. Some Israeli sources claim it has sheltered and/or underground missile production/assembly facilities at Aleppo, Hama, and near Damascus, which have been built with aid from Chinese, Iranian, and North Korean technicians. Possibly some Russian technical aid.
  - Israeli defense officials have been reported as stating that Syria has been producing about 30 Scud C missiles per year at an underground facility.[58]
  - A missile test site exists 15 kilometers south of Homs where Syria has tested missile modifications and new chemical warheads. It has heavy perimeter defenses, a storage area and bunkers, heavily sheltered bunkers, and a missile storage area just west of the site.
  - According to some reports, Syria has built two missile plants near Hama, about 110 miles north of Damascus, one is for solid fueled rockets and the other is for liquid fueled systems. North Korea may have provided the equipment for the liquid fuel plant, and Syria may now be able to produce the missile.
- Reports of Chinese deliveries of missiles but little hard evidence:
  - Reports of PRC deliveries of missile components by China Precision Machinery Company, maker of the M-11, in July1996. The M-11 has a 186-mile (280 kilometer) range with a warhead of 1,100 pounds. Missile components may have included "contained sensitive guidance equipment."[59]
- Reports of Syrian purchases and production of Chinese M-9 missile are unconfirmed and of uncertain value:
  - Some sources believe M-9 missile components, or M-9-like components delivered to Syria. Missile is reported to have a CEP as low as 300 meters.
  - Some intelligence reports indicate that 24 M-9 launchers were sighted in late 1991.[60] Other reports suggest that the 1991 missile deliveries were subsequently cancelled due to US pressure.
  - "Since 1989 there have been persistent rumors that Syria was trying to import the M-9 from China. Up to the mid-1990s, Israeli sources believed that these attempts ended in failure - Beijing reportedly backed out of the deal due to US pressure. The reports surfaced again in the late 1990s, with suggestions that the M-9 had been delivered from China - possibly in kit form, or partly assembled."
  - *Jane's* reported in March 1999 that Syria had created a production facility to build both the M-11 (CSS-7/DF-11) and M-9 missiles with ranges of 280 and 600-800 kilometers respectively. It reports that production of the booster stage of the M-11 began in 1996, and that missile production is expected to start "soon."
  - An April 1993 report in Jane's Intelligence Review report indicated that North Korea and Iran (with Chinese assistance) helped in the construction of underground production facilities for the Scud C and M-9 missiles. At the time of the article (April 1993), production of the Scud C was believed to be 12-18 months off, while M-9 production was believed to be 2-3 years away.[61]
- Senior administration officials were quoted as stating that China had sold missile technology to Syria. 30-90 tons of chemicals for solid propellant were sold to Syria by mid 1992.[62]
- Some Israeli sources report that Syria has also developed, with North Korean assistance, a Syrian version of the Korean No Dong (sometimes referred to as the Scud-D).
  - A number of sources reported the September 23, 2000 test flight of the Syrian No Dong.
  - Four tunnels for shelters for No Dong launchers have been excavated, as of late 2002.[63]
  - Syria expected to produce or have already started production at the rate of about 30 missiles per year.[64]
  - Israeli officials claimed that Syria was developing "multiple warhead clusters" in a bid to defeat Israel's Arrow missile defense system.[65]

- Syria has shorter range systems:
    - Short-range M-1B missiles (up to 60 miles range) seem to be in delivery from PRC.
    - SS-N-3, and SSC-1b cruise missiles.
- The Center for Nonproliferation Studies at the Monterey Institute of International Studies has compiled the following chronology of North Korean assistance to Syria through 2000[66]:

Date	Item(s)	Remarks
1991 March	24 Scud-Cs and 20 TELs	Syria pays approximately $250 million, and Libya reportedly helps finance transaction.
1991 April	60 Scud-Cs and 12 TELs	First delivery after agreement for Syria to acquire 150 Scud-Cs for an estimated $500 million.
1991 May	36 Scud-Cs	Missiles transported by Yugoslavian freighter.
1991 summer	Unknown number of Scud-Cs	Missiles delivered by North Korean ship *Mupo* and transferred to Syria via Cyprus.
1992	24 Scud-C missiles; missile-production and assembly equipment	Delivered by North Korean freighter *Tae Hung Ho* in March. Part of the shipment was airlifted to Syria via the Iranian port of Bandar Abbas, and the remaining cargo was transported directly to the Tartus. The manufacturing equipment reportedly destined for suspected missile factories in Hama and Aleppo.
1992	Approximately 50 Scud-Cs	A North Korean ship carrying 100 Scud-Cs depart for the Iranian port Bandar Abbas in October. Half of the delivery transported overland to Syria.
1993	seven MAZ 543 chassis and unknown number of Scud-Cs	In August, two Russian Condor aircraft transport the missiles and chassis from Sunan International Airport to Damascus. According to Israeli Foreign Minister Shimon Peres, North Korea offered to stop the delivery if Israel paid $500 million.
1994	Unknown number of Scud-C missiles and TELs	
1994	Unknown number of Scud-C cluster warheads	
1996	Missile expertise	Syrian missile technicians spend two weeks training in North Korea.
1999	10 tons of powdered aluminum	Originally from China, shipment delivered to the Centre des Etudes de Recherche Scientifique, the institute in charge of Syria's missile program.
2000	Scud-D missile	Unconfirmed; Syria conducted Scud-D flight test on 23 September 2000.
2000	No Dong missiles and TELs	Unconfirmed; North Korean firm Ch'ongchon'gang reportedly delivers 50 No Dong missiles and seven TELs to Syria. Missiles possibly procured on behalf of

		Iraq, Egypt and Libya for $600 million.

- Sheltered or underground missile production/assembly facilities at Aleppo and Hamas have been built with aid from Chinese, Iranian, and North Korean technicians. Possibly some Russian technical aid.
- May be converting some long range surface-to-air and naval cruise missiles to use chemical warheads.
- Syria has improved its targeting capability in recent years by making extensive direct and indirect use of commercial satellite imagery, much of which now offers 3 meter levels of resolution and comes with coordinate data with near GPS-like levels of accuracy. One-meter levels of resolution will become commercially available.
- Unconfirmed reports indicate Syria is interested in purchasing Russia's Iskander-E (SS-X-26) ballistic missile when once it has finished development.[67]
- The CIA estimated in January 1999 that Syria continued work on establishing a solid-propellant rocket motor development and production capability. Foreign equipment and assistance have been and will continue to be essential for this effort.
- The CIA reported in November 2003 that, "During the first half of 2003, Damascus continued to seek help from abroad to establish a solid-propellant rocket motor development and production capability. Syria's liquid-propellant missile program continued to depend on essential foreign equipment and assistance—primarily from North Korean entities. Damascus also continued to manufacture liquid-propellant Scud missiles. In addition, Syria was developing longer-range missile programs such as a Scud D and possibly other variants with assistance from North Korea and Iran."

Chemical Weapons

- First acquired small amounts of chemical weapons from Egypt in 1973.
- Began production of non-persistent nerve gas in 1984. May have had chemical warheads for missiles as early as 1985.
- Experts believe has stockpiled 500 to 1,000 metric tons of chemical agents. Holdings thought to include persistent (VX) and non-persistent nerve agents (Sarin) as well as blister agents.
- Believed to have begun deploying VX in late 1996, early 1997.
    - CIA reported in June 1997 that Syria had acquired new chemical weapons technology from Russia and Eastern Europe in 1996.
    - Unconfirmed reports of sheltered Scud missiles with unitary Sarin or Tabun nerve gas warheads, now being replaced by cluster warheads with VX bomblets, deployed in caves and shelters near Damascus.
    - Tested Scuds in manner indicating possible chemical warheads in 1996.
    - Seems to have cluster warheads and bombs.
    - May have VX and Sarin in modified Soviet ZAB-incendiary bombs and PTAB-500 cluster bombs. Reports stated that US intelligence source had obtained information indicating a late October 1999 test of a live chemical bomb dropped by a Syrian MiG-23.[68]
- Acquired design for Soviet Scud warhead using VX in 1970s.
- Major nerve gas, and possible other chemical agent production facilities north of Damascus. Two to three plants.
    - One facility is located near Homs and is located next to a major petrochemical plant. It reportedly produces several hundred tons of nerve gas a year.
    - Reports is building new major plant at Safira, near Aleppo.
    - Reports that a facility co-located with the Center d'Etdues et de Recherche Scientifique (CERS) is developing a warhead with chemical bomblets for the Scud C.

- Many parts of the program are dispersed and compartmented. Missiles, rockets, bombs, and artillery shells are produced/modified and loaded in other facilities. Many may be modified to use VX bomblets.
- Wide range of potential delivery systems:
    - Extensive testing of chemical warheads for Scud Bs. May have tested chemical warheads for Scud Cs. Recent tests include a July 2001 test of a Scud B near Aleppo and a May 1998 test of a Scud C with a VX warhead near Damascus.
    - Shells, bombs, and nerve gas warheads for multiple rocket launchers.
    - FROG warheads may be under development.
    - Reports of SS-21 capability to deliver chemical weapons are not believed by US or Israeli experts.
    - Israeli sources believe Syria has binary weapons and cluster bomb technology suitable for delivering chemical weapons.
  - The CIA estimated in January 1999 that Chinese entities sought to supply Iran and Syria with CW-related chemicals during this reporting period.
- The CIA reported in November 2003 that, "Syria continued to seek CW-related expertise from foreign sources during the reporting period. Damascus already held a stockpile of the nerve agent sarin, but apparently tried to develop more toxic and persistent nerve agents. Syria remained dependent on foreign sources for key elements of its CW program, including precursor chemicals and key production equipment."

Biological Weapons

- Signed, but not ratified the 1972 Biological and Toxin Weapons Convention. Extensive research effort.
- US State Department, Bureau of Arms Control report in August 1996 indicated that, "it is highly probably that Syria is developing an offensive biological capability."
- Extensive research effort. Reports of one underground facility and one near the coast.
- Probable production capability for anthrax and botulism, and possibly other agents.
- Israeli sources claim Syria weaponized botulinum and ricin toxins in early 1990s, and probably anthrax as well.
- Limited indications may be developing or testing biological variations on ZAB-incendiary bombs and PTAB-500 cluster bombs and Scud warheads.
  - Major questions exist regarding Syria's strike capabilities. Older types of biological weapons using wet agents, and placed in older bomb and warhead designs with limited dissemination capability, can achieve only a small fraction of the potential effectiveness of biological weapons. Dry micropowders using advanced agents – such as the most lethal forms of Anthrax – can have the effectiveness of small theater nuclear weapons. It is difficult to design adequate missile warheads to disseminate such agents, but this is not beyond Syrian capabilities – particularly since much of the technology needed to make effective cluster munitions and bomblets for VX gas can be adapted to the delivery of biological weapons.[69]
- The design of biological bombs and missile warheads with the lethality of small nuclear weapons may now be within Syrian capabilities, as is the design of UAV, helicopter, cruise missile, or aircraft-borne systems to deliver the agent slowly over a long line of flight and taking maximum advanced of wind and weather conditions. US and Soviet texts proved that this kind of "line source" delivery could achieve lethalities as high as 50-100 kiloton weapons by the late 1950s, and the technology is well within Syria's grasp. So is the use of proxy or covert delivery.
  - The CIA reported in November 2003 that, "It is highly probable that Syria also continued to develop an offensive BW capability."

Nuclear Weapons

- Ongoing low-level research effort seems likely.
- No evidence of major progress in development effort.

- Announced nuclear reactor purchase plans including 10 megawatt research reactor from Argentina. Discussions with Argentina were resumed in the mid-1990s, but plans to build a Syrian reactor were scrapped under US pressure.
- Syria tried to obtain six power reactors (for a total of 6000 megawatts of generating capacity) in 1980s from a number of countries, including the Soviet Union, Belgium and Switzerland, but plans were never implemented.
- The Center for Nonproliferation Studies at the Monterey Institute of International Studies quotes a *Jane's Intelligence Review* article from 1993 claiming Syria attempted to purchase "large (thousand ton) quantities" of yellowcake from Namibia.[70]
- In December 1991 Syria purchased a 30 kilowatt neutron-source research reactor from China, reactor is not suitable for weapons production. The Atomic Energy Commission of Syria received 980.4 g of 90.2% enriched Uranium 235 as part of the deal.
- Russia and Syria have approved a draft of a plan for cooperation on civil nuclear power, which is expected to provide opportunities for Syria to expand its indigenous nuclear capabilities.[71] Reports surfaced in January of 2003 indicating that Syria and Russia had reached an agreement on the construction of a $2 billion facility that would include a nuclear reactor. Although within several days, Russian Foreign Ministry officials had indicated that no reactor would be sold.[72]

Missile Defenses

- Seeking Russian S-300or S-400 surface-to-air missile system with limited anti tactical ballistic missile capability.

Figure 10.21

Iran’s Search for Weapons of Mass Destruction

Delivery Systems

- The Soviet-designed Scud B (17E) guided missile currently forms the core of Iran’s ballistic missile forces — largely as a result of the Iran-Iraq War.
  - Iran only acquired its Scuds in response to Iraq’s invasion. It obtained a limited number from Libya and then obtained larger numbers from North Korea. It deployed these units with a special Khatam ol-Anbya force attached to the air element of the Pasdaran. Iran fired its first Scuds in March 1985. It fired as many as 14 Scuds in 1985, 8 in 1986, 18 in 1987, and 77 in 1988. Iran fired 77 Scud missiles during a 52 day period in 1988, during what came to be known as the "war of the cities." Sixty-one were fired at Baghdad, nine at Mosul, five at Kirkuk, one at Tikrit, and one at Kuwait. Iran fired as many as five missiles on a single day, and once fired three missiles within 30 minutes. This still, however, worked out to an average of only about one missile a day, and Iran was down to only 10-20 Scuds when the war of the cities ended.
  - Iran's missile attacks were initially more effective than Iraq's attacks. This was largely a matter of geography. Many of Iraq's major cities were comparatively close to its border with Iran, but Tehran and most of Iran's major cities that had not already been targets in the war were outside the range of Iraqi Scud attacks. Iran's missiles, in contrast, could hit key Iraqi cities like Baghdad. This advantage ended when Iraq deployed extended range Scuds.
  - The Scud B is a relatively old Soviet design which first became operational in 1967, designated as the R-17E or R-300E. The Scud B has a range of 290-300 kilometers with its normal conventional payload. The export version of the missile is about 11 meters long, 85-90 centimeters in diameter and weighs 6,300 kilograms. It has a nominal CEP of 1,000 meters. The Russian versions can be equipped with conventional high explosive, fuel air explosive, runway penetrator, submunition, chemical, and nuclear warheads.
  - The export version of the Scud B comes with a conventional high explosive warhead weighing about 1,000 kilograms, of which 800 kilograms are the high explosive payload and 200 are the warhead structure and fusing system. It has a single stage storable liquid rocket engine and is usually deployed on the MAZ-543 eight wheel transporter-erector-launcher (TEL) . It has a strap-down inertial guidance, using three gyros to correct its ballistic trajectory, and uses internal graphite jet vane steering. The warhead hits at a velocity above Mach 1.5.
  - Most estimates indicate that Iran now has 6-12 Scud launchers and up to 200 Scud B (R-17E) missiles with 230-310 KM range.
  - Some estimates give higher figures. They estimate Iran bought 200-300 Scud Bs from North Korea between 1987 and 1992, and may have continued to buy such missiles after that time. Israeli experts estimate that Iran had at least 250-300 Scud B missiles, and at least 8-15 launchers on hand in 1997.
  - US experts also believe that Iran can now manufacture virtually all of the Scud B, with the possible exception of the most sophisticated components of its guidance system and rocket motors. This makes it difficult to estimate how many missiles Iran has in inventory and can acquire over time, as well as to estimate the precise performance characteristics of Iran’s missiles, since it can alter the weight of the warhead and adjust the burn time and improve the efficiency of the rocket motors.
- Iran has new long range North Korean Scuds - with ranges near 500 kilometers.
  - The North Korean missile system is often referred to as a "Scud C." Typically, Iran formally denied the fact it had such systems long after the transfer of these missiles became a fact. Hassan Taherian, an Iranian foreign ministry official, stated in February 1995, “There is no missile cooperation between Iran and North Korea whatsoever. We deny this.”
  - In fact, a senior North Korean delegation traveled to Tehran to close the deal on November 29, 1990, and met with Mohsen Rezaei, the former commander of the IRGC. Iran either bought the missile then, or placed its order shortly thereafter. North Korea then exported the missile through its Lyongaksan Import

Corporation. Iran imported some of these North Korean missile assemblies using its B-747s, and seems to have used ships to import others.

