Limiting the Nuclear Club—Iraq, North Korea, *et al.*

Jonathan I. Katz

Washington University, St. Louis, Mo.

History

When the atom bomb became public knowledge in August, 1945 the dreaded question immediately arose: How long before Stalin gets one? Members of the public and the political establishment believed, or hopefully tried to believe, that American scientists had unlocked a deep dark secret which could be kept for decades. Scientists involved in atomic energy knew better, and typically guessed that it would take the Soviets about five more years; it actually took them four.

Although Stalin controlled atomic bombs for the last four years of his life, and hydrogen bombs for some fraction of that time, there was no catastrophe. A man and system which murdered tens of millions of people with bullets, famine, and prison camps never used the most powerful weapons in history. Even the boundaries of the Soviet occupied territories and sphere of influence, which had rapidly expanded in 1945–48, did not grow further after the Soviet development of nuclear weapons in 1949.

Two plausible conclusions may be drawn from this history of the first proliferation of nuclear weapons. The first conclusion is that proliferation is easy and inevitable. The second is that it does not matter very much, because a nuclear balance of power will deter aggressors from using their nuclear weapons, either directly to kill people, or indirectly, threatening their use in order to secure advantage.

Both of these conclusions are wrong. The Soviet Union, like any overextended empire, was a fundamentally conservative power preoccupied with trying to digest its indigestible pieces and to repair the damage done by its leader's paranoia and a disastrous system of central planning. This Potemkin threat was easily deterred and contained by a Western alliance led by Churchill, Truman, and their successors, and enjoying overwhelming public

support; this alliance was usually ready to do battle (at least by proxy) with any hint of Soviet expansion into even the most obscure backwaters. The more serious threats are those which initiated two World Wars, as well as the most recent war in the Persian Gulf: vigorous compact states looking for neighbors to digest.

The Present

We have not yet faced a reckless and flagrant aggressor, such as Iraq, armed with nuclear weapons. The overwhelming strength of even a post-Cold War United States will surely deter a direct attack on it. The greater danger will be nuclear or nuclear-backed conventional attacks on non-nuclear states which are not securely under a great power's nuclear umbrella, or the escalation of conventional war between two small or threshold nuclear powers to nuclear war. American resolve to defend South Korea in 1950 or to undertake Desert Shield and Desert Storm in 1990–91 would have been questionable if the aggressors had possessed nuclear weapons. Deterrence may prevent further aggression, but is never sufficient to roll back *faits accomplis*; a nuclear-armed Iraq would today occupy Kuwait, and would have thereby cowed the rest of the Persian Gulf into obedience.

There are a few dozen countries in the world which possess a sufficient scientific and engineering capability and technical and industrial base to develop nuclear weapons without major difficulty or outside help. Fortunately, most of these countries are stable democracies and therefore not aggressors; the two chief exceptions (the Former Soviet Union and China) were successfully contained for many years, and the more powerful of these is making a transition, one hopes successful and irreversible, to democracy. This first tier includes the six powers (counting the FSU as one) which have detonated nuclear explosions (India asserts that its was not a weapon); this club has not grown since 1974 (unless one chooses to count the recently revealed, but now dismantled and never tested,*

* The widely reported supposed nuclear explosion of September 22, 1979 in the South Atlantic Ocean did not occur; the observed signals are completely explicable as instrumen-

South African bombs).

The proliferation threat comes from a second tier of countries. Their indigenous scientific and technical resources are limited, so they would be required to import much of the technology, materials, and components required. Most of the several dozen countries in this group are not attempting to develop nuclear weapons, but a few are. Unfortunately, but not surprisingly, those few include habitual aggressor or fanatic nations—Iraq, Iran and North Korea. The existing regime of export controls on strategic materials, equipment and technology is directed at these countries.

It is evident that the present proliferation control regime has failed. We now know that Iraq made very substantial progress toward a nuclear weapon by circumventing the controls. Without the Persian Gulf war it is likely that Saddam Hussein would have obtained a weapon within a few years. This leads to the following questions: How hard is the job of a would-be proliferator? Is it possible to prevent proliferation by the unholy three—Iraq, Iran, and North Korea—and by others with similar resources? If we accept that proliferation can and should be controlled, how do we do it?

