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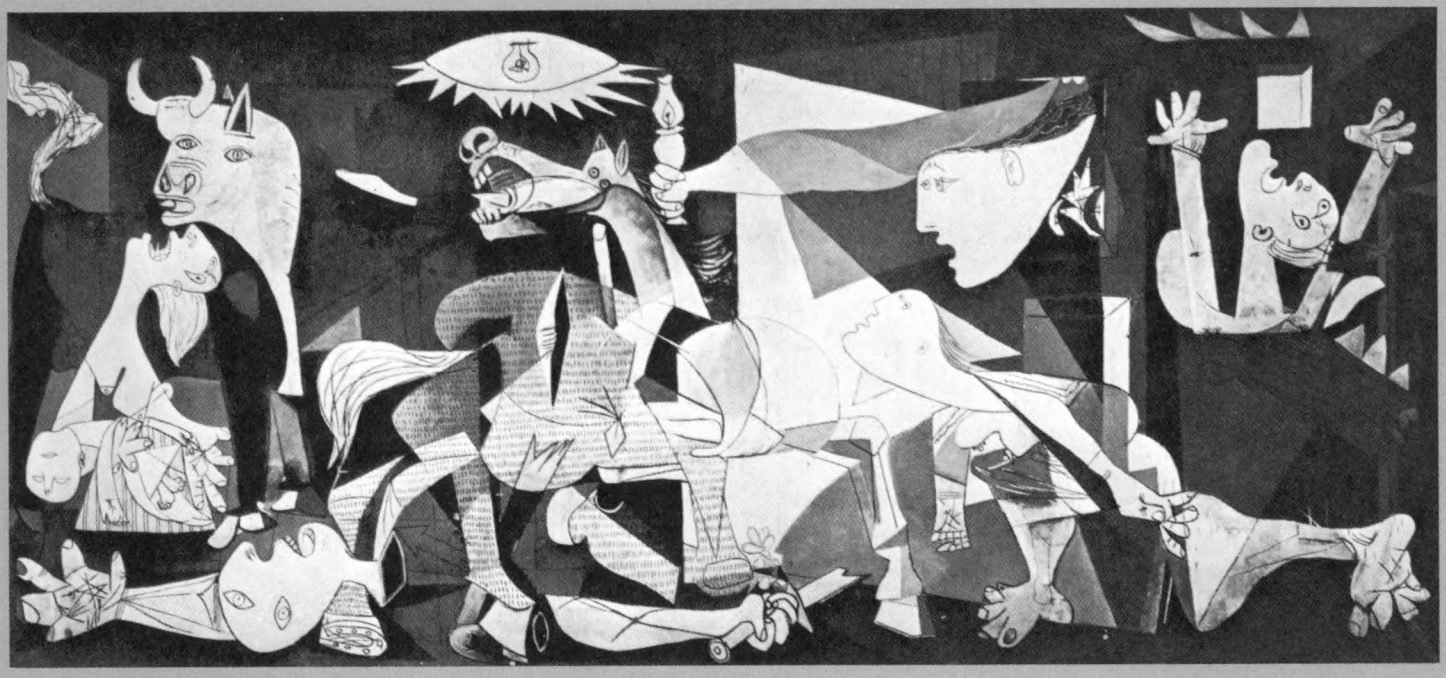

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COMMERCIAL NUCLEAR POWER AND NUCLEAR PROLIFERATION

by Steven J. Baker

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Commercial Nuclear Power and Nuclear Proliferation

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Commercial Nuclear Power and Nuclear Proliferation

INTRODUCTION

In the last year concern has grown over the implications of nuclear energy exports: intense competition among advanced industrial countries to export nuclear reactors, fuels, and fuel processing facilities has increased fears about accelerating the acquisition of nuclear weapons capabilities in Third World countries. This concern has reportedly generated an examination of the possibility of a common approach to the problem of nuclear exports on the part of some of the nuclear exporting nations--the United States, Britain, the Soviet Union, France, West Germany, Canada, Japan, and Italy.