- Iran probably had more than 60 of the longer range North Korean missiles by 1998, although other sources report 100, and one source reports 170.
  - Iran has begun to test its new North Korean missiles. There are reports it has fired them from mobile launchers at a test site near Qom about 310 miles (500 kilometers) to a target area south of Shahroud. There are also reports that units equipped with such missiles have been deployed as part of Iranian exercises like the Saeqer-3 (Thunderbolt 3) exercise in late October 1993.
  - The missile is more advanced than the Scud B, although many aspects of its performance are unclear. North Korea seems to have completed development of the missile in 1987, after obtaining technical support from the People's Republic of China. While it is often called a "Scud C," it seems to differ substantially in detail from the original Soviet Scud B. It seems to be based more on the Chinese-made DF-61 than on a direct copy of the Soviet weapon.
  - Experts estimate that the North Korean missiles have a range of around 310 miles (500 kilometers), a warhead with a high explosive payload of 700 kilograms, and relatively good accuracy and reliability. While this payload is a bit limited for the effective delivery of chemical agents, Iran might modify the warhead to increase payload at the expense of range and restrict the using of chemical munitions to the most lethal agents such as persistent nerve gas. It might also concentrate its development efforts on arming its Scud C forces with more lethal biological agents. In any case, such missiles are likely to have enough range-payload to give Iran the ability to strike all targets on the southern coast of the Gulf and all of the populated areas in Iraq, although not the West. Iran could also reach targets in part of eastern Syria, the eastern third of Turkey, and cover targets in the border area of the former Soviet Union, western Afghanistan, and western Pakistan.
  - Accuracy and reliability remain major uncertainties, as does operational CEP. Much would also depend on the precise level of technology Iran deployed in the warhead. Neither Russia nor the People's Republic of China seem to have transferred the warhead technology for biological and chemical weapons to Iran or Iraq when they sold them the Scud B missile and CSS-8. However, North Korea may have sold Iran such technology as part of the Scud C sale. If it did so, such a technology transfer would save Iran years of development and testing in obtaining highly lethal biological and chemical warheads. In fact, Iran would probably be able to deploy far more effective biological and chemical warheads than Iraq had at the time of the Gulf War.
  - Iran may be working with Syria in such development efforts, although Middle Eastern nations rarely cooperate in such sensitive areas. Iran served as a transshipment point for North Korean missile deliveries during 1992 and 1993. Some of this transshipment took place using the same Iranian B-747s that brought missile parts to Iran. Others moved by sea. For example, a North Korean vessel called the *Des Hung Ho*, bringing missile parts for Syria, docked at Bandar Abbas in May, 1992. Iran then flew these parts to Syria. An Iranian ship coming from North Korea and a second North Korean ship followed, carrying missiles and machine tools for both Syria and Iran. At least 20 of the North Korean missiles have gone to Syria from Iran, and production equipment seems to have been transferred to Iran and to Syrian plants near Hama and Aleppo.
  - Iran may have 5-10 Scud C launchers, each with several missiles. This total seems likely to include four new North Korean TELs received in 1995.
  - Iran can now assemble Scud B and Scud C missiles using foreign-made components. It may soon be able to make entire missile systems and warhead packages in Iran.
- Iran seems to want enough missiles and launchers to make its missile force highly dispersible.
- Iran has created shelters and tunnels in its coastal areas which it could use to store Scud and other missiles in hardened sites and reduce their vulnerability to air attack.
- Iran is developing an indigenous missile production capability with both solid and liquid fueled missiles. Seems to be seeking capability to produce MRBMs.

- The present scale of Iran's production and assembly efforts is unclear. Iran seems to have a design center, at least two rocket and missile assembly plants, a missile test range and monitoring complex, and a wide range of smaller design and refit facilities.
- The design center is said to be located at the Defense Technology and Science Research Center, which is a branch of Iran's Defense Industry Organization, and located outside Karaj — near Tehran. This center directs a number of other research efforts. Some experts believe it has support from Russian and Chinese scientists.
- Iran's largest missile assembly and production plant is said to be a North Korean-built facility near Isfahan, although this plant may use Chinese equipment and technology. There are no confirmations of these reports, but this region is the center of much of Iran's advanced defense industry, including plants for munitions, tank overhaul, and helicopter and fixed wing aircraft maintenance. Some reports say the local industrial complex can produce liquid fuels and missile parts from a local steel mill.
- A second missile plant is said to be located 175 kilometers east of Tehran, near Semnan. Some sources indicate this plant is Chinese-built and began rocket production as early as 1987. It is supposed to be able to build 600-1,000 Oghab rockets per year, if Iran can import key ingredients for solid fuel motors like ammonium perchlorate. The plant is also supposed to produce the Iran-130.
- Another facility may exist near Bandar Abbas for the assembly of the Seersucker. China is said to have built this facility in 1987, and is believed to be helping the naval branch of the Guards to modify the Seersucker to extend its range to 400 kilometers. It is possible that China is also helping Iran develop solid fuel rocket motors and produce or assemble missiles like the CS-801 and CS-802. There have, however, been reports that Iran is developing extended range Scuds with the support of Russian experts, and of a missile called the Tondar 68, with a range of 700 kilometers.
- Still other reports claim that Iran has split its manufacturing facilities into plants near Pairzan, Seman, Shiraz, Maghdad, and Islaker. These reports indicate that the companies involved in building the Scuds are also involved in Iran's production of poison gas and include Defense Industries, Shahid, Bagheri Industrial Group, and Shahid Hemat Industrial Group.
- Iran's main missile test range is said to be further east, near Shahroud, along the Tehran-Mashhad railway. A telemetry station is supposed to be 350 kilometers to the south at Taba, along the Mashhad-Isfahan road. All of these facilities are reportedly under the control of the Islamic Revolutionary Guards Corps.

- There were many reports during the late 1980s and early 1990s that Iran had ordered the North Korean No Dong missile, which was planned to have the capability to carry nuclear and biological missile ranges of up to 900 kilometers. This range would allow the missile could reach virtually any target in Gulf, Turkey, and Israel. The status of the No Dong program has since become increasingly uncertain, although North Korea deployed some developmental types at test facilities in 1997.
    - The No Dong underwent flight tests at ranges of 310 miles (500 kilometers) on May 29, 1993. Some sources indicate that Iranians were present at these tests. Extensive further propulsion tests began in August 1994, and some reports indicate operational training began for test crews in May 1995. Missile storage facilities began to be built in July 1995, and four launch sites were completed in October 1995.
    - The progress of the program has been slow since that time, and may reflect development problems. However, mobile launchers were seen deployed in northeast North Korea on March 24, 1997. According to some reports, a further seven launcher units were seen at a facility about 100 kilometers from Pyongyang.
    - The No Dong 1 is a single-stage liquid-fueled missile, with a range of up to 1,000 to 1,300 kilometers (810 miles), although longer ranges may be possible with a reduced warhead and maximum burn. There are also indications that there may be a No Dong 2, using the same rocket motor, but with an improved fuel supply system that allows the fuel to burn for a longer period.
    - The missile is about 15.2 meters long — four meters longer than the Scud B — and 1.2 meters in diameter. The warhead is estimated to weigh 770 kilograms (1,200-1,750 pounds) and a warhead manufacturing facility exists near Pyongyang. The No Dong has an estimated theoretical CEP of 700 meters at maximum range, versus 900 meters for the Scud B, although its practical accuracy could be as wide as 3,000-4,000 meters. It has an estimated terminal velocity of Mach 3.5, versus 2.5 for the Scud B, which presents added

problems for tactical missile defense. The missile is transportable on a modified copy of the MAZ-543P TEL that has been lengthened with a fifth axle and which is roughly 40 meters long. The added support stand for the vertical launch modes brings the overall length to 60 meters, and some experts questioned whether a unit this big is practical.

- Other reports during the later 1980s and early 1990s indicated that Iran was also interested in two developmental North Korean IRBMs called the Tapeo Dong 1 and Tapeo Dong 2
  - The Tapeo Dong 1 missile has an estimated maximum range of 2,000 kilometers, and the Tapeo Dong 2 may have a range up to 3,500 kilometers.
  - Both Tapeo Dongs are liquid fueled missiles which seem to have two stages.
  - Unlike the No Dong, the Tapeo Dongs must be carried to a site in stages and then assembled at a fixed site. The No Dong transporter may be able to carry both stages of the Tapeo Dong 1, but some experts believe that a special transporter is needed for the first stage of the Tapeo Dong 1, and for both stages of the Tapeo Dong 2.
- Since the early 1990s, the focus of reports on Iran's missile efforts have shifted, and it has since become clear that Iran is developing its own longer-range variants of the No Dong for indigenous production with substantial Russian and some Chinese aid:
  - As early as 1992, one such missile was reported to have a range of 800-930 miles and a 1,650 pound warhead. Reports differ sharply on its size. *Jane's* estimates a launch weight up to 16,000 kilograms, provided the system is derived from the No Dong. It could have a launch weight of 15,000 kilograms, a payload of 600 kilograms, and a range of 1,700-1,800 kilometers if it is based on a system similar to the Chinese CSS-5 (DF-21) and CSS-N3 (JL-1). These systems entered service in 1983 and 1987.
  - A longer-range missile was said to have improved guidance components, a range of up to 1,240 miles and a warhead of up to 2,200 pounds.
  - IOC dates were then estimated to be 1999-2001.
  - Russia agreed in 1994 that it would adhere to the terms of the Missile Technology Control Regime and would place suitable limits on the sale or transfer of rocket engines and technology. Nevertheless, the CIA has identified Russia as a leading source of Iranian missile technology, and the State Department has indicated that President Clinton expressed US concerns over this cooperation to President Yeltsin. This transfer is one reason the President appointed former Ambassador Frank Wisner, and then Robert Gallucci, as his special representatives to try to persuade Russia to put a firm halt to the transfer of missile technology to Iran.
  - These programs are reported to have continuing support from North Korea, and from Russian and Chinese firms and technicians. One such Chinese firm is Great Wall Industries. The Russian firms include the Russian Central Aerohydrodynamic Institute, which has provided Iran's Shahid Hemat Industrial Group (SHIG) with wind tunnels for missile design, equipment for manufacturing missile models, and the software for testing launch and reentry performance. They may also include Rosvoorouzhenie, a major Russian arms-export agency; NPO Trud, a rocket motor manufacturer; a leading research center called the Bauman Institute, and Polyus (Northstar), a major laser test and manufacturing equipment firm.
  - The CIA reported in June 1997 that Iran obtained major new transfers of new long-range missile technology from Russian and Chinese firms during 1996. Since that time, there have been many additional reports of technology transfer from Russia.
  - The reports on Chinese technology transfers involve the least detail:
    - There have been past reports that Iran placed orders for PRC-made M-9 (CSS-6/DF-15) missile (280-620 kilometers range, launch weight of 6,000 kilograms).
    - It is more likely, however, that PRC firms are giving assistance in developing indigenous missile R&D and production facilities for the production of an Iranian solid fueled missile.
    - The US offered to provide China with added missile technology if it would agree to fully implement an end of technology transfer to Iran and Pakistan during meetings in Beijing on March 25-26, 1998.

- Recent reports and tests have provided more detail on the Shahab system:
  - Some US experts believe that Iran tested booster engines in 1997 capable of driving a missile to ranges of 1,500 kilometers. Virtually all US experts believe that Iran is rapidly approaching the point where it will be able to manufacture missiles with much longer ranges than the Scud B.
  - It is less clear when Iran will be able to bring such programs to the final development stage, carry out a full range of suitable test firings, develop highly lethal warheads, and deploy actual units. Much may still depend on the level of foreign assistance.
  - Eitan Ben Eliyahu — the commander of the Israeli Air Force — reported on April 14, 1997 that Iran had tested a missile capable of reaching Israel. The background briefings to his statement implied that Russia was assisting Iran in developing two missiles — with ranges of 620 and 780 miles. Follow-on intelligence briefings that Israel provided in September 1997 indicated that Russia was helping Iran develop four missiles. US intelligence reports indicate that China has also been helping Iran with some aspects of these missile efforts.
  - These missiles included the Shahab ("meteor") missiles, with performance similar to those previously identified with Iranian missiles adapted from North Korean designs.
  - The Israeli reports indicated that the Shahab 3 was a liquid-fueled missile with a range of 810 miles (1,200-1,500 kilometers) and a payload of 1550 pounds (700 kilometers).
  - Israel claimed the Shahab might be ready for deployment as early as 1999**.**
- Iran tested the Shahab 3 on July 21, 1998, claiming that it was a defensive action to deal with potential threats from Israel.
  - The missile flew for a distance of up to 620 miles, before it exploded about 100 seconds after launch. US intelligence sources could not confirm whether the explosion was deliberate, but indicated that the final system might have a range of 800-940 miles (a maximum of 1,240 kilometers), depending on its payload. The test confirmed the fact the missile was a liquid fueled system.
  - Gen. Mohammad Bagher Qalibaf, head of the Islamic Revolutionary Guards Corps' air wing publicly reported on August 2, 1998 that the Shahab-3 is 53-foot-long ballistic missile that can travel at 4,300 mph and carry a one-ton warhead at an altitude of nearly 82,000 feet. He claimed that the weapon was guided by an Iranian-made system that gives it great accuracy: "The final test of every weapon is in a real war situation but, given its warhead and size, the Shahab-3 is a very accurate weapon."
  - Other Iranian sources reported that the missile had a range of 800 miles. President Mohammad Khatami on August 1, 1998 stated that Iran was determined to continue to strengthen its armed forces, regardless of international concerns: "Iran will not seek permission from anyone for strengthening its defense capability."
  - Martin Indyck, the US Assistant Secretary for Near East Affairs testified on July 28, that the US estimated that the system needed further refinement but might be deployed in its initial operational form between September 1998 and March 1999.
  - Iran publicly displayed the Shahab 3 on its launcher during a parade on September 25, 1998. The missile carrier bore signs saying, "The US can do nothing" and "Israel would be wiped from the map."
  - There are some reports of a Shahab-3B missile with extended range and a larger booster.
  - The resulting system seems to be close to both the No Dong and Pakistani Ghauri or Haff-5 missile, first tested in April 1998, raising questions about Iranian-North Korean-Pakistani cooperation.
  - North Korean parades exhibiting the Tapeo Dong in September 1999 exhibited a missile with rocket motor and nozzle characteristics similar to those of the Shahab 3.
  - Iran conducted further tests of the Shahab 3.
    - Tests on July 15, 2000 and May 23, 2003 were successful.