SECRETS and Secrets

Information which is not generally known or readily available to those interested may be divided into two distinct classes. SECRETs are stamped with a SECRET (or similar) label, which bears the force of law. Prior to August 6, 1945 nearly every fact about atomic energy, from basic scientific data to weapons design information and the existence of the Manhattan Project, was SECRET. On that date an atomic bomb was dropped on Hiroshima. With its announcement and the release of the Smyth report, a large quantity of formerly SECRET information became publicly available, a process which has continued intermittently to this day.

---

tal artifacts. See "Ad Hoc Panel Report on the September 22 [1979] Event", J. Ruina, *et al.* (Office of Science and Technology Policy, Washington, D. C.).

Secrets are information which is not readily available, even though not formally classified or protected by law. If you were to build a factory to make automobiles, integrated circuits, or any other industrial product, you would need to re-invent a very large number of details of how the factory and product should be designed, and of how to fix them when something goes wrong. These details are secrets because they are not found in any publicly available document. Often they exist only in the hands and minds of the engineers and technicians who actually make the machines work. Most of these details are not even trade secrets, because they are generally known to people in the industry. But, if you did not know them, and could not hire people who do know them, they would be secrets to you, and you would find it expensive, difficult, and time-consuming to produce a workable product. Even if you were to purchase a turn-key factory, ready to function at the state of the art, you would need a great deal of secret information—or a staff of competent engineers and technicians knowledgeable and experienced in the processes used—to perform maintenance, to adapt to changing conditions, and to fix breakdowns.

Most of the little secret details involved in any design and manufacturing process are never written down. Often they are not even recognized as secrets until a beginner tries to proceed without their benefit and fails, or succeeds only after error and delay. This is everyday experience in the kitchen and in home and automobile repair, and also explains why modern equipment sent to Third World countries often turns into an unused hulk in a few years. The first time one tries something new it usually does not work well, or at all, or it may take much longer than it should. The details of a machine or process are hard to describe fully in writing. Most skills cannot be learned from a book or manual, but must be learned by doing. These unwritten secrets are particularly important in the production of nuclear materials and the design and construction of nuclear weapons, which involve expensive and hazardous materials. The cost, and risk, of learning by trial and error are high.

How Hard is Proliferation?

The most important fact about the atomic bomb is that it can be built. It took the United States about four years to establish that fact, and it was SECRET for three weeks, until the first military use of a bomb at Hiroshima disclosed it to the world. The hydrogen bomb contains some very clever inventions, some of which are still SECRET, but for it, too, the central SECRET was that it could be done. It took several more years for the United States to unlock that SECRET, during which time there was grave doubt that the problem could be solved, and bitter controversy; the central SECRET—that the problem was soluble—was soon disclosed. It is not possible to conceal the detonation of a high yield explosive. Other nuclear powers succeeded faster or more economically, after the path had been pointed out.

In addition to these two big SECRETs there are a multitude of smaller and more technical SECRETs and secrets. Nuclear weapons are complicated devices, making stringent demands on certain technologies, but being remarkably tolerant in some other respects. The processes for making their components and materials are complex and, in many ways, technically demanding. Some of these lesser SECRETs have been disclosed, either by deliberate declassification, or through leaks and independent rediscovery. However, many have not been disclosed, and many of the disclosures are incomplete or salted with deliberate or inadvertent disinformation.

There is wide disagreement as to just how hard it is for a would-be nuclear power to become one. It has been argued (for example, recently in The National Interest by Tom Clancy and Russell Seitz) that there is hardly any barrier to a determined second-tier country. This argument is based on the evident progress made by the Iraqis, and particularly on their use of uncontrolled technologies to circumvent controlled technologies, on the steady declassification of nuclear technologies, and on the worldwide spread of technical training in the physical sciences and technology.

There can be little doubt that a potential proliferator's task is much easier than was

that of the Manhattan Project. However, the resources available to potential proliferators in the second tier are very much less than those of the United States, then or now. The scientific and technological bases of such countries are very limited. They must buy most of the materials and expertise they need, which makes their effort vulnerable to export controls. They find it difficult to respond flexibly to problems as they arise, because the needed resources (human and material) are not indigenous.