In the United States, congressional concern has resulted in a proposal to revise the standards and procedures governing nuclear exports. Opposition to these unilateral restrictions is strong in various parts of the bureaucracy, in the Joint Committee on Atomic Energy, and in the nuclear industry.

This paper surveys the development of the international nuclear energy market, with particular reference to America's role in this process. The emphasis is on the interplay between the commercial promotion of nuclear energy and the proliferation of nuclear weapons, between domestic and foreign policies, and the implications of domestic energy policy choices for future nuclear weapons proliferation.

COMMERCIAL NUCLEAR POWER AND NUCLEAR PROLIFERATION

India has demonstrated in practice what has always been recognized in principle: a nuclear weapons option may be spun-off from a peaceful nuclear energy program.[1] Whereas the nuclear energy programs of the first five nuclear weapons states were the outgrowth of essentially military programs, India's point of departure was a civil nuclear program[2] and as such represents an important and portentous variant in nuclear proliferation.

The danger inherent in the international spread of nuclear energy was recognized from the beginning. The Soviet Union and the United States have sought to deal with this danger in two interrelated ways: generally to create the international political conditions in which there would be little incentive to exercise a weapons option; and more specifically, to erect an international web of technical dependency relationships that would allow them to control the domestic nuclear development of other nations.

Neither of these approaches has been completely successful. By maintaining nuclear weapons as a permanent part of the calculus of national power, the superpowers have perpetuated the incentive for other nations to consider a nuclear option. The export of nuclear technology has given the superpowers some influence in the promotion of certain lines of nuclear technology, but has been less effective in blocking lines of technology which they did not favor. These

policies have not diminished the incentives to go nuclear, but they have accelerated other nations' acquisition of nuclear weapons capabilities.

These trends are likely to be accentuated in the future as a result of the widespread commercialization of nuclear energy. The political and economic conditions resulting from the creation of an international nuclear energy industry have become important parameters that further complicate the task of nuclear arms control, parameters that tend to be underestimated in arms control studies. Domestic politics and national economic interests are involved in any nonproliferation measure. It is important to understand how far this process has gone and why, as a prelude to considering the policy alternatives in a world in which nuclear nonproliferation objectives are increasingly conditioned by economic considerations.

THE INTERNATIONAL NUCLEAR MARKET

The present contribution of nuclear energy to meeting the world's demand for electricity is still rather limited. While there are hundreds of small research reactors around the world, there are only about 130 power reactors producing electricity in about eighteen nations, numbers that will double as new reactors start up in the next four or five years.[3] Similarly, nuclear fuel plants are still relatively few in number: for example, there are only thirteen nations

in the world that have either experimental or industrial scale fuel reprocessing facilities.[4]

These figures represent little more than the prototype stage of the nuclear industry; until the dramatic increase in the price of oil following the Arab-Israeli war of 1973, nuclear power was at best marginally economically competitive with conventional energy sources. But in the wake of the oil crisis most of the world's industrial nations projected heavy increases in reliance on nuclear power,[5] and for the first time nuclear energy was being promoted in very small-sized plants as an economically viable source of electricity for developing countries.[6]

The international market for nuclear energy technology, hardware, and nuclear fuels is projected to grow enormously. Estimates of the dollar value of this market vary, but all are impressive: one, an industry set of projections for the period 1971 to 1985, estimates a $250 billion investment in reactors worldwide, with an additional $45 billion to be invested in uranium mining, milling, enrichment, fuel fabrication, and reprocessing.[7] The existence of this kind of international market, and the commitment by governments and private firms of enormous financial resources to exploit this market, constitute a set of political facts of the highest importance. Energy supplies have moved to the center of national and international political concerns. Political desires for maximum national independence in energy (or more

aptly, maximum diversity in forms of dependence) often conflict with national economic priorities--national independence promises to be more expensive in the short run than reliance on imported fuels. And in a competitive international environment, profit-oriented strategies of nuclear industries, some of which are extensions of multinational corporations, may not coincide with the political and economic goals of governments but must nonetheless be taken into account by government policy makers.