- An additional test on September 21, 2000 was claimed to be successful test launch by Iran, although US officials claim that the missile exploded shortly after launch.

- A July 2002 test was also determined to be unsuccessful. On whole, test firings of the Shahab 3 series have met with success in approximately half of all launches.

- Sources quote unconfirmed reports by Turkish intelligence that the Shahab 3 is now in production. Additionally, Israeli intelligence is quoted as saying that Iran may have as many as 20 missiles.[73]

- On July 4, 2000, Iran's Islamic Revolutionary Guards Corps claimed to have formed five new missile units, apparently to be equipped with Shahab 3 missiles.[74]

- In September 1999, the Revolutionary Guard exhibited another missile called the Zelzal, which it stated was "now in mass production." The missile was said to have taken four and one-half years to develop and to be derived from the Zelzal 2, which the IRGC had exhibited earlier. Some estimates indicate that it can carry a warhead of 500 kilograms for up to 900 kilometers. However, the missile exhibited in Tehran was a rocket on a truck-mounted launch rail that seemed more likely to have a range of 150-200 kilometers.

  - There have been growing reports that Iran might be using Russian technology to develop long-range missiles with ranges from 2,000 to 6,250 kilometers.

- Israeli and US intelligence sources have reported that that Iran is developing the Shahab 4, with a range of 2,000 kilometers (1,250 miles), a payload of around 2,000 pounds, and a CEP of around 2,400 meters. Some estimates indicate that this system could be operational in 2-5 years. The US Assistant Secretary for Near East Affairs testified on July 28, 1998, that the US estimated that the system still needed added foreign assistance to improve its motors and guidance system.

  - Some reports indicate that the Shahab 4 is based on the Soviet SS-4 missile. Others that there is a longer range Shahab 5, based on the SS-4 or Tapeo Dong missile. Reports saying the Shahab is based on the SS-4 say it has a range of up to 4,000 kilometers and a payload in excess of one ton.)

  - Iran may have two other missile programs include longer-range systems, variously reported as having maximum ranges of 3,650, 4,500-5,000, 6,250, or 10,000 kilometers.

  - It seems clear that Iran has obtained some of the technology and design details of the Russian SS-4. The SS-4 (also known as the R-12 or "Sandal") is an aging Russian liquid fuel design that first went into service in 1959, and which was supposedly destroyed as part of the IRBM Treaty. It is a very large missile, with technology dating back to the early 1950s, although it was evidently updated at least twice during the period between 1959 and 1980. It has a CEP of 2-4 kilometers and a maximum range 2,000 kilometers, which means it can only be lethal with a nuclear warhead or a biological weapon with near-nuclear lethality.

  - At the same time, the SS-4's overall technology is relatively simple and it has a throwweight of nearly 1,400 kilograms (3,000 pounds). It is one of the few missile designs that a nation with a limited technology base could hope to manufacture or adapt, and its throw weight and range would allow Iran to use a relatively unsophisticated nuclear device or biological warhead. As a result, an updated version of the SS-4 might be a suitable design for a developing country.

- Iran is reported to have carried out the test of a sea-launched ballistic missile in 1998.

- Russia has been a key supplier of missile technology.

  - Some sources have indicated that Russian military industries have signed contracts with Iran to help produce liquid fueled missiles and provide specialized wind tunnels, manufacture model missiles, and develop specialized computer software. For example, these reports indicate that the Russian Central Aerohydrodynamic Institute is cooperating with Iran's Defense Industries Organization (DIO) and the DIO's Shahid Hemmat Industrial Group (SHIG). The Russian State Corporation for Export and Import or Armament and Military Equipment (Rosvoorouzhenie) and Infor are also reported to be involved in deals with the SHIG. These deals are also said to include specialized laser equipment, mirrors, tungsten-coated graphite material, and maraging steel for missile development and production. They could play a major role in help Iran develop long range versions of the Scud B and C, and more accurate variations of a missile similar to the No Dong.

- The Israeli press reported in August 1997 that Israeli had evidence that Iran was receiving Russian support. In September 1997, Israel urged the US to step up its pressure on Iran, and leaked reported indicating that private and state-owned Russian firms had provided gyroscopes, electronic components, wind tunnels, guidance and propulsion systems, and the components needed to build such systems to Iran.

- President Yeltsin and the Russian Foreign Ministry initially categorically denied that such charges were true. Following a meeting with Vice President Gore, President Yeltsin stated on September 26, 1997 that, "We are being accused of supplying Iran with nuclear or ballistic missile technologies. There is nothing further from the truth. I again and again categorically deny such rumors."

- Russia agreed, however, that Ambassador Wisner and Yuri Koptyev, the head of the Russian space program, should jointly examine the US intelligence and draft a report on Russian transfers to Iran. This report reached a very different conclusion from President Yeltsin and concluded that Russia had provided such aid to Iran. Further, on October 1, 1997 — roughly a week after Yeltsin issued his denial — the Russian security service issued a statement that it had "thwarted" an Iranian attempt to have parts for liquid fuel rocket motors manufactured in Russia, disguised as gas compressors and pumps.

- Russian firms said to be helping Iran included the Russian Central Aerohydrodynamic Institute which developed a special wind tunnel; Rosvoorouzhenie, a major Russian arms-export agency; Kutznetzov (formerly NPO Trud) a rocket motor manufacturer in Samara; a leading research center called the Bauman National Technical University in Moscow, involved in developing rocket propulsion systems; the Tsagi Research Institute for rocket propulsion development; and the Polyus (Northstar) Research Institute in Moscow, a major laser test and manufacturing equipment firm. Iranians were also found to be studying rocket engineering at the Baltic State University in St. Petersburg and the Bauman State University.

- Russia was also found to have sold Iran high strength steel and special foil for its long-range missile program. The Russian Scientific and Production Center Inor concluded an agreement as late as September 1997 to sell Iran a factory to produce four special metal alloys used in long-range missiles. Inor's director, L. P Chromova worked out a deal with A. Asgharzadeh, the director of an Iranian factory, to sell 620 kilograms of special alloy called 21HKMT, and provide Iran with the capability to thermally treat the alloy for missile bodies. Iran had previously bought 240 kilograms of the alloy. Inor was also selling alloy foils called 49K2F, CUBE2, and 50N in sheets 0.2-0.4 millimeters thick for the outer body of missiles. The alloy 21HKMT was particularly interesting because North Korea also uses it in missile designs. Inor had previously brokered deals with the Shahid Hemat Industrial Group in Iran to supply maraging steel for missile cases, composite graphite-tungsten material, laser equipment, and special mirrors used in missile tests.

- The result was a new and often tense set of conversations between the US and Russia in January 1998. The US again sent Ambassador Frank Wisner to Moscow, Vice President Gore called Prime Minster Viktor Chernomyrdin and Secretary of State Madeline Albright made an indirect threat that the Congress might apply sanctions. Sergi Yastrzhembsky, a Kremlin spokesman, initially responded by denying that any transfer of technology had taken place.

- This Russian denial was too categorical to have much credibility. Russia had previously announced the arrest of an Iranian diplomat on November 14, 1997, that it caught attempting to buy missile technology. The Iranian was seeking to buy blueprints and recruit Russian scientists to go to Iran. Yuri Koptev, the head of the Russian Space Agency, explained this, however, by stating that that, "There have been several cases where some Russian organizations, desperately struggling to make ends meet and lacking responsibility, have embarked on some ambiguous projects...they were stopped long before they got to the point where any technology got out."

- The end result of these talks was an agreement by Gore and Chernomyrdin to strengthen controls over transfer technology, but it was scarcely clear that it put an end to the problem.

- Prime Minister Chernomyrdin again promised to strengthen his efforts to restrict technology transfer to Iran in a meeting with Gore on March 12, 1998. The US informed Russia of 13 cases of possible Russian aid to Iran at the meeting and offered to increase the number of Russian commercial satellite launches it would license for US firms as an incentive.

- New arrests of smugglers took place on April 9, 1998. The smugglers had attempted to ship 22 tons of specialized steel to Iran via Azerbaijan, using several Russia shell corporations as a cover.
- On April 16, 1998, the State Department declared 20 Russian agencies and research facilities were ineligible to receive US aid because of their role in transferring missile technology to Iran.

- A US examination of Iran's dispersal, sheltering, and hardening programs for its anti-ship missiles and other missile systems indicate that Iran has developed effective programs to ensure that they would survive a limited number of air strikes and that Iran had reason to believe that the limited number of preemptive strikes Israel could conduct against targets in the lower Gulf could not be effective in denying Iran the capability to deploy its missiles.
- Iran has shorter missile range systems:
    - In 1990, Iran bought CSS-8 surface-to-surface missiles (converted SA-2s) from China with ranges of 130-150 kilometers.
    - Has Chinese sea and land-based anti-ship cruise missiles. Iran fired 10 such missiles at Kuwait during Iran-Iraq War, hitting one US-flagged tanker.
- Iran has acquired much of the technology necessary build long-range cruise missile systems from China:
    - Such missiles would cost only 10% to 25% as much as ballistic missiles of similar range, and both the HY-2 Seersucker and CS-802 could be modified relatively quickly for land attacks against area targets.
    - Iran reported in December, 1995 that it had already fired a domestically built anti-ship missile called the Saeqe-4 (Thunderbolt) during exercises in the Strait of Hormuz and Gulf of Oman Other reports indicate that China is helping Iran build copies of the Chinese CS-801/CS-802 and the Chinese FL-2 or F-7 anti-ship cruise missiles. These missiles have relatively limited range. The range of the CS-801 is 8-40 kilometers, the range of the CS-802 is 15-120 kilometers, the maximum range of the F-7 is 30 kilometers, and the maximum range of the FL-10 is 50 kilometers. Even a range of 120 kilometers would barely cover targets in the Southern Gulf from launch points on Iran's Gulf coast. These missiles also have relatively small high explosive warheads. As a result, Iran may well be seeking anti-ship capabilities, rather than platforms for delivering weapons of mass destruction.
    - A platform like the CS-802 might, however, provide enough design data to develop a scaled-up, longer-range cruise missile for other purposes, and the Gulf is a relatively small area where most urban areas and critical facilities are near the coast. Aircraft or ships could launch cruise missiles with chemical or biological warheads from outside the normal defense perimeter of the Southern Gulf states, and it is at least possible that Iran might modify anti-ship missiles with chemical weapons to attack tankers — ships which are too large for most regular anti-ship missiles to be highly lethal.
    - Building an entire cruise missile would be more difficult. The technology for fusing CBW and cluster warheads would be within Iran's grasp. Navigation systems and jet engines, however, would still be a major potential problem. Current inertial navigation systems (INS) would introduce errors of at least several kilometers at ranges of 1,000 kilometers and would carry a severe risk of total guidance failure — probably exceeding two-thirds of the missiles fired. A differential global positioning system (GPS) integrated with the inertial navigation system (INS) and a radar altimeter, however, might produce an accuracy of 15 meters. Some existing remotely piloted vehicles (RPVs), such as the South African Skua claim such performance. Commercial technology is becoming available for differential global positioning system (GPS) guidance with accuracies of 2 to 5 meters.
    - There are commercially available reciprocating and gas turbine engines that Iran could adapt for use in a cruise missile, although finding a reliable and efficient turbofan engine for a specific design application might be difficult. An extremely efficient engine would have to be matched to a specific airframe. It is doubtful that Iran could design and build such an engine, but there are over 20 other countries with the necessary design and manufacturing skills.
    - While airframe-engine-warhead integration and testing would present a challenge and might be beyond Iran's manufacturing skills, it is inherently easier to integrate and test a cruise missile than a long-range ballistic missile. Further, such developments would be far less detectable than developing a ballistic system if the program used coded or low altitude directional telemetry.

- Iran could bypass much of the problems inherent in developing its own cruise missile by modifying the HY-2 Seersucker for use as a land attack weapon and extending its range beyond 80 kilometers, or by modifying and improving the CS-801 (Ying Jai-1) anti-ship missile. There are reports that the Revolutionary Guards are working on such developments at a facility near Bandar Abbas.
- China has delivered approximately 150 of 400 C-802 missiles ordered by Iran.[75]
- A number of reports claim that Chinese companies have provided extensive technical assistance to Iranian cruise missile efforts, in engineering, production assistance, critical materials and equipment upgrades.

- Su-24 long-range strike fighters with range-payloads roughly equivalent to US F-111 and superior to older Soviet medium bombers.
- F-4D/E fighter-bombers with capability to carry extensive payloads to ranges of 450 miles.
- Can modify HY-2 Silkworm missiles and SA-2 surface-to-air missiles to deliver weapons of mass destruction.
- Iran has made several indigenous-long range rockets.
  - The Iran-130, or Nazeat, since the end of the Iran-Iraq War. The full details of this system remain unclear, but it seems to use commercially available components, a solid fuel rocket, and a simple inertial guidance system to reach ranges of about 90-120 kilometers. It is 355 mm in diameter, 5.9 meters long, weighs 950 kilograms, and has a 150 kilogram warhead. It seems to have poor reliability and accuracy, and its payload only seems to be several hundred kilograms.
  - The Shahin 2. It too has a 355 mm diameter, but is only 3.87 meters long, and weighs only 580 kilograms. It evidently can be equipped with three types of warheads: A 180 kilogram high explosive warhead, another warhead using high explosive submunitions, and a warhead that uses chemical weapons.
  - Iranian Oghab (Eagle) rocket with 40+ kilometers range.
  - New SSM with 125 mile range may be in production, but could be modified FROG.
- Large numbers of multiple rocket launchers and tube artillery for short range delivery of chemical weapons.
- The CIA reported in January 1999 that entities in Russia and China continue to supply missile-related goods and technology to Iran. Tehran is using these goods and technologies to achieve its goal of becoming self-sufficient in the production of MRBMs. The July flight test of the Shahab-3 MRBM demonstrates the success Iran has achieved in realizing that goal. Iran already is producing Scud SRBMs with North Korean help and has begun production of the Shahab-3. In addition, Iran's Defense Minister has publicly acknowledged the development of the Shahab-4 ballistic missile, with a "longer range and heavier payload than the 1,300-km Shahab-3."
- Iran's earlier success in gaining technology and materials from Russian companies accelerated Iranian development of the Shahab-3 MRBM, which was first flight tested in July 1998.
- The CIA report on missile proliferation in September 1999 estimated that Iran is the next hostile country most capable of testing an ICBM capable of delivering a weapon to the United States during the next 15 years.
  - Iran *could test* an ICBM that could deliver a several-hundred kilogram payload to many parts of the United States in the between 2005 and 2010, using Russian technology and assistance.
  - Iran *could pursue* a Taepo Dong-type ICBM. Most analysts believe it could test a three-stage ICBM patterned after the Taepo Dong-1 SLV or a three-stage Taepo Dong-2-type ICBM, possibly with North Korean assistance, in the next few years.
  - Iran is *likely to test* an SLV by 2010 that—once developed—could be converted into an ICBM capable of delivering a several-hundred kilogram payload to the United States.
- Analysts differ on the likely timing of Iran's first flight test of an ICBM that could threaten the United States. Assessments include:
  - *likely* before 2010 and *very likely* before 2015 (noting that an SLV with ICBM capabilities will *probably be tested within the next few years)*;

- no more than an *even chance* by 2010 and a *better than even chance* by 2015;
- and less than an even chance by 2015.