People with scientific and technical training (as measured by counts of Ph.D.'s, for example) are much more numerous than they were 50 years ago, and may be found in more countries. However, most of this growth is irrelevant to proliferation. A few countries which did not have scientific establishments have developed them, but most of these are not threats. Technical training is now much more specialized that it was formerly, and most of the specialties (abstruse theoretical physics and a variety of more recently developed technologies such as microelectronics) are essentially irrelevant to a proliferator. Innovative generalists are valuable, and remain scarce.

The difficulty of proliferation is shown by Iraq's failure, despite more than a decade of effort and substantial investment. Iraq is a medium-sized semi-developed country with a substantial Western-educated elite, heavily militarized, and tightly controlled by the secret police. Large numbers of Iraqis received technical training abroad, nearly all in fields chosen by their government. Iraq receives (when not embargoed) substantial oil income, nearly all in the hands of the government and available for military purposes. There was no effective enforcement of the export control regulations, so that Iraq obtained most of the Western technology it wanted. Great effort and expense brought Iraq within a few years of the nuclear threshold, but it is clear that effective enforcement of measures (chiefly export controls) against proliferation would have made its task much harder.

How to Prevent It

It is possible to prevent a second-tier nation from developing nuclear weapons. It

requires a number of measures, some of them new. Most importantly, it requires a serious commitment to the task, a willingness to pay the political and economic price (much smaller than the price paid by the would-be proliferator), and the recognition that the struggle will continue indefinitely. This is a microcosm of the effort which won the Cold War, requiring equal determination, greater persistence, but much lesser resources. Iraq was nearly successful because the West was not willing to pay any significant price—nuclear technology was exported in disregard of (or through loopholes in) the regulations.

I first define a second-tier nation more carefully. It is a nation whose scientific and technological establishment is not capable of training new people and developing new (for that country) technology in all fields in which it may be required. It is an importer of technical training, and maintaining its technical base requires infusions of outside expertise. To make a nuclear metaphor, these countries are sub-critical. In contrast, in a first-tier nation the technological base is self-sustaining, developing expertise and training people as required. It is evident that it would be impossible to prevent a determined first-tier nation from building nuclear weapons, given time and money. On the other hand, it may be possible to block a second tier nation entirely.

There are many possible routes to a nuclear weapon, each of which has branches and byways. The problem resembles that of finding a path through a mountain range with many passes and valleys. It is not possible to block each path with an insurmountable barrier. The goal of anti-proliferation efforts should be to place as high a barrier as possible in each path, including those apparently unlikely, in order to raise the price of proliferation above the resources (human and material) a would-be proliferator possesses and is willing to spend.

The first step towards preventing proliferation is to end the creeping declassification of nuclear technologies. This process began with the Smyth report in 1945, and has continued ever since. While most of the details have not been published, there can be no doubt that declassification makes a would-be proliferator's task easier, chiefly by directing its attention

away from dead ends and towards paths known to be successful. Scientists and engineers who have worked on weapons and related technologies must resist the temptation to show the world how clever they were, or to compare notes publicly with former adversaries. Since the early 1950's American nuclear secrecy has been more useful as protection against potential proliferators than against the Soviet Union, and the end of the Cold War has not diminished its importance.

There is a penumbra of militarily useful science and technology (not just nuclear) which is presently unclassified (and sometimes described in open publications and conferences), but which can be very useful to a nation lacking an indigenous technical base. Unfortunately, the security classification system evolved with the Soviet threat in mind. Technical information which is no longer "state of the art" among the world's most advanced nations is often routinely declassified. Yet these technologies (nuclear and non-nuclear) may be very useful to those nations posing a proliferation threat.

It would be prudent to extend some security protection to *all* weapons-related technology. Before the advent of formal classification schemes it was universally understood that military technology should not be released to outsiders. At present an "Unclassified" stamp removes this useful restraint, and is generally interpreted as both license and invitation to distribute information and technology freely. For example, technical articles on armor protection and on the dispersal of nerve gases have been published in open literature, with a few key words removed to maintain the pretense that the subject is basic research rather than war. A system of low level security protection (perhaps the present "Official Use Only") would effectively protect a broad technological base; it would avoid the cumbersome handling of formally classified documents, but would prevent the release of large quantities of officially unclassified but militarily useful data and technology.