The result is an international situation marked by intense commercial competition among technologically advanced nations, an atmosphere that is scarcely conducive to arms control measures. Even where there is substantial government commitment to the objective of nuclear nonproliferation, subgovernmental bureaucratic and political groups and non-governmental organizations may be pursuing interests that in effect contradict arms control objectives. Arms control policies must increasingly adjust to a situation in which "low politics" kinds of considerations involving economic welfare impinge on "high politics" kinds of considerations involving national security: increasingly, we are compelled to adjust to what has been called the "vulgarization of the atomic enterprise."[8]

COMMERCIALIZATION OF NUCLEAR ENERGY IN THE UNITED STATES

American policies are primarily responsible for the creation of an international nuclear market with its present characteristics. Although nuclear science was international before World War II (scientists of thirteen nations worked on the Manhattan project[9]) the manner in which science was harnessed to industrial capacity to achieve political goals is perhaps peculiarly American. The wartime pattern of interpenetrating government bureaucracies, university research facilities, and industrial enterprises was perpetuated into the postwar period. This made the development of nuclear energy a kind of prototype of the phenomenon loosely termed the "military-industrial complex."

The United States was instrumental in shaping the competitive international environment that frustrated attempts at achieving international controls on nuclear weapons. The permanent American advantage in nuclear technology that the Baruch Plan would have given to the United States was clearly unacceptable to the Soviet Union, and had it been accepted by the Soviet government, it is not clear that it would have been acceptable to the American Congress.[10] In the absence of an international regime, nuclear weapons became a permanent part of the calculus of national power, with the emergence over time of successive nuclear weapons states.

The peaceful atom became no less a tool of national policy than the atomic bomb, and American predominance in

the non-communist world helped shape the international spread of nuclear energy. While national security concerns dominated, calculations of national commercial advantage were present from the first in nuclear technology. Even during World War II the issue of postwar commercial rights to civil nuclear applications contributed to the breakdown in cooperation between the United States and Great Britain in 1943[11] and later the question of postwar patent rights complicated the problem of the repatriation of French scientists who had worked on bomb-related projects in Canada.[12]

In the postwar period, the American government became committed to the development of the peaceful uses of nuclear energy. While the 1946 McMahon Act includes the exhortation to "further private enterprise," the dominant role assigned to the federal government in nuclear affairs was unprecedented in peacetime. Civil applications of nuclear science were judged to be essential to continuing work on the atomic bomb, since nuclear scientists tended to justify their work on the latter in terms of their contributions to the former.[13] American industry was initially reluctant to become involved in nuclear projects, given the scant prospects for immediate industrial applications and rigid government controls. But ample government financial support, especially in research and development, helped overcome industry's initial diffidence.[14] This same government investment in civil nuclear research and development helped create a permanent government interest in

promoting the commercialization of nuclear energy in order to redeem the promises made to the private sector and to redeem the government's own considerable commitment.[15]

The creation of the Atomic Energy Commission was crucial. The emergence of an effective, expansive bureaucratic actor assured that the interests of nuclear energy would be pursued within the government.[16] And the political support of important Congressional leaders, concentrated in the Joint Committee on Atomic Energy, provided a critical link between private interests and bureaucratic policy.[17] These several sources of nuclear policy were often at odds with one another over questions like public versus private power.[18] But there was also a minimal agreement on a common goal: that nuclear energy should be promoted to the point where it was a commercially viable technology, a dependable alternative to coal and oil as a means of generating electricity. Despite persistent differences, the agreement of disparate groups on this general goal was sufficient to give American nuclear energy policy in the 1950s and early 1960s a certain coherence and effectiveness. It was this policy that allowed the United States to establish itself as the dominant force in the world nuclear energy market.