- The CIA reported in November 20003 that, "Ballistic missile-related cooperation from entities in the former Soviet Union, North Korea, and China over the years has helped Iran move toward its goal of becoming self-sufficient in the production of ballistic missiles. Such assistance during the first half of 2003 continued to include equipment, technology, and expertise. Iran's ballistic missile inventory is among the largest in the Middle East and includes some 1,300-km-range Shahab-3 medium-range ballistic missiles (MRBMs) and a few hundred short-range ballistic missiles (SRBMs)—including the Shahab-1 (Scud-B), Shahab-2 (Scud C), and Tondar-69 (CSS-8)—as well as a variety of large unguided rockets. Already producing Scud SRBMs, Iran announced that it had begun production of the Shahab-3 MRBM and a new solid-propellant SRBM, the Fateh-110. In addition, Iran publicly acknowledged the development of follow-on versions of the Shahab-3. It originally said that another version, the Shahab-4, was a more capable ballistic missile than its predecessor but later characterized it as solely a space launch vehicle with no military applications. Iran is also pursuing longer-range ballistic missiles."

- The Center for Nonproliferation Studies at the Monterey Institute of International Studies has compiled a chronology of North Korean assistance to Iran through 2003[76]:

Date	Item(s)	Remarks
1980s	About 100 Scud missile launchers	
Late 1984-Early 1985	Technical assistance for Scud-B production facility	In October 1983 Iran and North Korea reach agreement for assistance in setting up missile production capability.
1987-88	100 modified Scud-B missiles and 12 TELs	
1987	Technical assistance for modified Scud-B production	
1987-88	Unknown number of HY-2 Silkworm anti-ship missiles	Agreement signed in 1986; some believe that the missiles were supplied by China, but Beijing insists Pyongyang was supplier.
1987-92	200-300 Scud-B missiles	
1988 Early	40 Scud-B missiles	Probably part of the 100 Scuds reportedly shipped in 1987-1988.
1988 January	four Styx anti-ship missiles and at least one HY-2 Silkworm anti-ship missile	
1988 February	80 HY-2 Silkworm anti ship missiles and 40 Scud-B missiles	Report says missiles came from both China and North Korea.
1990 Early	20 Scud-B missiles	
1990 December	Missile technicians	North Korean technicians arrive in eastern Iran to convert a missile maintenance facility into a missile production plant.
1991	170 Scud-C missiles	Uncertain; Iran probably had not received all 170

		missiles by 1991 because, according to estimates, North Korea would not have been able to produce 170 Scud-C missiles by this time.
1992 March	Unknown; suspected Scud-B missiles	US officials suspect Iranian ship with Scud missiles travels from Singapore to the Iranian port of Char Bahar.
1992 Second Half	A few No Dong-1 prototypes	
1992 October	100 Scud-C missiles	Half of the Scud-C shipment possibly transferred to Syria.
1993	Unknown number of Scud-C missiles	Possibly the same shipment of 100 Scud-Cs reported in late October 1992.
1994 Mid to Late	No Dong-1 components or a small number of complete missiles	In April 1993 North Korea reportedly agreed to sell 150 No Dongs to Iran in exchange for access to test facilities and financial support.
Late 1994-Early 1995	At least four Scud-C TELs and possibly a No Dong MEL	
1995 Early	At least 12 No Dong missiles	Based on an Israeli intelligence report; in April 1996, *Jane's Defense Weekly* reports that North Korea may have exported as many as 20 No Dongs.
1997	Unknown missile components	
1997 Early	Computer software for No Dong production	
1999 November	12-20 No Dong engines	
2001 March	Engines and airframes; unspecified number of missile components	US reconnaissance satellite detects missile components being loaded onto an Iranian Il-76 transport plane at Sunan International Airport near Pyongyang.

Chemical Weapons

- Iran purchased large amounts of chemical defense gear from the mid-1980s onwards. Iran also obtained stocks of non-lethal CS gas, although it quickly found such agents had very limited military impact since they could only be used effectively in closed areas or very small open areas.
- Acquiring poisonous chemical agents was more difficult. Iran did not have any internal capacity to manufacture poisonous chemical agents when Iraq first launched its attacks with such weapons. While Iran seems to have made limited use of chemical mortar and artillery rounds as early as 1985 — and possibly as early as 1984 — these rounds were almost certainly captured from Iraq.
- Iran had to covertly import the necessary equipment and supplies, and it took several years to get substantial amounts of production equipment, and the necessary feedstocks. Iran sought aid from European firms like Lurgi to produce large "pesticide" plants, and began to try to obtain the needed feedstock from a wide range of sources, relying heavily on its Embassy in Bonn to manage the necessary deals. While Lurgi did not provide the pesticide plant Iran sought, Iran did obtain substantial support from other European firms and feedstocks from many other Western sources.

- By 1986-1987, Iran developed the capability to produce enough lethal agents to load its own weapons. The Director of the CIA, and informed observers in the Gulf, made it clear that Iran could produce blood agents like hydrogen cyanide, phosgene gas, and/or chlorine gas. Iran was also able to weaponize limited quantities of blister (sulfur mustard) and blood (cyanide) agents beginning in 1987, and had some capability to weaponize phosgene gas, and/or chlorine gas. These chemical agents were produced in small batches, and evidently under laboratory scale conditions, which enabled Iran to load small numbers of weapons before any of its new major production plants went into full operation.
- These gas agents were loaded into bombs and artillery shells, and were used sporadically against Iraq in 1987 and 1988.
- Reports regarding Iran's production and research facilities are highly uncertain:
  - Iran seems to have completed completion of a major poison gas plant at Qazvin, about 150 kilometers west of Tehran. This plant is reported to have been completed between November 1987 and January 1988. While supposedly a pesticide plant, the facility's true purpose seems to have been poison gas production using organophosphorous compounds
  - It is impossible to trace all the sources of the major components and technology Iran used in its chemical weapons program during this period. Mujahideen sources claim Iran also set up a chemical bomb and warhead plant operated by the Zakaria Al-Razi chemical company near Mahshar in southern Iran, but it is unclear whether these reports are true.
  - Reports that Iran had chemical weapons plants at Damghan and Parchin that began operation as early as March, 1988, and may have begun to test fire Scuds with chemical warheads as early as 1988-1989, are equally uncertain.
  - Iran established at least one large research and development center under the control of the Engineering Research Centre of the Construction Crusade (Jahad e-Sazandegi), had established a significant chemical weapons production capability by mid-1989,
- Debates took place in the Iranian parliament or Majlis in late 1988 over the safety of Pasdaran gas plants located near Iranian towns, and that Rafsanjani described chemical weapons as follows: "Chemical and biological weapons are poor man's atomic bombs and can easily be produced. We should at least consider them for our defense. Although the use of such weapons is inhuman, the war taught us that international laws are only scraps of paper."
- Post Iran-Iraq War estimates of Iran chemical weapons production are extremely uncertain:
  - US experts believe Iran was beginning to produce significant mustard gas and nerve gas by the time of the August, 1988 cease-fire in the Iran-Iraq War, although its use of chemical weapons remained limited and had little impact on the fighting.
  - Iran's efforts to equip plants to produce V-agent nerve gases seem to have been delayed by US, British, and German efforts to limit technology transfers to Iran, but Iran may have acquired the capability to produce persistent nerve gas during the mid 1990s.
  - Production of nerve gas weapons started no later than 1994.
  - Began to stockpile of cyanide (cyanogen chloride), phosgene, and mustard gas weapons after 1985. Recent CIA testimony indicates that production capacity may approach 1,000 tons annually.
- On August 2, 2002, the NSC's Director for the Near East indicated that Iran is producing and stockpiling blister, blood and choking agents.
- The Defense Department's 2001 Report "Proliferation: Threat and Response" suggests that Iran, in addition to producing and stockpiling blister, blood and choking agents, has weaponized these agents for use with artillery shells, mortars, rockets and bombs. The report also states that Iran is continuing its research into nerve agents.
- Weapons include bombs and artillery. Shells include 155 mm artillery and mortar rounds. Iran also has chemical bombs and mines. It may have developmental chemical warheads for its Scuds, and may have a chemical package for its 22006 RPV (doubtful).

- There are reports that Iran has deployed chemical weapons on some of its ships. Training for Iranian naval forces suggests that they are preparing for the possibility of operating in a contaminated environment.
- Iran has increased chemical defensive and offensive warfare training since 1993.
- Iran is seeking to buy more advanced chemical defense equipment, and has sought to buy specialized equipment on world market to develop indigenous capability to produce advanced feedstocks for nerve weapons.
    - CIA sources indicated in late 1996, that China might have supplied Iran with up to 400 tons of chemicals for the production of nerve gas.
    - One report indicated in 1996, that Iran obtained 400 metric tons of chemicals for use in nerve gas weapons from China — including carbon sulfide.
    - Another report indicated that China supplied Iran with roughly two tons of calcium-hypochlorate in 1996, and loaded another 40,000 barrels in January or February of 1997. Calcium-hypochlorate is used for decontamination in chemical warfare.
    - Iran placed several significant orders from China that were not delivered. Razak Industries in Tehran, and Chemical and Pharmaceutical Industries in Tabriz ordered 49 metric tons of alkyl dimethylamine, a chemical used in making detergents, and 17 tons of sodium sulfide, a chemical used in making mustard gas. The orders were never delivered, but they were brokered by Iran's International Movalled Industries Corporation (Imaco) and China's North Chemical Industries Co. (Nocinco). Both brokers have been linked to other transactions affecting Iran's chemical weapons program since early 1995, and Nocinco has supplied Iran with several hundred tons of carbon disulfide, a chemical uses in nerve gas.
    - Another Chinese firm, only publicly identified as Q. Chen, seems to have supplied glass vessels for chemical weapons.
    - The US imposed sanctions on seven Chinese firms in May 1997, for selling precursors for nerve gas and equipment for making nerve gas — although the US made it clear that it had, "no evidence that the Chinese government was involved." The Chinese firms were the Nanjing Chemical Industries Group and Jiangsu Yongli Chemical Engineering and Import/Export Corporation. Cheong Yee Ltd., a Hong Kong firm, was also involved. The precursors included thionyl chloride, dimethylamine, and ethylene chlorohydril. The equipment included special glass lined vessels, and Nanjing Chemical and Industrial Group completed construction of a production plant to manufacture such vessels in Iran in June 1997.
    - Iran sought to obtain impregnated alumina, which is used to make phosphorous oxychloride — a major component of VX and GB — from the US.
    - It has obtained some equipment from Israelis. Nahum Manbar, an Israeli national living in France, was convicted in an Israeli court in May 1997 for providing Iran with $16 million worth of production equipment for mustard and nerve gas during the period from 1990 to 1995.
    - CIA reported in June 1997 that Iran had obtained new chemical weapons equipment technology from China and India in 1996.
    - India is assisting in the construction of a major new plant at Qazvim, near Tehran, to manufacture phosphorous pentasulfide, a major precursor for nerve gas. The plant is fronted by Meli Agrochemicals, and the program was negotiated by Dr. Mejid Tehrani Abbaspour, a chief security advisor to Rafsanjani.
    - A recent report by German intelligence indicates that Iran has made major efforts to acquire the equipment necessary to produce Sarin and Tabun, using the same cover of purchasing equipment for pesticide plants that Iraq used for its Sa'ad 16 plant in the 1980s. German sources note that three Indian companies — Tata Consulting Engineering, Transpek, and Rallis India — have approached German pharmaceutical and engineering concerns for such equipment and technology under conditions where German intelligence was able to trace the end user to Iran
- Iran ratified the Chemical Weapons Convention in June 1997.
    - It submitted a statement in Farsi to the CWC secretariat in 1998, but this consisted only of questions in Farsi as to the nature of the required compliance.

- It has not provided the CWC with any data on its chemical weapons program.

- The CIA estimated in January 1999 that Iran obtained material related to chemical warfare (CW) from various sources during the first half of 1998. It already has manufactured and stockpiled chemical weapons, including blister, blood, and choking agents and the bombs and artillery shells for delivering them. However, Tehran is seeking foreign equipment and expertise to create a more advanced and self-sufficient CW infrastructure.

- The CIA stated that Chinese entities sought to supply Iran with CW-related chemicals during 1997-1998 period. The US sanctions imposed in May 1997 on seven Chinese entities for knowingly and materially contributing to Iran's CW program remain in effect.

- There exists a large number of sites in Iran that are alleged to be related to Iran's chemical warfare effort[77]:

    - Abu Musa Island: Suspected site of a large number of chemical weapons, principally 155mm artillery shells, in addition to some weaponized biological agents.

    - Bandar Khomeni: Allegedly the location of a chemical weapons facility, run by the Razi chemical corporation, established during the Iran-Iraq war to manufacture chemical weapons.

    - Damghan: Either a chemical weapons plant or warhead assembly facility. Primarily involved in 155mm artillery shells and Scudwarheads.

    - Isfahan: Suspected location of a chemical weapons facility, possibly operated by the Poly-Acryl Corporation.

    - Karaj: Located about 14km of Tehran, this is the site of an alleged storage and manufacturing facility for chemical weapons. Reports suggest that this facility was built with Chinese assistance.

    - Marvdasht: The Chemical Fertilizers Company is suspected to have been a manufacturing facility for mustard agents during the Iran-Iraq War.

    - Parchin: The location of at least one munitions factory and is suspected of being a major chemical weapons production facility. Reports of uncertain reliability indicate that the plant was in operation no later than March 1988. In April 1997, a German newspaper reported that, according to the German Federal Intelligence Service, the factories at Parchin were producing primary products for chemical warfare agents.

    - Qazvin: A large pesticide plant at this location is widely believed to produce nerve gas.

    - Mashar: Iranian opposition groups have made allegations, of uncertain reliability, that a warhead filling facility is operated at this location.

- A number of reports indicate that China has provided Iran with the ability to manufacture chemical weapons indigenously as well as providing precursors since at least 1996.[78]

- The CIA reported in November 2003 that, "Iran is a party to the Chemical Weapons Convention (CWC). Nevertheless, during the reporting period it continued to seek production technology, training, and expertise from Chinese entities that could further Tehran's efforts to achieve an indigenous capability to produce nerve agents. Iran likely has already stockpiled blister, blood, choking, and probably nerve agents—and the bombs and artillery shells to deliver them—which it previously had manufactured."

Biological Weapons

- Extensive laboratory and research capability.

- Weapons effort documented as early as 1982. Reports surfaced that Iran had imported suitable type cultures from Europe and was working on the production of mycotoxins — a relatively simple family of biological agents that require only limited laboratory facilities for small-scale production.

- US intelligence sources reported in August 1989, that Iran was trying to buy two new strains of fungus from Canada and the Netherlands that can be used to produce Mycotoxins. German sources indicated that Iran had successfully purchased such cultures several years earlier.