The barriers to proliferation are as much political as technical. If all acknowledged nuclear powers were to observe a complete ban or moratorium on nuclear tests, that would increase pressure on a potential proliferator not to test. An explosion in the 10 kiloton range

would probably be detected, and recognized as such, wherever it occurred. A renegade nation certainly would feel no moral scruples against breaking such a worldwide ban or moratorium, but would recognize that breaking it would incur a high political price. The seriousness of this price might be comparable to that exacted after unprovoked aggression against a neighbor. A determined bully or aggressor nation would be willing to pay this price, but even it might therefore postpone its test until a suitable occasion, perhaps when the same price was being paid for other aggressive acts.

Postponement of a proliferator's first test would be of significant value. South Africa never tested its bomb, probably because of the political cost of such a test, and dismantled its nuclear weapons program before disclosing it. Without a test a nation could not be confident its bomb would work, and after the test there might be inadequate time to correct any flaws. Compare, for example, the different hypothetical threats posed by an Iraq whose first test (possibly only partially successful or unsuccessful) coincided with the invasion of Kuwait, to an Iraq which had completed the development of a bomb with a program of two or three tests over the previous years, and had time to build a small stockpile of proven weapons. Further, indefinite delay can lead to atrophy of the technical team required for further development, or even to dissipation of the aggressive impulse (the Soviet Union) or of the desire for nuclear weapons (South Africa). The American nuclear weapons program is mature; without any superpower adversary tests are of much less value to us than to a potential proliferator. While obtaining the agreement of China remains an obstacle, a worldwide test ban would contribute to the barriers against proliferation.

Anti-proliferation measures are founded on an export control regime of materials, devices, and technologies needed by a potential proliferator. Iraq circumvented this regime in two ways—by covert purchases of forbidden items, and by following paths to a weapon (such as calutrons for uranium isotope separation) which do not depend on forbidden items. Despite our best efforts, no export control list will ever be complete, or perfectly observed. This history emphasizes the importance of collecting intelligence, interpreting it percep-

tively, and acting on its implications. A close examination of a suspected proliferator's legal as well as illicit imports may reveal its true intent and activities.

It is necessary to deny a would-be proliferator any nuclear reactor. "Atoms for Peace" is an oxymoron—nuclear technology leads directly to nuclear weapons if in the hands of a state which chooses to use it in that manner. Research and power reactors can be readily used or modified to produce significant quantities of the isotopes used in nuclear weapons. While such use or modifications may be revealed by detailed on-site inspection, detection is not assured, and it is a simple matter to conceal these activities by delaying, diverting, or simply refusing entry to inspectors. On the other hand, a second-tier nation like Iraq would find it difficult to develop a reactor with its own resources, because there are too many engineering details and special materials involved; second tier nations generally import reactors rather than designing and building their own.

It is also necessary to deny a would-be proliferator any particle accelerator or related technology. Accelerators of moderate energy can be used in place of reactors to make isotopes for weapons.

The development of thermonuclear weapons from an atomic bomb presents a proliferator additional significant technical and material problems. Because of the much greater potential destructiveness of thermonuclear weapons, an anti-proliferation effort should be directed against this development in addition to its measures against the threshold atomic bomb. This requires strict controls on an additional set of materials and technologies.

The most important strategic material for a nuclear weapons program is technical training, and it should be controlled as such. Even if the physical production facilities for making nuclear materials are acquired, they will not work without knowledgeable people to maintain them and to solve the problems which arise. The most effective way to stop a would-be proliferator is to deny its citizens training in the relevant branches of science and engineering. A country without a broad base of technically trained people will stumble over a hundred small obstacles—it will find it difficult to rediscover all the unwritten little

secrets of any industrial process. A country with a broad base of trained people will be able to surmount obstacles. It will be able to develop for itself technologies which it cannot import, thus circumventing even the strictest export controls. The best indication of intent to build nuclear weapons may be a systematic program to send students abroad for technical training in relevant areas of science and technology.