THE UNITED STATES AND THE INTERNATIONAL SPREAD OF NUCLEAR ENERGY

These domestic interests are sufficient to account for the government's attempts to promote the commercialization of nuclear energy, but not its internationalization. Indeed, in the wake of the rejection of the Baruch Plan and with the 1946 McMahon Act, the trend was in the opposite direction. Under the policy of nuclear secrecy, nuclear sharing with Great Britain and Canada was terminated and the United States consciously sought to preserve its nuclear weapons monopoly through a policy of restricted access to nuclear technology.

It is generally conceded that the policy of nuclear secrecy was a failure. The Russian detonation of an A-bomb in 1949 and the British A-bomb detonation in 1952 confirmed this proposition.[19] But at a distance of twenty-five years, the conclusion that the United States should actively promote the international spread of nuclear reactors because the Soviet Union and Great Britain had exploded nuclear weapons requires some explanation.

In the narrowest sense, nuclear secrecy had failed to prevent others from acquiring nuclear weapons. But in order to develop independently a nuclear weapons capability, the Soviet Union and Britain had had to make enormous economic and technical exertions, many of which merely duplicated American efforts. Their achievements were as much as anything an example of the staggering costs of breaking the American nuclear monopoly, not the ease of doing so. Indeed,

this seems to have been the conclusion of those American policy makers, especially in Congress, who opposed aiding allies like France in acquiring nuclear weapons and opposed simply giving nuclear weapons to allies.[20] What could not be prevented could at least be subjected to substantial penalties in terms of resources and effort.

And yet, the United States did proceed to promote nuclear energy internationally and thereby help to reduce the technical barriers and material costs of acquiring a nuclear weapons option, a policy difficult to reconcile with the arms control objectives with which it was justified. In fact, the Atoms-for-Peace proposal was only in part a reflection of arms control objectives. Some of the convergent influences were completely contrary to arms control aims, others only partially or potentially so, but the internal contradictions of the Atoms-for-Peace approach were evident from the beginning.

The most contradictory element that contributed to this approach is clear in the genesis of the proposal itself within the Eisenhower Administration. In the course of the policy debate over whether or not the United States should build and deploy the H-bomb, Robert Oppenheimer argued that the U.S. public should be fully informed of the dangers of thermonuclear weapons; he and other scientists urged that strict nuclear secrecy be ended. This original appeal for "candor" in confronting the dangers of the H-bomb was

transformed over a series of breakfast conferences at the White House into the Atoms-for-Peace proposal of December, 1953.[21] In part, the Atoms-for-Peace proposal helped to render politically acceptable in America and the world the government's decision to go ahead with the H-bomb.

This is not to say that Atoms-for-Peace did not have an arms control objective, with its proposal for the creation of a pool of fissile materials withdrawn from the weapons stocks of the nuclear powers. And of course, the creation of an International Atomic Energy Agency to regulate these fissile materials was a major international arms control initiative. It was the failure to achieve the first of these goals, with the consequent relegation of the IAEA to the status of a marginal technical agency, that is most frequently criticized, a failure for which American policy was partly responsible.[22]

But it is curious that even though the international political framework that would have made the Atoms-for-Peace approach a constructive arms control initiative was not realized, the international promotion of nuclear energy continued; the result was that the pace of nuclear weapons capabilities was accelerated as nations gained greater access to plutonium produced in power reactors and to weapons relevant technologies.[23] This apparent paradox was the result of the convergence in the Atoms-for-Peace proposal of an arms control rationale and domestic political interests.

It became a tenet of American policy that the spread of nuclear technology was inevitable and therefore that it was wise to seek to control that which could not be prevented. Atoms-for-Peace was designed to spread American controls internationally by means of spreading American nuclear technology and hardware. The political support generated for the proposal in America rested on the compatibility of the government's international political objectives with the nuclear industry's commercial interests.