- The Imam Reza Medical Center at Mashhad Medical Sciences University and the Iranian Research Organization for Science and Technology were identified as the end users for this purchasing effort, but it is likely that the true end user was an Iranian government agency specializing in biological warfare.
- Many experts believe that the Iranian biological weapons effort was placed under the control of the Islamic Revolutionary Guards Corps, which is known to have tried to purchase suitable production equipment for such weapons.
- Since the Iran-Iraq War, Iran has conducted research on more lethal active agents like Anthrax, hoof and mouth disease, and biotoxins. In addition, Iranian groups have repeatedly approached various European firms for the equipment and technology necessary to work with these diseases and toxins.
    - Unclassified sources of uncertain reliability have identified a facility at Damghan as working on both biological and chemical weapons research and production, and believe that Iran may be producing biological weapons at a pesticide facility near Tehran.
    - Some universities and research centers may be linked to biological weapons program.
    - Reports surfaced in the spring of 1993 that Iran had succeeded in obtaining advanced biological weapons technology in Switzerland and containment equipment and technology from Germany. According to these reports, this led to serious damage to computer facilities in a Swiss biological research facility by unidentified agents. Similar reports indicated that agents had destroyed German bio-containment equipment destined for Iran.
    - More credible reports by US experts indicate that Iran has begun to stockpile anthrax and Botulinum in a facility near Tabriz, can now mass manufacture such agents, and has them in an aerosol form. None of these reports, however, can be verified.
    - The CIA has reported that Iran has, "sought dual-use biotech equipment from Europe and Asia, ostensibly for civilian use." It also reported in 1996 that Iran might be ready to deploy biological weapons. Beyond this point, little unclassified information exists regarding the details of Iran's effort to "weaponize" and produce biological weapons.
- Iran may have the production technology to make dry storable and aerosol weapons. This would allow it to develop suitable missile warheads and bombs and covert devices.
- Iran may have begun active weapons production in 1996, but probably only at limited scale suitable for advanced testing and development.
- CIA testimony indicates that Iran is believed to have weaponized both live agents and toxins for artillery and bombs and may be pursuing biological warheads for its missiles. The CIA reported in 1996 that, "We believe that Iran holds some stocks of biological agents and weapons. Tehran probably has investigated both toxins and live organisms as biological warfare agents. Iran has the technical infrastructure to support a significant biological weapons program with little foreign assistance."
- CIA reported in June 1997 that Iran had obtained new dual use technology from China and India during 1996.
- Iran announced in June 1997 that it would not produce or employ chemical weapons including toxins.
- The CIA estimated in January 1999 that Iran continued to pursue purchasing dual-use biotechnical equipment from Russia and other countries, ostensibly for civilian uses. Its biological warfare (BW) program began during the Iran-Iraq war, and Iran may have some limited capability for BW deployment. Outside assistance is both important and difficult to prevent, given the dual-use nature of the materials and equipment being sought and the many legitimate end uses for these items.
- The CIA reported in November 2003 that, "Even though Iran is part of the Biological Weapons Convention (BWC), Tehran probably maintained an offensive BW program. Iran continued to seek dual-use biotechnical materials, equipment, and expertise. While such materials had legitimate uses, Iran's biological warfare (BW) program also could have benefited from them. It is likely that Iran has capabilities to produce small quantities of BW agents, but has a limited ability to weaponize them."

- Russia remains a key source of biotechnology for Iran. Russia's world-leading expertise in biological weapons makes it an attractive target for Iranians seeking technical information and training on BW agent production processes.

Nuclear Weapons

- The Shah established the Atomic Energy Organization of Iran in 1974, and rapidly began to negotiate for nuclear power plants.
  - He concluded an extendible ten-year nuclear fuel contract with the US in 1974, with Germany in 1976, and France in 1977.
  - In 1975, he purchased a 10% share in a Eurodif uranium enrichment plant being built at Tricastin in France that was part of a French, Belgian, Spanish, and Italian consortium. Under the agreement the Shah signed, Iran was to have full access to the enrichment technology Eurodif developed, and agreed to buy a quota of enriched uranium from the new plant.
  - He created an ambitious plan calling for a network of 23 power reactors throughout Iran that was to be operating by the mid-1990s, and sought to buy nuclear power plants from Germany and France.
  - By the time the Shah fell in January 1979, he had six reactors under contract, and was attempting to purchase a total of 12 nuclear power plants from Germany, France, and the US. Two 1,300 megawatt German nuclear power plants at Bushehr were already 60% and 75% completed, and site preparation work had begun on the first of two 935 megawatt French plants at Darkhouin that were to be supplied by Framatome.
  - The Shah also started a nuclear weapons program in the early to mid-1970s, building upon his major reactor projects, investment in URENCO, and smuggling of nuclear enrichment and weapons related technology from US and Europe.
    - 5 megawatt light-water research reactor operating in Tehran.
    - 27 kilowatt neutron-source reactor operating in Isfahan.
    - Started two massive 1300 megawatt reactor complexes.
    - The Shah attempted to covertly import controlled technology from the US.
  - US experts believe that Shah began a low-level nuclear weapons research program, centered at the Amirabad Nuclear Research Center. This research effort included studies of weapons designs and plutonium recovery from spent reactor fuel.
    - It also involved a laser enrichment program which began in 1975, and led to a complex and highly illegal effort to obtain laser separation technology from the US. This latter effort, which does not seems to have had any success, continued from 1976 until the Shah's fall, and four lasers operating in the critical 16 micron band were shipped to Iran in October, 1978.
    - At the same time, Iran worked on other ways to obtain plutonium, created a secret reprocessing research effort to use enriched uranium, and set up a small nuclear weapons design team.
    - In 1976, Iran signed a secret contract to buy $700 million worth of yellowcake from South Africa, and appears to have reached an agreement to buy up to 1,000 metric tons a year. It is unclear how much of this ore South Africa shipped before it agreed to adopt IAEA export restrictions in 1984, and whether South Africa really honored such export restrictions. Some sources indicate that South Africa still made major deliveries as late as 1988-1989.
    - Iran also tried to purchase 26.2 kilograms of highly enriched uranium; the application to the US for this purchase was pending when the Shah fell
    - The Shah did eventually accept full IAEA safeguards but their value is uncertain.
  - In 1984, Khomeini revived nuclear weapons program begun under Shah.
    - Received significant West German and Argentine corporate support in some aspects of nuclear technology during the Iran-Iraq War.

- Limited transfers of centrifuge and other weapons-related technology from PRC, possibly Pakistan.
- It has a Chinese-supplied heavy-water, zero-power research reactor at Isfahan Nuclear Research Center, and two-Chinese supplied sub-critical assemblies — a light water and graphite design.
- It has stockpiles of uranium and mines in the Yazd area. It may have had a uranium-ore concentration facility at University of Tehran, but status unclear.
- Some experts suspect that the IRGC moved experts and equipment from the Amirabad Nuclear Research Center to a new nuclear weapons research facility near Isfahan in the mid-1980s, and formed a new nuclear research center at the University of Isfahan in 1984 — with French assistance. Unlike many Iranian facilities, the center at Isfahan was not declared to the IAEA until February 1992, when the IAEA was allowed to make a cursory inspection of six sites that various reports had claimed were the location of Iran's nuclear weapons efforts.
- Bushehr I & II, on the Gulf Coast just southwest of Isfahan, were partially completed at the time of the Shah's fall. Iran attempted to revive the program and sought German and Argentine support, but the reactors were damaged by Iraqi air strikes in 1987 and 1988.
- Iran may also have opened a new uranium ore processing plant close to its Shagand uranium mine in March 1990, and it seems to have extended its search for uranium ore into three additional areas. Iran may have also begun to exploit stocks of yellowcake that the Shah had obtained from South Africa in the late 1970s while obtaining uranium dioxide from Argentina by purchasing it through Algeria.
- Iran began to show a renewed interest in laser isotope separation (LIS) in the mid-1980s, and held a conference on LIS in September 1987.
- Iran opened a new nuclear research center in Isfahan in 1984, located about four kilometers outside the city and between the villages of Shahrida and Fulashans. This facility was built at a scale far beyond the needs of peaceful research, and Iran sought French and Pakistani help for a new research reactor for this center.
- The Khomeini government may also have obtained several thousand pounds of uranium dioxide from Argentina by purchasing it through Algeria. Uranium dioxide is considerably more refined than yellowcake, and is easier to use in irradiating material in a reactor to produce plutonium.

- The status of Iran's nuclear program since the Iran-Iraq War is highly controversial, and Iran has denied the existence of such a program.
  - On February 7, 1990, the speaker of the Majlis publicly toured the Atomic Energy Organization of Iran and opened the new Jabir Ibn al Hayyan laboratory to train Iranian nuclear technicians. Reports then surfaced that Iran had at least 200 scientists and a work force of about 2,000 devoted to nuclear research
  - Iran's Deputy President Ayatollah Mohajerani stated in October 1991, that Iran should work with other Islamic states to create an "Islamic bomb."
  - The Iranian government has repeatedly made proposals to create a nuclear-free zone in the Middle East. For example, President Rafsanjani was asked if Iran had a nuclear weapons program in an interview in the CBS program *60 Minutes* in February 1997. He replied, "Definitely not. I hate this weapon."
  - Other senior Iranian leaders, including President Khatami have made similar categorical denials. Iran's Foreign Minister, Kamal Kharrazi, stated on October 5, 1997, that, "We are certainly not developing an atomic bomb, because we do not believe in nuclear weapons... We believe in and promote the idea of the Middle East as a region free of nuclear weapons and other weapons of mass destruction. But why are we interested to develop nuclear technology? We need to diversify our energy sources. In a matter of a few decades, our oil and gas reserves would be finished and therefore, we need access to other sources of energy...Furthermore, nuclear technology has many other utilities in medicine and agriculture. The case of the United States in terms of oil reserve is not different from Iran's. The United States also has large oil resources, but at the same time they have nuclear power plants. So there is nothing wrong with having access to nuclear technology if it is for peaceful purposes..."
- The IAEA reports that Iran has fully complied with its present requirements, and that it has found no indications of nuclear weapons effort, but IAEA only inspects Iran's small research reactors.

- The IAEA visits to other Iranian sites are not inspections, and do not use instruments, cameras, seals, etc. These are informal walk-throughs.
- The IAEA visited five suspect Iranian facilities in 1992 and 1993 in this manner, but did not conduct full inspections.
- Iran has not had any 93+2 inspections and its position on improved inspections is that it will not be either the first or the last to have them.
- Iranian officials have repeatedly complained that the West tolerated Iraqi use of chemical weapons and its nuclear and biological build-up during the Iran-Iraq War, and has a dual standard where it does not demand inspections of Israel or that Israel sign the NPT.
- The IAEA has inspected the uranium enrichment facility at Natanz, although it is unclear what kind of future inspection regime will be put in place.
- Despite agreeing to discuss concluding an Additional Protocol for inspections with the IAEA, during a March 13, 2003 interview with *Le Monde*, the Iranian Vice President Gholamreza Aghazadeh indicated that Iran would not sign such a protocol unless the United States lifted economic sanctions.

- These are reasons to assume that Iran still has a nuclear program:
    - Iran attempted to buy highly enriched fissile material from Kazakhstan. The US paid between $20 million and $30 million to buy 1,300 pounds of highly enriched uranium from the Ust-Kamenogorsk facility in Kazakhstan that Iran may have sought to acquire in 1992. A total of 120 pounds of the material — enough for two bombs — cannot be fully accounted for.
    - Iran has imported maraging steel, sometimes used for centrifuges, by smuggling it in through dummy fronts. Britain intercepted a 110-pound (50 kilogram) shipment in August 1996. Seems to have centrifuge research program at Sharif University of Technology in Tehran. IAEA "visit" did not confirm.
    - Those aspects of Iran's program that are visible indicate that Iran has had only uncertain success. Argentina agreed to train Iranian technicians at its Jose Balaseiro Nuclear Institute, and sold Iran $5.5 million worth of uranium for its small Amirabad Nuclear Research Center reactor in May 1987. A CENA team visited Iran in late 1987 and early 1988, and seems to have discussed selling sell Iran the technology necessary to operate its reactor with 20% enriched uranium as a substitute for the highly enriched core provided by the US, and possibly uranium enrichment and plutonium reprocessing technology as well. Changes in Argentina's government, however, made it much less willing to support proliferation. The Argentine government announced in February 1992, that it was canceling an $18 million nuclear technology sale to Iran because it had not signed a nuclear safeguards arrangement. Argentine press sources suggested, however, that Argentina was reacting to US pressure.
    - In February 1990 a Spanish paper reported that Associated Enterprises of Spain was negotiating the completion of the two nuclear power plants at Bushehr. Another Spanish firm called ENUSA (National Uranium Enterprises) was to provide the fuel, and Kraftwerke Union (KWU) would be involved. Later reports indicated that a 10 man delegation from Iran's Ministry of Industry was in Madrid negotiating with the Director of Associated Enterprises, Adolofo Garcia Rodriguez.
    - Iran negotiated with Kraftwerke Union and CENA of Germany in the late 1980s and early 1990s. Iran attempted to import reactor parts from Siemens in Germany and Skoda in Czechoslovakia. None of these efforts solved Iran's problems in rebuilding its reactor program, but all demonstrate the depth of its interest.
    - Iran took other measures to strengthen its nuclear program during the early 1990s. It installed a cyclotron from Ion Beam Applications in Belgium at a facility in Karzaj in 1991.
    - Iran conducted experiments in uranium enrichment and centrifuge technology at its Sharif University of Technology in Tehran. Sharif University was also linked to efforts to import cylinders of fluorine suitable for processing enriched material, and attempts to import specialized magnets that can be used for centrifuges, from Thyssen in Germany in 1991.

  - In 1992, Iran attempted to buy beryllium from a storage site in Kazakhstan that also was storing 600 kilograms of highly enriched uranium. These contacts then seem to have expanded to an attempt to try the material. In 1994, they helped lead the US to buy the enriched material and fly it out of the country.
  - It is clear from Iran's imports that it has sought centrifuge technology ever since. Although many of Iran's efforts have never been made public, British customs officials seized 110 pounds of maraging steel being shipped to Iran in July 1996.
  - Iran seems to have conducted research into plutonium separation and the Iranians published research on uses of tritium that had applications to nuclear weapons boosting. Iran also obtained a wide range of US and other nuclear literature with applications for weapons designs. Italian inspectors seized eight steam condensers bound for Iran that could be used in a covert reactor program in 1993, and high technology ultrasound equipment suitable for reactor testing at the port of Bari in January 1994.
  - Other aspects of Iran's nuclear research effort had potential weapons applications. Iran continued to operate an Argentine-fueled five megawatt light water highly enriched uranium reactor at the University of Tehran. It is operated by a Chinese-supplied neutron source research reactor, and subcritical assemblies with 900 grams of highly enriched uranium, at its Isfahan Nuclear Research Center. This Center has experimented with a heavy water zero-power reactor, a light water sub-critical reactor, and a graphite sub-critical reactor. In addition, it may have experimented with some aspects of nuclear weapons design.
- The German Ministry of Economics has circulated a wide list of such Iranian fronts which are known to have imported or attempted to import controlled items. These fronts include the:
  - Bonyad e-Mostazafan;
  - Defense Industries Organization (Sazemane Sanaye Defa);
  - Pars Garma Company, the Sadadja Industrial Group (Sadadja Sanaye Daryaee);
  - Iran Telecommunications Industry (Sanaye Mokhaberet Iran);
  - Shahid Hemat Industrial Group, the State Purchasing Organization, Education Research Institute (ERI);
  - Iran Aircraft Manufacturing Industries (IAI);
  - Iran Fair Deal Company, Iran Group of Surveyors;
  - Iran Helicopter Support and Renewal Industries (IHI);
  - Iran Navy Technical Supply Center;
  - Iran Tehran Kohakd Daftar Nezarat, Industrial Development Group;
  - Ministry of Defense (Vezerate Defa).
- Iran claims it eventually needs to build enough nuclear reactors to provide 20% of its electric power. This Iranian nuclear power program presents serious problems in terms of proliferation. Although the reactors are scarcely ideal for irradiating material to produce Plutonium or cannibalizing the core, they do provide Iran with the technology base to make its own reactors, have involved other technology transfer helpful to Iran in proliferating and can be used to produce weapons if Iran rejects IAEA safeguards.
- Russian has agreed to build up to four reactors, beginning with a complex at Bushehr — with two 1,000-1,200 megawatt reactors and two 465 megawatt reactors, and provide significant nuclear technology.
  - Russia has consistently claimed the light water reactor designs for Bushehr cannot be used to produce weapons-grade plutonium and are similar to the reactors the US is providing to North Korea.
  - The US has claimed, however, that Victor Mikhaliov, the head of Russia's Atomic Energy Ministry, proposed the sale of a centrifuge plant in April 1995. The US also indicated that it had persuaded Russia not to sell Iran centrifuge technology as part of the reactor deal during the summit meeting between President's Clinton and Yeltsin in May 1995.
  - It was only after US pressure that Russia publicly stated that it never planned to sell centrifuge and advanced enrichment technology to Iran, and Iran denied that it had ever been interested in such

technology. For example, the statement of Mohammed Sadegh Ayatollahi, Iran's representative to the IAEA, stated that, "We've had contracts before for the Bushehr plant in which we agreed that the spent fuel would go back to the supplier. For our contract with the Russians and Chinese, it is the same." According to some reports, Russia was to reprocess the fuel at its Mayak plant near Chelyabinsk in the Urals, and could store it at an existing facility, at Krasnoyarsk-26 in southern Siberia.