The final tool against proliferation is the precision guided munition (PGM). In 1981 and again in 1991 use of PGMs set Iraq's proliferation efforts back by about a decade. A nuclear weapons program depends on a small number of valuable facilities. With adequate intelligence these present lucrative targets for PGMs. Some dispersal is possible, but a nuclear reactor, isotope separation cascade, fuel reprocessing plant, and weapons test or assembly facilities cannot be subdivided into a large number of dispersed components. They may be hardened by burial, but buried structures always have portals for ingress and egress; these portals are vulnerable to attack. If a nation like Iraq, Iran, or North Korea should develop a significant proliferation effort, we should not hesitate to destroy it.

Iraq

Iraq is the most serious case of attempted proliferation. Its intent has been proven and its leadership is aggressive. It is now defeated. The present close inspection regime is unique, and negates any short-term threat. It is important to recognize that the political will to maintain the trade embargo and to do political battle when Iraq obstructs inspection will not last indefinitely, and has weakened since the Gulf War. It is now essential to plan a permanent control regime on which we may depend for the indefinite future, after the present trade embargo is relaxed and Iraq becomes again a wealthy oil exporter. The aggressive intent of Iraqi regimes, and the political culture which produces it, must prudently be assumed to be immutable, and the control regime may have to be maintained for many decades, or even longer.

The present export control lists need to be extended to include a variety of items potentially useful in a nuclear weapons program which Iraq previously obtained legally. The right of unannounced intrusive inspection must be demanded, along with plans and capability for the re-imposition of effective sanctions (embargo enforced by air and sea blockade) in event of non-cooperation. The willingness to destroy facilities whose inspection is denied must be unambiguous. All significant Iraqi industrial imports should be monitored. If they are capable of military as well as civil use they should be accountable and subject to inspection in use.

Iraqi nationals should be denied foreign training in any of the sciences and branches of engineering related to nuclear weapons: physics, chemistry, astrophysics, materials science, and chemical, electrical, mechanical and nuclear engineering. All technologically advanced countries should agree to deny student visas to Iraqis to study these subjects. This is important in two ways—it will prevent their development of a self-sustaining technical establishment capable of developing new technologies and training people in them, and it will prevent them from obtaining training targeted to specific technological problems encountered in a proliferation effort. It is likely that most of the Iraqis who went abroad for technical training over the past 15 years were sent for the explicit purposes of the Iraqi weapons programs, chiefly nuclear; they did not travel on their own initiative to learn basic science or to train for jobs in civil industry.

North Korea

North Korea poses an advanced proliferation threat because of its nuclear reactors and likely fuel reprocessing plant. Its recent denial of access to IAEA inspectors and withdrawal from the Non-Proliferation Treaty are evidence of an active and advanced program to produce plutonium for nuclear weapons, although it is not possible to say how much progress they have made. They are too far along to be stopped by export controls. South Korea and the United States must decide how North Korea is likely to

use its forthcoming ability to build nuclear weapons—to obtain influence in the South, as explicit blackmail, or in an unprovoked first strike. This threat must be compared to the risks of a pre-emptive strike against the nuclear facilities, including resumption of a conventional Korean War. This judgement is political and military rather than technical. If the decision is made to strike it should be done as soon as possible, for delay can only increase the risk that the North will have a nuclear weapon available for retaliation.

Others

Iran, Syria and Libya pose longer term threats. Their resources are generally less than those of Iraq, and measures which are sufficient to control Iraq should also be sufficient to control them. Still other countries may be more advanced technically, but are not a threat to the world if they lack aggressive intent.

The Future

Now, and in the forseeable future, the threat is posed by second-tier nations. First-tier countries are not a proliferation problem: either they are already nuclear powers, or they do not wish to be. Second-tier countries can be stopped, provided there is the collective will to do so among the more advanced nations, and a willingness to pay the economic and political price. It is necessary to enforce effective and comprehensive export controls, obtaining the cooperation of all potential exporters. Technical training is the most important item to control. We must be prepared to maintain these controls indefinitely. This is not an easy problem, but it is political, rather than technical, and therefore is soluble if the political will exists. If these measures fail, then it may be necessary to take direct military action, as has twice been successfully employed against Iraq.