Agreement on the "inevitability" of the spread of nuclear technology left only the timing of its spread as a relevant political consideration: convinced of the benefits of nuclear energy and the utility of its spread under American tutelage, there seemed to be no good reason not to accelerate the process.[24]

In retrospect, the assumption that the spread of nuclear technology was inevitable seems open to question. The development and spread of nuclear technology are better understood as flowing from prior political choices rather than as the result of "inexorable laws governing the flow of scientific information." The postwar priority of nuclear physics in governments' research and development allocations, the choice among various reactor types, the size, number and location of power reactors and fuel processing plants around the world are primarily the outcomes of political processes, and were promoted and subsidized by governments.

Furthermore, by accelerating the spread of nuclear energy the United States was helping to undermine its own political position. It was assumed that reliance on American-supplied nuclear energy technology and nuclear fuels would give the United States additional political leverage. But the greater the role nuclear power came to play in a nation's energy mix, the less politically tolerable continued dependence on America became. Again, this is easier to see in retrospect than it was in the mid 1950s. But the kind of hubris reflected in these earlier American policies is not altogether lacking in more recent nuclear export initiatives.

Secretary of State Dulles' version of the inevitable spread of nuclear energy was sensitive to both domestic and international politics. Before a Congress wary of international inspections, Dulles argued that nuclear plants would spread first under American promotion and controls, but that sovereign nations would not long tolerate inspection by other sovereign nations. The IAEA was essential, Dulles argued, "...if we want long-term and safe foreign markets for our nuclear materials and technology."[25]

The American concern about international exports under controls is sometimes explained as a function of American fears that the Soviet Union was poised to make a major effort in spreading its political influence through the export of civil nuclear technology.[26] While credible in the political

atmosphere of the time, there is little in the record to suggest that this was in fact the Soviet intent. The Soviet Union has consistently been more reluctant to export nuclear technology and hardware than the United States, and when it has done so it has most often been to nations whose political subordination to the Soviet Union acted as a control on the uses to which the technology would be put.[27]

British, not Soviet, nuclear exports seem to have been the dominant preoccupation of American policymakers. The British nuclear energy program commanded relatively impressive resources in the immediate postwar period. With more pressing energy needs than the United States, Great Britain specialized earlier and gained initial successes with its natural uranium fueled reactor type.[28] By 1952-3 the British seemed a step ahead of the American nuclear industry--and were aggressively seeking commercial outlets overseas. American industry opposed the policy of nuclear secrecy as the major obstacle to commercial nuclear power in the United States, and as an impediment to meeting foreign competition. This was the commercial challenge to which the Atoms-for-Peace proposal was designed to respond.

By the mid 1950s the lag in nuclear power installation in America threatened the nuclear industry with an excess in productive capacity while the potential overseas market was estimated at $30 billion.[29] Electricity produced by conventional fuels was too cheap in America for nuclear power to compete economically, but overseas, especially in

Western Europe, the costs of conventional fuels were higher and fuel supplies were largely imported. Thus, Americans looked to foreign markets to bolster a flagging domestic nuclear industry. And the American government, with its own enormous investment in nuclear energy, was prepared to actively promote the commercialization abroad of nuclear energy. Under the Atoms-for-Peace program, bilateral agreements were concluded with forty-three nations between 1955 and 1958, involving the transfer of research and power reactors subsidized by the United States government, in addition to exchanges of technology and personnel.[30] All of this required the revision of American statutes regarding nuclear energy which were progressively liberalized, especially in 1954 and 1958, to permit and encourage the commercialization and internationalization of nuclear energy.[31] While these bilateral agreements fell short of the exaggerated expectations of the American nuclear industry, they did succeed in stimulating foreign interest in nuclear energy despite the lag in American nuclear power installation.