- The CIA reported in June 1997 that Iran had obtained new nuclear technology from Russia during 1996.
- A nuclear accident at plant at Rasht, six miles north of Gilan, exposed about 50 people to radiation in July 1996.
- Russian Nuclear Energy Minister Yevgeny Adamov and Russian Deputy Prime Minister Vladimir Bulgak visited in March 1998 and Iran and dismissed US complaints about the risk the reactors would be used to proliferate.
  - Russia indicated that it would go ahead with selling two more reactors for construction at Bushehr within the next five years.
- The first 1,000-megawatt reactor at Bushehr has experienced serious construction delays. In March 1998, Russia and Iran agreed to turn the construction project into a turn key plant because the Iranian firms working on infrastructure had fallen well behind schedule. In February, Iran had agreed to fund improved safety systems. The reactor is reported to be on a 30- month completion cycle.
- The US persuaded the Ukraine not to sell Iran $45 million worth of turbines for its nuclear plant in early March 1998, and to strengthen its controls on Ukrainian missile technology under the MTCR.
- The CIA reported in January 1999 that Russia remained a key supplier for civilian nuclear programs in Iran and, to a lesser extent, India. With respect to Iran's nuclear infrastructure, Russian assistance would enhance Iran's ability to support a nuclear weapons development effort. Such assistance is less likely to significantly advance India's effort, given that India's nuclear weapons program is more mature. By its very nature, however, even the transfer of civilian technology may be of use in the nuclear weapons programs of these countries.
- Following intense and continuing engagement with the United States, Russian officials have taken some positive steps. Russia has committed to observe certain limits on its nuclear cooperation with Iran, such as not providing militarily useful nuclear technology.
- In January 1998, the Russian Government issued a broad decree prohibiting Russian companies from exporting items known or believed to be used for developing WMD or related delivery systems, whether or not these items are on Russia's export control list. In May 1998, Russia announced a decree intended to strengthen compliance of Russian businesses with existing export controls on proliferation-related items. These actions, if enforced, could help to counter the proliferation of WMD and their delivery systems.
- However, there are signs that Russian entities have continued to engage in behavior inconsistent with these steps. Monitoring Russian proliferation behavior, therefore, will have to remain a very high priority for some time to come.
- On January 14, 2000, Russia's Minister of Defense Igor Ivanavov met with Hassan Rowhani, the secretary of Iran's Supreme National Security Council, and promised that Russia would maintain defense cooperation, and that Russia, "intends to fulfill its obligations under the agreements made in 1989-1990."
- The same day, Vice Minister Ilya Klebanov met with Hassan Rowhani, and announced that Iran might order three additional Russian reactors.
- The CIA warned in January 2000 that Russia might have sold Iran heavy water and graphite technology.

- China is reported to have agreed to provide significant nuclear technology transfer and possible sale of two 300 megawatt pressurized water reactors in the early 1990s, but then agreed to halt nuclear assistance to Iran after pressure from the US.
  - Iran signed an agreement with China's Commission on Science, Technology, and Industry for National Defense on January 21, 1991, to build a small 27-kilowatt research reactor at Iran's nuclear weapons research facility at Isfahan. On November 4, 1991, China stated that it had signed commercial cooperation agreements

with Iran in 1989 and 1991, and that it would transfer an electromagnetic isotope separator (Calutron) and a smaller nuclear reactor, for "peaceful and commercial" purposes.

- The Chinese reactor and Calutron were small research-scale systems and had no direct value in producing fissile material. They did, however, give Iran more knowledge of reactor and enrichment technology, and US experts believe that China provided Iran with additional data on chemical separation, other enrichment technology, the design for facilities to convert uranium to uranium hexaflouride to make reactor fuel, and help in processing yellowcake.
- The US put intense pressure on China to halt such transfers. President Clinton and Chinese President Jiang Zemin reached an agreement at an October 1997 summit. China strengthened this pledge in negotiations with the US in February 1998.
- In March 1998, the US found that the China Nuclear Energy Corporation was negotiating to sell Iran several hundred tons of anhydrous hydrogen fluoride (AHF) to Isfahan Nuclear Research Corporation in central Iran, a site where some experts believe Iran is working on the development of nuclear weapons. AHF can be used to separate plutonium, help refine yellowcake into uranium hexaflouride to produce U-235, and as a feedstock for Sarin. It is on two nuclear control lists. China agreed to halt the sale.
- Iran denied that China had halted nuclear cooperation on March 15, 1998.
- Even so, the US acting Under Secretary of State for Arms Control and International Security Affairs stated that China was keeping its pledge not to aid Iran on March 26, 1998.
- The CIA reported in January 1999 that during the first half of 1998, China continued to take steps to strengthen its control over nuclear exports. China promulgated new export control regulations in June 1998 that cover the sale of dual-use nuclear equipment. This follows on the heels of the September 1997 promulgation of controls covering the export of equipment and materials associated exclusively with nuclear applications. These export controls should give the Chinese Government greater accounting and control of the transfer of equipment, materials, and technology to nuclear programs in countries of concern.
- China pledged in late 1997 not to engage in any new nuclear cooperation with Iran and to complete work on two remaining nuclear projects—a small research reactor and a zirconium production facility—in a relatively short period of time. During the first half of 1998, Beijing appears to have implemented this pledge. The intelligence community will continue to monitor carefully Chinese nuclear cooperation with Iran.
- During the reporting period, Chinese entities provided a variety of missile-related items and assistance to several countries of proliferation concern. China also was an important supplier of ACW to Iran through the first half of 1998.

- The control of fissile material in the FSU remains a major problem:
  - US estimates indicate the FSU left a legacy of some 1,485 tons of nuclear material. This includes 770 tons in some 27,000 weapons, including 816 strategic bombs, 5,434 missile warheads, and about 20,000 theater and tactical weapons. In addition, there were 715 tons of fissile or near-fissile material in eight countries of the FSU in over 50 sites: enough to make 35,000-40,000 bombs.
  - There are large numbers of experienced FSU technicians, including those at the Russian weapons design center at Arzamas, and at nuclear production complexes at Chelyabinsk, Krasnoyarsk, and Tomsk.
  - These factors led the US to conduct Operation Sapphire in 1994, where the US removed 600 kilograms of highly enriched uranium from the Ulba Metallurgy Plant in Kazakhstan at a time Iran was negotiating for the material.
  - They also led to Britain and the US cooperating in Auburn Endeavor, and airlifting fissile material out of a nuclear research facility in Tiblisi, Georgia. There were 10 pounds of material at the institute, and 8.8 pounds were HEU. (It takes about 35 pounds to make a bomb.) This operation was reported in the *New York Times* on April 21, 1998. The British government confirmed it took place, but would not give the date.

- The *Jerusalem Post* reported on April 9, 1998 that Iran had purchased four tactical nuclear weapons from Russian smugglers for $25 million in the early 1990s, that the weapons had been obtained from Kazakhstan in 1991, and that Argentine technicians were helping to activate the weapon.
    - It quoted what it claimed was an Iranian report, dated December 26, 1991, of a meeting between Brigadier General Rahim Safavi, the Deputy Commander of the Revolutionary Guards and Reza Amrohalli, then head of the Iranian atomic energy organization.
    - It also quoted a second document — dated January 2, 1992 — saying the Iranians were awaiting the arrival of Russian technicians to show them how to disarm the protection systems that would otherwise inactivate the weapons if anyone attempted to use them.
    - The documents implied the weapons were flawed by did not indicate whether Iran had succeeded in activating them.
    - The US intelligence community could not find any evidence that such a transfer had taken place.
- The most detailed reports of Iran's nuclear weapons program are the least reliable, and come from the People's Mujahideen, a violent, anti-regime, terrorist group. Such claims are very doubtful, but the People's Mujahideen has reported that:
    - Iran's facilities include a weapons site called Ma'allem Kelayah, near Qazvin on the Caspian. This is said to be an IRGC-run facility established in 1987, which has involved an Iranian investment of $300 million. Supposedly, the site was to house the 10 megawatt reactor Iran tried to buy from India.
    - Two Soviet reactors were to be installed at a large site at Gorgan on the Caspian, under the direction of Russian physicists.
    - The People's Republic of China provided uranium enrichment equipment and technicians for the site at Darkhouin, where Iran once planned to build a French reactor.
    - A nuclear reactor was being constructed at Karaj; and that another nuclear weapons facility exists in the south central part of Iran, near the Iraqi border.
    - The ammonia and urea plant that the British firm M. W. Kellog was building at Borujerd in Khorassan province, near the border with Turkestan, might be adapted to produce heavy water.
    - The Amir Kabar Technical University, the Atomic Energy Organization of Iran (AEOI) (also known as the Organization for Atomic Energy of Iran), Dor Argham Ltd., the Education and Research Institute, GAM Iranian Communications, Ghoods Research Center, Iran Argham Co., Iran Electronic Industries, Iranian Research Organization, Ministry of Sepah, Research and Development Group, Sezemane Sanaye Defa, the Sharif University of Technology, Taradis Iran Computer Company, and Zakaria Al-Razi Chemical Company are all participants in the Iranian nuclear weapons effort.
    - Other sources based on opposition data have listed the Atomic Energy Organization of Iran, the Laser Research Center and Ibn-e Heysam Research and Laboratory Complex, the Bonab Atomic Energy Research Center (East Azerbaijan), the Imam Hussein University of the Revolutionary Guards, the Jabit bin al-Hayyan Laboratory, the Khoshomi uranium mine (Yazd), a possible site at Moallem Kalayeh, the Nuclear Research Center at Tehran University, the Nuclear Research Center for Agriculture and Medicine (Karaj), the Nuclear Research Center of Technology (Isfahan), the Saghand Uranium mine (Yazd), the Sharif University (Tehran) and its Physics Research Center.
    - The CIA estimated in January 1999 that Iran remains one of the most active countries seeking to acquire WMD technology and ACW. During the reporting period, Iran focused its efforts to acquire WMD-related equipment, materials, and technology primarily on two countries: Russia and China. Iran is seeking to develop an indigenous capability to produce various types of nuclear, chemical, and biological weapons and their delivery systems.
- Iran actively sought relevant production technology to lessen its dependence on foreign sources.
- Russian entities continued to market and support a variety of nuclear-related projects in Iran during the first half of 1998, ranging from the sale of laboratory equipment for nuclear research institutes to the construction of a 1,000-megawatt nuclear power reactor in Bushehr, Iran, that will be subject to International Atomic Energy

Agency (IAEA) safeguards. These projects, along with other nuclear-related purchases, will help Iran augment its nuclear technology infrastructure, which in turn would be useful in supporting nuclear weapons research and development.

- The completion date of the light-water reactor at Bushehr has been moved forward from 2005 to the end of 2003.
- Russia has indicated that it would provide fuel for the reactor, in a bid to decouple the construction of the reactor from the Iranian fuel production program.
- Russia has agreed to provide fuel only if Iran returns the spent fuel to Russia. This is intended to deny Iran the fuel rods needed for plutonium production.

- Russia has committed to observe certain limits on its nuclear cooperation with Iran. For example, President Yeltsin has stated publicly that Russia will not provide militarily useful nuclear technology to Iran. Beginning in January this year, the Russian Government has taken a number of steps. For example, in May 1998, Russia announced a decree intended to strengthen compliance of Russian businesses with existing export controls on proliferation-related items.
- China continued to work on one of its two remaining projects—to supply Iran's civil nuclear program with a zirconium production facility. This facility will be used by Iran to produce cladding for reactor fuel. As a party to the Nuclear Nonproliferation Treaty, Iran is required to apply IAEA safeguards to nuclear fuel, but safeguards are not required for the zirconium plant or its products. During the US-China October 1997 Summit, China pledged not to engage in any new nuclear cooperation with Iran and to complete cooperation on two ongoing nuclear projects in a relatively short time. This pledge appears to be holding. In addition, China promulgated new export regulations in June 1998 that cover the sale of dual-use nuclear equipment. The regulations took effect immediately and were intended to strengthen control over equipment and material that would contribute to proliferation. Institution of these regulations fulfills Jiang Zemin's commitment to the United States last fall to implement such controls by the middle of 1998.
- Iran claims to desire the establishment of a complete nuclear fuel cycle for its civilian energy program. In that guise, it seeks to obtain whole facilities, such as a uranium conversion facility, that, in fact, could be used in any number of ways in support of efforts to produce fissile material needed for a nuclear weapon. Despite outside efforts to curtail the flow of critical technologies and equipment, Tehran continues to seek fissile material and technology for weapons development and has set up an elaborate system of military and civilian organizations to support its effort.
- US estimates of Iran's progress in acquiring nuclear weapons have changed over time.
  - In 1992, the CIA estimated that Iran would have the bomb by the year 2000. In 1995, John Holum testified that Iran could have the bomb by 2003.
  - In 1997, after two years in which Iran might have made progress, he testified that Iran could have the bomb by 2005-2007.
  - In 1999, the NIE on proliferation estimated that Iran could test a missile that could reach the US by 2010, but did not change the 1997 estimate or when Iran might acquire a bomb.
  - In early 2000, the *New York Time*s reported that the CIA had warned that Iran might now be able to make a nuclear weapon. The assessment stated that the CIA could not monitor Iran closely enough to be certain whether Iran had acquired fissile material from an outside source.
  - US experts increasingly refer to Iran's efforts as "creeping proliferation" and there is no way to tell when or if Iranian current efforts will produce a weapon, and unclassified lists of potential facilities have little credibility.
  - Timing of weapons acquisition depends heavily on whether Iran can buy fissile material — if so it has the design capability and can produce weapons in 1-2 years — or must develop the capability to process plutonium or enrich uranium — in which case, it is likely to be 5-10 years.

- On August 14, 2002, the representative office of the National Council of Resistance of Iran (NCRI), an Iranian opposition group which includes the People's Mujahideen, held a press briefing in which they released information about Iran's nuclear program.
    - The construction of a large site in Natanz which, according to the allegations, is to have been completed by March 2003.
    - The construction of a heavy water production facility at Arak.
    - Additional nuclear projects at a number of facilities:
        - The Bushehr power reactor complex.
        - The Nuclear Fuel Center in Isfahan.
        - The Nuclear Research Center at Karaj.
        - Research Center of Bonab.
        - Saghand Research Center of Yazd.
        - Amirabad Research and Reactor Center in Tehran.
- The Natanz site was previously unknown. By late 2002, the facility had been identified as a uranium enrichment facility.
    - In September 2002, Iran informed the IAEA of the existence of the facility. In a March 17, 2003 report the IAEA had confirmed their February 21, 2002 inspection of the facility.
    - At the time of the inspection, the IAEA Director General Mohamed El Baradei observed approximately 164 gas centrifuges operating at a pilot plant, with parts for perhaps an additional 1,000 centrifuges. When the IAEA delegation visited the facility, no uranium was in any of the centrifuges.
        - The Iranian government has stated that uranium hexaflouride will be produced at Isfahan and then shipped to Natanz for separation and processing. A March 14, 2003 Iranian state television broadcast indicated that on March 3, 2003, the Secretary of the Supreme National Security Council stated that the Isfahan facility for converting yellowcake into uranium hexaflouride was complete.
    - News stories quoting government sources, independent analysis of commercially-available satellite imagery and reports from the NCRI all note that the two main halls are quite large (between 25,000 m^2 and 32,000 m^2), are several meters underground and have walls in excess of two meters thick.
        - The size of the halls tends to suggest that the total number of centrifuges may total roughly 50,000 or more – contradicting recent media reports which claim that Natanz is intended only to house 5,000 centrifuges.[79] This number may merely reflect an interim goal for the site.
        - Previously the Iranian government had announced that it intended to achieve complete self-sufficiency throughout the entire fuel cycle for a projected generation capacity of 6,000 megawatts over the next 20 years.
        - The total capacity of the Natanz facility depends on the efficiency of the centrifuges. At the low end, a complex housing 50,000 centrifuges would produce a quarter of the fuel need for the Bushehr reactor – which is only about 4 percent of the total stated goal of the Iranian nuclear program. At the high end, 50,000 centrifuges could produce 25% more than the amount called for in publicly stated nuclear program objectives.
            - The throughput of the centrifuges depends on the quality of the materials used in manufacturing the centrifuges, as well as their design.
            - Unconfirmed reports quoting western governmental sources suggest that the Iranian centrifuges may tend towards the upper bounds of the range of production capabilities.
        - The amount of separation capacity needed to meet the stated goals of providing sufficient fuel for 6,000 MW is sufficient to produce enough highly-enriched uranium for 180 weapons annually.

    - It is uncertain what portion, if any, of the separation capacity at Natanz will be dedicated to producing highly-enriched, weapons-grade uranium versus low-enriched uranium for use in power reactors.
    - More significantly, the ability to construct a plant of this scale suggests that there may exist ample capacity to produce separation equipment for use in a weapons program. Such equipment could be located at other, unknown, sites.
- National Council of Resistance of Iran (NCRI) also released information about a heavy water production facility at Arak during it's August 14, 2002, press briefing.
    - The construction of a heavy-water production facility is puzzling to many observers, as Iran has no reactor that utilizes heavy water.
        - Heavy water can be used in a reactor that uses natural uranium fuel.
        - Analysts note that heavy water is a key material used in plutonium production.
- On February 9, 2003, Iranian President Khatami made a televised speech on Iran's nuclear program in which a number of pronouncements were made indicating the scope and scale of the Iranian nuclear program.
    - Iran has started mining uranium near the city of Yazd.
    - A facility for converting ore into yellowcake has been built in the same province as the mines.
    - Iran is building or operating uranium mines, uranium concentration and conversion facilities and fuel fabrication plants.
    - A statement made the next day by the head of Iran's Atomic Energy Organization, stated that the Isfahan facility would convert yellowcake into uranium oxide, uranium hexaflouride and uranium metal.
    - Uranium metal has very few civil uses, but is a key to the construction of nuclear weapons.
    - On March 3, 2003, the state-run Islamic Republic News Agency reported that the Isfahan facility was completed and would begin operation.
- Statements made over the last few months by the Iranian government regarding fuel-cycle self-sufficiency had troubled some observers, including the US State Department, as these statements could be interpreted to mean that Iran is pursuing the ability to reprocess spent fuel.
    - Reprocessing of spent fuel produces plutonium.
    - Russia's earlier agreements regarding the construction of the reactor at Bushehr included an agreement for Russia to provide reactor fuel. This agreement was contingent on Iran returning spent fuel rods to Russia.
- On December 13, 2002, IAEA Director General Mohammed El-Baradei indicated that the reports by Iranian opposition groups and Western governments on Iranian nuclear facilities at Natanz and Arak was not a surprise, citing discussions with Iranian authorities over the last 6 months.
    - On February 22, 2003, Iran permitted three IAEA personnel to visit the Natanz enrichment facility. More detailed inspections began on March 10, 2003.
    - During the visit, personnel observed between 160-200 active centrifuges at the Natanz pilot plant. However, none of these centrifuges appeared to have contained uranium hexaflouride. It is possible that some UF_6 has been processed somewhere in Iran, at least on a trial basis.
    - Inspectors also observed parts for about an additional 1,000 centrifuges.
    - Iranian authorities promised to provide information on centrifuge design no later than 60 days before the start of processing of uranium hexaflouride. Under existing agreements, Iran would also be required to provide IAEA with data covering the number of centrifuges installed as well as the total facility throughput.

- The United States and other western governments have pressured the IAEA to more aggressively monitor the Iranian nuclear program and have encouraged the IAEA to seek additional, more comprehensive, inspection agreements. Iran originally indicated some willingness to make such an agreement, although recently they appear to be more inclined to extract concessions in exchange for further inspections.

- The CIA reported in November 2003 that, "The United States remains convinced that Tehran has been pursuing a clandestine nuclear weapons program, in violation of its obligations as a party to the Nuclear Nonproliferation Treaty (NPT). To bolster its efforts to establish domestic nuclear fuel-cycle capabilities, Iran sought technology that can support fissile material production for a nuclear weapons program.

  - Iran tried to use its civilian nuclear energy program to justify its efforts to establish domestically or otherwise acquire assorted nuclear fuel-cycle capabilities. In August 2002, an Iranian opposition group disclosed that Iran was secretly building a heavy water production plant and a "nuclear fuel" plant. Press reports later in the year confirmed these two facilities using commercial imagery and clarified that the "fuel" plant was most likely a large uranium centrifuge enrichment facility located at Natanz. Commercial imagery showed that Iran was burying the enrichment facility presumably to hide it and harden it against military attack. Following the press disclosures, Iran announced at the International Atomic Energy Agency (IAEA) September 2002 General Conference that it had "ambitious" nuclear fuel cycle plans and intended to develop all aspects of the entire fuel cycle.

  - By the end of 2002, the IAEA had requested access to the enrichment facility at Natanz, and the IAEA Director General (DG) for the first time visited the facility in February 2003. The IAEA is investigating the newly disclosed facilities, and previously undisclosed nuclear material imports to determine whether Iran has violated its NPT-required IAEA safeguards agreement in developing these facilities and their related technologies. At the June 2003 Board of Governors meeting, the IAEA DG presented a report on the Iranian program noting Tehran had failed to meet its safeguards obligations in a number of areas. The DG's report described a pattern of Iranian safeguards failures related to the undeclared import and processing of uranium compounds in the early 1990s, expressed concern over the lack of cooperation from Iran with IAEA inspections, and identified a number of unresolved concerns in Iran's program that the IAEA will continue to investigate. The IAEA Board on 19 June welcomed the report and called on Iran to answer all IAEA questions, cooperate fully with IAEA inspectors, and sign and implement an Additional Protocol immediately and unconditionally.

  - Although Iran claims that its nascent enrichment plant is to produce fuel for the Russian-assisted construction projects at Bushehr and other possible future power reactors, we remain concerned that Iran is developing enrichment technology to produce fissile material for nuclear weapons under the cover of legitimate fuel cycle activities. Iran appears to be embarking on acquiring nuclear weapons material via both acquisition paths—highly enriched uranium and low burn-up plutonium. Even with intrusive IAEA safeguards inspections at Natanz, there is a serious risk that Iran could use its enrichment technology in covert activities. Of specific proliferation concern are the uranium centrifuges discovered at Natanz, which are capable of enriching uranium for use in nuclear weapons. Iran claims its heavy water plant is for peaceful purposes. In June, Iran informed the IAEA that it is pursuing a heavy water research reactor that we believe could produce plutonium for nuclear weapons. We also suspect that Tehran is interested in acquiring fissile material and technology from foreign suppliers to support its overall nuclear weapons program."

- Iran agreed to sign the NNPT protocol allowing full IAEA challenge inspections, and to IAEA inspections of suspect nuclear facilities in late 2003, after the discovery of undeclared centrifuge and heavy water facilities, and the IAEA discovered it was conducting a variety of activities illegal under the NNPT. It did so in the face of UN condemnation and possible sanctions.

- The IAEA, in early 2004, found traces of highly enriched uranium at an Iranian nuclear facility. The uranium, the uncommon 235 isotope, had been refined to 90 percent, making it of a quality usually used in a nuclear bomb.

- Iran claimed that its equipment must have been contaminated by uranium while being shipped to its facilities. Iran stated that the exact time and location of the contamination was impossible to determine due to the fact that the parts had been shipped through five different countries.

- The IAEA suggested that the contamination may have occurred in Pakistan as a result of the alleged collusion between Iranian officials and the Pakistani scientist, Abdul Qadeer Kahn. The IAEA requested that Pakistan allow the organization to take samples from its enrichment sites to determine whether or not the contamination occurred in Pakistan.

- The Iranian Defense Minister, Ali Shamkhani, admitted that centrifuge production had taken place under military supervision and were designed to enrich uranium. These centrifuges, he maintained, were solely for use in civilian power plants. Kamal Kharrazi, the Foreign Minister, accused the US of using every opportunity to pressure Iran and indicated that the actions of the US could "complicate" Iran's cooperation with the IAEA. Kharrazi insisted that Iran would resume enriching uranium for "peaceful purposes" after the IAEA was satisfied with Iran's compliance.[80]

- The US has threatened to refer Iran to the UN Security Council if the country refused to reveal or tried to conceal developments in its nuclear research. The European nations have been reluctant to support such a measure, believing that it would rule out further Iranian cooperation with the IAEA. The revelation of highly enriched uranium and the Iranians' decision to suspend further IAEA inspections until April on March 11, 2004, however, has caused them to reevaluate their positions with regard to Iran.

- On March 13, 2004, the IAEA passed a resolution that criticized Iran for failing to reveal all aspects of its nascent nuclear weapons program. In response, Iran suspended IAEA inspections indefinitely. The IAEA's main concerns were[81]:

  - Iran had failed to reveal the full extent of its past and current nuclear program as requested by the IAEA in November.

  - Iran had signed the Additional Protocol but had failed to ratify it as the IAEA called for in November.

  - The IAEA found additional equipment and designs not disclosed by Iran. They included a more advanced centrifuge design, centrifuge research, centrifuge testing, and centrifuge manufacture. The IAEA found the designs for two hot cells at the Arak heavy water research reactor and two mass spectrometers for the laser enrichment process. Iran has not provided the IAEA with the reason for the planned construction of a second heavy-water reactor. These issues require greater investigation but are consistent with an active nuclear weapons research program.

  - Iran failed to show the extent of its research and development in uranium enrichment. Iran failed to provide the IAEA with the source of the uranium contamination.

  - No sufficient explanation has been given for Iran's experiments with polonium-210.

Missile Defenses

- Seeking Russian S-300 or S-400 surface-to-air missile system with limited anti tactical ballistic missile capability.

Figure 10.22

Saudi Arabia's Search for Weapons of Mass Destruction

Delivery Systems

- Between 30 and 60 modified CSS-2 missiles purchased from China in 1988. The CSS-2 is based on the Russian SS-4 and has an estimated range of 2,650 km, a payload of 2,150 kg, with a CEP of 2.5 km.
    - Saudi Arabia is thought to possess 9 launchers.
    - The missiles are deployed in two installations al-Sulayil and al-Joffer 500 and 100 km south of Riyadh, respectively.
- XX Tornado fighter ground attack aircraft.
- XX F-15s of various models.
- Tube artillery and multiple rocket launchers.

Chemical Weapons

- Possible development. No evidence of deployed systems.

Biological Weapons

- Possible development. No evidence of deployed systems.

Nuclear Weapons

- There has been a great deal of ongoing speculation regarding Saudi nuclear intentions. None of these suspicions have been confirmed although the allegations are persistent.
- The Saudis are alleged to have first open a nuclear research center at Al-Kharj in 1975.
- Later, there have been many reports of nuclear cooperation between Saudi Arabia and Iraq, prior to the 1990 invasion of Kuwait. Reportedly, Saudi Arabia offered to pay for the rebuilding of the Osirak reactor, following its destruction in 1981.
- In 1994 a Saudi diplomat, the second-in-command of the Saudi mission to the United Nations sought political asylum.[82]
    - He brought more than 10,000 documents with him, including letters written in 1989 from the China Nuclear Energy Industry Corporation to a Saudi prince discussing the purchase of miniature neutron source reactors.
    - The veracity of these letters and the validity of these allegations have never been established.
- On October 22, 2003, an article citing an unnamed Pakistani source indicated that Saudi Arabia and Pakistan had reached a secret agreement on the exchange of nuclear weapons technology for cheap oil.[83]
    - Both Pakistan and Saudi Arabia have vehemently denied this and no evidence has been produced to support this allegation.
- Other unverified reports speculate that Pakistan will be seeking a joint control and command of Pakistani nuclear weapons in Saudi Arabia. The article argues that this would increase Saudi prestige and safety, while giving Pakistan a complex second strike capability against India.[84]
- Saudi Arabia is a signatory to the nuclear non-proliferation treaty.

Figure 10.23

Problems in Collecting Data WMD Capabilities and Delivery Systems: Iraq As a Case Study

Even a cursory review of this list of U.S. and British charges about Iraq's WMD capabilities shows that point after point that was made was not confirmed during war or after the first two months of effort following the conflict. Despite all of the advances in their IS&R capabilities, the United States and Britain went to war with Iraq without the level of evidence needed to provide a clear strategic rationale for the war, and without the ability to fully understand the threat that Iraqi weapons of mass destruction posed to U.S., British, and Australian forces. This uncertainty is not a definitive argument against carrying out a war that responded to grave potential threats. It *is* a definitive warning that this intelligence and targeting are not yet adequate to support grand strategy, strategy, and tactical operations against proliferating powers or to make accurate assessments of the need to preempt.

It is difficult to put these problems into perspective without access to classified material. Past declassified U.S. intelligence reporting on proliferation has made it clear, however, that proliferation presents very serious problems for intelligence collection and analysis. UNSCOM and UNMOVIC reports show that Iraq was well aware of these problems and how to exploit them:

- Iraq and other powers sophisticated enough to proliferate are also sophisticated enough to have a good understanding of many of the strengths and limitations of modern intelligence sensors, the timing and duration of satellite coverage, and the methods use to track imports and technology transfer. They have learned to cover and conceal, to deceive, and to create smaller and better disseminated activities.