Where the most obvious tensions arose between the policies of international commercial promotion and arms control, the tension was dissipated in favor of commercial promotion. Thus when the Euratom countries refused both direct American inspection and international inspection under the IAEA, the United States allowed them the right of self inspection.[32] This was a politically important

concession that rendered the IAEA inspection system still-born but opened an attractive international market to the American nuclear industry.[33]

In practice, the prevalence of American technology on the international nuclear market did have positive implications for arms control: American enriched uranium fueled reactors produce only about one-half the plutonium that natural uranium reactor types do; American pressure vessel reactors can only be refueled with costly and obvious reactor shut-downs, making it difficult to hide any diversion of fissile materials from the fuel elements; American reactors have been dependent on the AEC for fuels and are subject therefore to periodic inspection. All of these are positive contributions to nuclear arms control and may have had some effect on the choice of reactor types by various nations in the spate of power reactor orders of the late 1950s and early 1960s. Those governments and utilities interested in long-term independence in nuclear technology may have favored British natural uraniums fueled reactor types,[34] but the American government's willingness to offset the disadvantages of dependence with attractive financial packages seems to have been crucial in winning several of the early international competitions.[35]

Finally, there is little evidence to suggest that these arms control implications played any major role in the American selection of reactor types to pursue commercially. The successful light water reactor was a spinoff

from the submarine reactor program. Alternatives were eliminated as a result of technical and economic criteria. Like the British, American industries simply exported what they had to sell.[36]

Arms control and commercial promotion, at best convergent interests but never really the logical ends and means of a coherent policy, have grown increasingly incompatible. Despite the failure of nuclear power to emerge as economically competitive without government subsidies until the late 1960s, [37] an international nuclear industry was established. This industry is generally composed of the nuclear power divisions of huge electronics companies, many of which operate as subsidiaries or licensees of multinational corporations based in the United States.[38] In the major industrial countries, the predominance of licensing is a result of the political preference of governments for the highest possible degree of national independence in nuclear technology; licensing of a national company seems politically preferable to direct foreign investment. There is considerable competition to export to countries without established nuclear industries not only among American firms, but between them and former licensees (e.g. German competition for reactor orders in Argentina and Brazil), or even with firms that are presently licensees (e.g. French competition for Iranian reactor orders). There is also competition between different lines of reactor

technology (e.g. the American enriched uranium fueled reactor versus the Canadian natural uranium fueled reactor). A kind of global division of labor may be emerging in which, for example, Japanese licensees of American multinationals might compete for smaller sized reactor exports to Southeast Asia while leaving the larger reactors to American firms.

This emerging pattern of competition is symbolic of broader political changes that are transforming the American-dominated postwar international system. Nuclear energy is politically attractive for advanced industrial countries because of the independence from energy imports it affords. Nations which must import their nuclear power plants and fuels see this as a way of increasing national independence through diversifying energy sources. As international competition in the nuclear industry intensifies, it reduces the prospect for exercising political influence through nuclear exports. Despite the "interdependence" of the industrialized nations, there is little evidence of a perception of common interest that could make nuclear exporters into a cartel with the political influence of OPEC.

But these industrial competitors have at least one thing in common: they have an interest in the pursuit of their economic activities with a minimum of political restrictions. This interest is shared in part with their national governments: restrictions that reduce the international competiveness of a nation's nuclear industry

diminish the prospects for significant foreign trade agreements, and perhaps reduce the industry's ability to meet pressing domestic energy needs as well. The political pressures exerted by this kind of constellation of government and private interests have been important and will become increasingly so in the future. The question is whether arms control objectives, already eroded, will become completely submerged in the future by commercial objectives.

THE COMMERCIALIZATION OF NUCLEAR POWER AND THE NPT

International commercial competition has always been an obstacle to attempts to control conventional armaments. But it was not until the NPT negotiations that nuclear arms control measures confronted commercial calculations openly and directly. And it was in relation to the NPT that the corrosive effects of the commercialization of nuclear energy on the prospects for nuclear arms control became most evident.