- Intelligence collection relies heavily on finding key imports and technology transfers. Such reports, however, only usually cover a small fraction of the actual effort on the part of the proliferating country, and the information collected is often vague and uncertain, in part because importers and smugglers have every incentive to lie and are also familiar with many the ways to defeat intelligence collection and import controls. When information does become available, it is often impossible to put in context, and a given import or technology transfer can often be used in many difficult ways, often was other than proliferation. Such import data can hint at the character of a proliferation effort, but give no picture of the overall character of the activity.

- Even when data are available on given imports or technology transfers, they generally present three serious problems. One is that there is no way to know the end destination and use of the import and how it is integrated into the overall effort. The second is there is no way to know if it is integrated into an ongoing research and development effort, a weapons production effort, being procured or stockpiled for later use, or simply an experiment or mistake that is never further exploited. The third is that many imports have civilian or other military uses. These so-called "dual-use" imports may have legitimate use.

- The very nature of arms control agreements like the Nuclear Non-Proliferation Treaty (NNPT), Biological Weapons Convention (BWC), and Chemical Weapons convention (**C**WC) encourages proliferating nations to lie and conceal as effectively as possible. The same is true of supplier agreements like the Missile Technology Control Regime (MTCR) and Australia List, and any form of sanctions. Arms control only encourages compliance among non-proliferators and non-sellers, and current enforcement efforts are too weak to be effective while their provisions effective license technology transfer to those nations who succeed in lying or concealing.

- The technology of proliferation generally permits the research and development effort to be divided up into a wide range of small facilities and projects. Some can be carried out as legitimate civil research. Others can be hidden in civil and commercial facilities. As proliferators become more sophisticated, they learn to create dispersed, redundant and parallel programs, and mix high secret covert programs with open civil or dual-use programs. Chemical, biological, and cruise missile programs are particularly easy to divide up into small cells or operations. However, this is increasingly true of nuclear weapons centrifuge programs, plutonium processing and fuel cycles, and the testing and simulation of nuclear weapons that does not involve weapons grade materials. Many key aspects of ballistic missile R&D, including warhead and launch system design fit into this category.

- Iraq and most other proliferators have, in the past, focused on creating stockpiles of weapons for fighting theater conflicts against military forces. These stockpiles require large inventories, large-scale deployments, and generally mixes of training and warfighting preparations that create significant intelligence indicators. There are, however, other strategies and many proliferators may now be pursuing them. One is to bring weapons to full development, and to wait until a threat becomes imminent to actually produce the weapon. A second is to follow the same course, but create large dual-use civil facilities that can be rapidly converted to the production of weapons of mass destruction. These can include pharmaceutical plants, food-processing plants, breweries, petrochemical plants, and pesticide plants, but key assembly lines can be concealed in a wide range of other commercial activities.[85] Weapons production facilities can be stockpiled for a later and sometimes sudden breakout. A third is to focus on creating as few highly lethal biological or nuclear weapons to attack key political or civilian facilities in a foreign country, rather than its military forces. Highly lethal non-infectious or infectious biological agents are one means of such an attack, biological weapons directed at crops or livestock are another.

- Countries can pursue very different strategies in dealing with their past inventories of weapons. They can disclose and destroy them, knowing they do not face an urgent warfighting need, better weapons are coming, and this suits current political objectives. They can claim to destroy and hide the remaining weapons in covert areas known only to a few. They can claim to destroy, or lie, and disperse weapons where they can be used for warfighting purposes. In many cases, intelligence collection may not be able to distinguish between such strategies, and a given proliferator like Iraq can pursue a mix of such strategies—depending on the value of the weapon.

- In many cases, there is no clear way to know whether a program is R&D, production and weapons deployment, or production capable/breakout oriented. The problem is further complicated by the fact that Iraq and other countries have learned to play a "shell game" by developing multiple surface and underground military facilities and dual-use facilities and to create relatively mobile mixes of trailer/vehicle mounted and "palletized" equipment for rapid movement. Large special-purpose facilities with hard to move equipment often still exist, but they are by no means the rule. Intelligence collection takes time and may often lag behind country activities.

- Unless a country keeps extremely accurate records of its programs, it is often far easier to estimate that maximum scale of what it might do than provide an accurate picture of what it has actually done.

- In most cases, it is impossible to know how far a given project or effort has gotten and how well it has succeeded. The history of proliferation is not the history of proliferators overcoming major technical and manufacturing problems. It is the history of massive management and systems integration problems, political failures, lying technical advocates and entrepreneurs, project managers who do not tell their political masters the truth, and occasional sudden success. Short of an intelligence breakthrough, it is rarely possible to assess the success of a given effort and even on the scene inspection can produce vary wrong results unless a given project can be subjected to detailed technical testing. For example, UNSCOM and the IAEA found that virtually all of their preliminary reporting on Iraq's nuclear effort in 1992-1993 tended to exaggerate Iraqi capabilities once they had had the time to fully assess the efficiency of key efforts like the Calutron and centrifuge programs.

- The only definitive way to counter most of these collection problems is to have a reliable mix of redundant human intelligence (HUMINT) sources within the system or as defectors. The United States, however, has never claimed or implied it had such capabilities in any proliferating country, and the history of U.S., British, UNSCOM, and UNMOVIC efforts to deal with Iraq makes it painfully clear both that such transparency was totally lacking in Iraq and that most Iraqi defectors and intelligence sources outside Iraq made up information, circulated unsubstantiated information, or simply lied. Breakthroughs do occur, but HUMIMT is normally inadequate, untrustworthy, or a failure, and these shortcomings cannot generally be corrected with data based on other intelligence means. Either inside information is available or it is not. When it is, imagery and signals intelligence generally do far more to indicate that HUMINT is wrong or suspect than to reveal the truth.[86]

- In many cases, even the leaders of a proliferating country may not have an accurate picture of the success of their efforts, and most probably do not have a clear picture of the accuracy, lethality and effects, and reliability of their weapons. U.S. and British research efforts have long shown that even highly sophisticated technical models of the performance and lethality of chemical, biological, and nuclear weapons and delivery systems can be grossly wrong, or require massive levels of human testing that simply are not practical even for closed authoritarian societies. No declassified intelligence report on any proliferation effort in any developing country has yet indicated that Iraq or any other proliferator has sophisticated technical and testing models in these areas. Intelligence cannot collect data that do not exist.

Figure 10.24

Problems in Analyzing WMD Capabilities and Delivery Systems: Iraq as a Case Study

Many of the resulting problems in the analysis of the WMD capabilities of Iraq and other countries are the result of the previous problems in collection. The details of U.S., British, and allied intelligence analyses remain classified. At the same time, background discussions with intelligence analysts and users reveal the following additional problems in analyzing the WMD threat:

- The uncertainties surrounding collection on virtually all proliferation and weapons of mass destruction programs are so great that it is impossible to produce meaningful point estimates. As the CIA has shown in some of its past public estimates of missile proliferation, the intelligence community must first develop a matrix of what is and is not known about a given aspect of proliferation in a given country, with careful footnoting or qualification of the problems in each key source. It must then deal with uncertainty by creating estimates that show a range of possible current and projected capabilities—carefully qualifying each case. In general, at least three scenarios or cases need to be analyzed for each major aspect of proliferation in each country—something approaching a "best," "most likely," and "worst case."[87]

- Even under these conditions, the resulting analytic effort faces serious problems. Security compartmentation within each major aspect of collection and analysis severely limits the flow of data to working analysts. The expansion of analytic staffs has sharply increased the barriers to the flow of data, and has brought large number of junior analysts into the process that can do little more than update past analyses and judgments. Far too little analysis is subjected to technical review by those who have actually worked on weapons development, and the analysis of delivery programs, warheads and weapons, and chemical, biological, and nuclear proliferation tends to be compartmented. Instead of the free flow of data and exchange of analytic conclusions, or "fusion" of intelligence, analysis is "stovepiped" into separate areas of activity. Moreover, the larger staffs get, the more stovepiping tends to occur.

- Analysis tends to focus on technical capability and not on the problems in management and systems integration that often are the real world limiting factors in proliferation. This tends to push analysis towards exaggerating the probable level of proliferation, particularly because technical capability is often assumed if collection cannot provide all the necessary information.

- Where data are available on past holdings of weapons and the capability to produce such weapons—such as data on chemical weapons feedstocks and biological growth material—the intelligence effort tends to produce estimates of the maximum size of the possible current holding of weapons and WMD materials. While ranges are often shown, and estimates are usually qualified with uncertainty, this tends to focus users on the worst case in terms of actual current capability. In the case of the Iraq, this was compounded by some 12 years of constant lies and a disbelief that a dictatorship obsessed with record keeping could not have records if it had destroyed weapons and materials. The end result, however, was to assume that little or no destruction had occurred whenever UNSCOM, UNMOVIC, and the IAEA reported that major issues still affected Iraqi claims.

- Intelligence analysis has long been oriented more towards arms control and counterproliferation rather than war fighting, although DIA and the military services have attempted to shift the focus of analysis. Dealing with broad national trends and assuming capability is not generally a major problem in seeking to push nations towards obeying arms control agreements, or in pressuring possible suppliers. It also is not a major problem in analyzing broad military counterproliferation risks and programs. The situation is very different in dealing with war fighting choices, particularly issues like preemption and targeting. Assumptions of capability can lead to preemption that is not necessary, overtargeting, inability to prioritize, and a failure to create the detailed collection and analysis necessary to support warfighters down to the battalion level. This, in turn, often forces field commanders to rely on field teams with limit capability and expertise, and to overreact to any potential threat or warning indicator.

- The intelligence community does bring outside experts into the process, but often simply to provide advice in general terms rather than cleared review of the intelligence product. The result is often less than helpful. The use of other cleared personnel in U.S. laboratories and other areas of expertise is inadequate and often presents major problems because those consulted are not brought fully into the intelligence analysis process and given all of the necessary data.

- The intelligence community does tend to try to avoiding explicit statements of the short comings in collection and methods in much of its analysis and to repeat past agreed judgments on a lowest common denominator level—particularly in the form of the intelligence products that get broad circulation to consumers. Attempts at independent outside analysis or "B-Teams," however, are not subject to the review and controls enforced on intelligence analysis, and the teams, collection data, and methods used are generally selection to prove given points rather than provide an objective counterpoint to finished analysis.[88]

More broadly, the users of intelligence are at best intolerant of analysis that consists of a wide range of qualifications and uncertainties even at the best of times, and the best of times do not exist when urgent policy and warfighting decisions need to be made. Users inevitably either force the intelligence process to reach something approaching a definitive set of conclusions, or else they make such estimates themselves.

Intelligence analysts and managers are all too aware of this fact. Experience has taught them that complex intelligence analysis—filled with alternative cases, probability estimates, and qualifications about uncertainty --generally go unused or make policy makers and commanders impatient with the entire intelligence process. In the real world, hard choices have to be made to provide an estimate that **can** actually be used and acted upon, and these choices must either by the intelligence community or the user.[89]

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[16] Judith Miller, "Libya Discloses Production of 23 Tons of Mustard Gas," The New York Times March 6, 2004, pg. 5.

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[37] Tass International, 1216 GMT, September 15, 1989; Washington Post, September 16, 1989; Jane's Defense Weekly, November 19, 1988, September 23, 1989, p. 549; Washington Times, July 22, 1987, p. D-4; International Defense Review, 7/1987, p. 857, and New York Times, July 22, 1987, p. A-6, July 29, 1987; Mideast Markets, November 23, 1987, p. 11; in Harold Hough, "Israel's Nuclear Infrastructure, Jane's Intelligence Weekly, November, 1994, pp. 505-511.

[38] BBC and ITV reporting efforts seem to give more credibility to the idea that Israel has some form of relatively short-range nuclear armed missile. Ranges of anywhere from 750-930 NM have been reported, with accuracy's of anywhere from 0.1 Km to radar correlator guidance packages capable of CEPs of 10 meters. Bulletin of Atomic Scientists, Vol. 46, Jan/Feb. 19980, p. 48; Washington Post, September 16, 1989, p. A-17, November 15, 1989, p. A-14; Economist, August 1, 1987, p. 41; Washington Times, July 22, 1987, p. D-4; July 24, 1987, p. A-9 and April 4, 1988, p. 17; International Defense Review, 7/1987, p. 857, and New York Times, July 29, 1987, p. A-10.

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[85] For an interesting discussion of the problems in assessing dual-use facilities in Iraq, see Walter Pincus, "Weapons Linked to Dual Use Facilities in Iraq," *Washington Post*, June 2, 2003.
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[87] Earlier unclassified CIA reports on problems like the ballistic missile threat often projected alternative levels of current and future capability. The qualifications and possible futures are far less well defined in more recent reports. For example, see CIA, Unclassified Summary of a National Intelligence Estimate, Foreign Missile Developments and the Ballistic Missile Threat Through 2015," National Intelligence Council, December 2001, http://www.cia.gov/nic/pubs/other_products/Unclassifiedballisticmissilefinal.htm.
[88] There is no way to determine just how much the Special Plans Office team set up within the office of the Secretary of Defense to analyze the threat in Iraq was designed to produce a given conclusion or politicized intelligence. The Department has denied this, and stated that the team created within its policy office was not working Iraqi per se, but on global terrorist interconnections. It also stated that the Special Plans Office was never tied to the Intelligence Collection Program—a program to debrief Iraqi defectors—and relied on CIA inputs for its analysis. It states that simply conducted a review, presented its findings in August 2002, and its members returned to other duties. See Jim Garamone, "Policy Chief Seeks to Clear Intelligence Record," American Forces Information Service, June 3, 2003; and Briefing on policy and intelligence matters, Douglas J. Feith, under secretary of defense for policy, and William J. Luti, deputy under secretary of defense for special plans and Near East and South Asian affairs, June 4, 2003, http://www.defenselink.mil/transcripts/2003/tr20030604-0248.html.
Some intelligence experts dispute this view, however, and claim the team's effort was used to put press on the intelligence community. Such "B-teams" also have a mixed history. They did help identify an intelligence community tendency to underestimate Soviet strategic nuclear efforts during the Cold War. The threat analysis of

missile threats posed to the United States by the "Rumsfeld Commission," however, was a heavily one-sided assessment designed to justify national missile defense. Also see Greg Miller, "Pentagon Defends Role of Intelligence Unit on Iraq," *Los Angeles Times*, June 5, 2003; and David S. Cloud, "The Case for War Relied on Selective Intelligence," *Wall Street Journal*, June 5, 2003..

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In fact, the unclassified excerpts from the DIA report, show that DIA was not stating that Iraqi did not have chemical weapons, but rather that it had, No reliable information on whether Iraq is producing and stockpiling chemical weapons, or where Iraq has—or will—establish its chemical weapons facilities." The report went on to say that, "although we lack any direct information, Iraq probably possess CW agent in chemical munitions, possibly include artillery rockets, artillery shells, aerial bombs, and ballistic missile warheads. Baghdad also probably possess bulk chemical stockpiles, primarily containing precursors, but that also could consist of some mustard agent of stabilized VX."

If anything, the report is a classic example of what happens when intelligence reports do state uncertainty and of how the user misreads or misuses the result.