As originally tabled in 1967, the joint Soviet-American draft NPT emphasized the restrictions to be placed on the Non-Nuclear Weapons States (NNWSs) and down-played the obligations of the Nuclear Weapons States (NWSs). Even as revised, the Treaty remains an unequal one in which obligations and responsibilities are clearly unbalanced. To some extent, this imbalance mirrors the present international system in which power is differentially distributed. But

many governments saw the Treaty as an attempt to legitimize and perpetuate these international disparities: these governments needed no additional reason to reject the NPT.

Other NNWS governments were willing to overlook the political inequalities of the Treaty because of their support for the arms control objective that the Treaty embodied, but even some of these had reason to object to the commercial effects of the NPT which were so clearly discriminatory as to add economic injury to political insult. It was argued that the inspection of the nuclear industries of the NNWSs would put them at a competitive disadvantage vis-a-vis the NWSs and non-parties to the Treaty. The fear was voiced that industrial espionage would be facilitated by opening domestic industries to IAEA inspectors, especially where such inspectors might be citizens of countries with which there were long-standing political differences. There were complaints that the Treaty would have the effect of restricting the international exchange of nuclear technology and information with the result of retarding the nuclear progress of the NNWSs.

While the United States had consistently hailed the economic advantages of nuclear energy, the American-backed NPT seemed particularly insensitive to the commercial aspects of nuclear technology. Understandably, there was some suspicion that the superpowers were pursuing their economic advantages in the guise of nuclear arms control, and conse-

quently many nations demanded revisions of the draft Treaty to mitigate its most serious economic defects.[39]

In the NWSs, there was a tendency to reject these kinds of objections as masking a desire on the part of certain nations to preserve nuclear weapons options. The vigor with which some of these arguments were voiced by nations like India and Brazil whose nuclear industries have only marginal roles in the world market made these arguments suspect--all the more so when they were linked to advocacy of the right to peaceful nuclear explosives (PNEs).[40] But these arguments were also made by nations like West Germany, Italy, and Japan and were perfectly consonant with their national economic concerns. Their adoption of these arguments was ultimately most persuasive in convincing the United States and the Soviet Union to give additional emphasis to Artivle IV's exhortation to promote the international exchange of civil nuclear technology.

The demands of the NNWSs went far beyond this kind of generic commitment on the part of the NWSs. A relevant example is the set of proposals advanced by the Italian government in August 1967, which was influential in the elaboration of recommendations by the Conference of NNWSs in 1968.[41] The thrust of these proposals was to give the NNWSs signatories to the NPT concrete economic and technical rewards for accession to the Treaty: they sought to commit explicitly the NWSs to transfer civil nuclear technology to

the NNWSs and in particular to guarantee enriched uranium fuel supplies to NNWSs at less than market cost.[42] These proposals were in line with the aims of the original Atoms-for-Peace proposal which would have furthered disarmament by creating a pool of fissile fuels taken from nuclear weapons stocks, and would have gone a long way towards redressing the imbalance of obligations under the NPT. The political inequalities would have remained, but the unacceptability of these inequalities would have been mitigated by the concrete benefits derived from participation in the Treaty.

The NWSs rejected all of the more specific commitments but the American government was not completely unresponsive to the demands of teh NNWSs. President Johnson offered to place all of America's nuclear industry under IAEA inspection except for any part explicity related to national security,[43] an offer echoed by Great Britain but not by the Soviet Union. This gesture reduced the force of the argument that the United States was seeking to maintain its commercial advantage at the expense of competitors. However, since inspections were conditional on the entering into full force of the IAEA inspection system elsewhere, they have yet to be applied to American industry. The nation for which such inspections are presumably the least objectionable, the United States, will be the last to be inspected rather than the first.[44]

The NNWSs' refusal to assume the burden of producing and supplying nuclear fuels for NNWSs is particularly interesting and important. The AEC has had a monopoly on the

non-communist world's upply of commercial enriched uranium and has consciously manipulated this monopoly as a tool of American nonproliferation policy. Thus, the United States successfully blocked efforts on the part of Euratom countries to build on enrichment plant in 1957-58 by manipulating terms and prices of American-supplied uranium.[45] Maintaining a fuel monopoly under the aegis of the NPT would have been a logical extension of this policy.

But the commercialization of nuclear power, dominated by the American LWR, resulted in enormous increases in projected demands for enrichment services. For the NWSs to assume the obligation to provide fuel services for all the NNWSs signatories to the Treaty could have quickly amounted to a commitment of several billion dollars per year on the part of the AEC requiring greatly expanded plant capacity; and of course, the AEC would be under strong political pressure not to charge commercial rates for these obligations assumed under international treaty--just as the NWSs are obligated to provide PNEs at less than market cost under the NPT's Article V. The United States government was understandably reluctant to undertake this kind of responsibility. These projected increases in demand led American and foreign industrial interests to eye the uranium enrichment field as an attractive commercial proposition. The prospective commercialization of this last area of government nuclear monopoly made it an unlikely area for international commitments on a noncommercial basis.

This kind of economic consideration precluded any American government use of its enrichment monopoly as a tool of its arms control policy: the means adopted for spreading American controls, the commercialization of nuclear energy based on American fuel supplies, began to envelop the goal of arms control. The commitment of Article IV to the "fullest possible exchange" of nuclear energy technology implies an obligation to share nuclear technology.[46] But in practice, market forces are increasingly the only mechanism for international nuclear technology transfers.[47] The possible economic costs of Treaty adherence were easy to imagine; the economic benefits were hard to discern. The result was to weaken the appeal of the NPT to those nations which might have been susceptible to economic inducements. Even where these nations signed and eventually ratified the Treaty, it was with the kind of profound political reservations which undermine the Treaty's broader goals.[48]

POLITICAL CONTROLS AND ENRICHED URANIUM

The long-term impact of the NPT on proliferation has yet to be seen. But one short-term impact has been to help to reduce obstacles to the spread of weapons relevant technologies, particularly in the nuclear fuel sector. The acceptance of IAEA safeguards by NNWSs makes it politically difficult for NWS parties to the Treaty to resist demands for purchases of fuel processing and enrichment technologies.[49] Interest in

these technologies has grown as the debate on the Treaty sensitized many nations to the importance of nuclear technology to national independence and economic well-being at the same time that it called into question established patterns of dependence, particularly on the United States, for supplies of enriched uranium for power reactor fuels.[50]

By the end of the 1960s, the goal of providing commercially viable nuclear power was essentially achieved: nuclear power was marginally economical in many nations and promised to be even more economical in the future. One of the consequences of this was the tendency for American nuclear energy policy to lose its relative coherence; the generalized support from disparate groups seemed to crumble. The scientific community began to split over the wisdom of nuclear power as environmental and safety concerns grew. The AEC vascillated between promoting the nuclear industry and promoting its institutional interests through increased vigilance in its regulatory functions. The JCAE was increasingly ambivalent about the proper degree of government participation in nuclear industrial undertakings while industrial circles grew restive under government controls now that government promotional activities seemed less essential. This loss of policy coherence was to have important arms control implications, especially in the field of uranium enrichment.

The American international inspections system depended on American dominance of the uranium enrichment sector: the right to inspection has not been tied to the nuclear reactor but to the fissile fuels supplied to run the reactor. Anticipating a huge market at home and abroad, in the late 1960s the American industrial interests began to press the government to allow a private takeover of the $2.3 billion gaseous diffusion enrichment plants that the AEC had operated as a government monopoly since the end of World War II.[51] The advent of the Nixon administration provided a sympathetic political context in Washington, and it became established administration policy to move towards the "privatization" of the enrichment facilities.[52] Under increasing public pressure, the AEC seemed inclined to exercise more regulatory controls over the industry under which the nuclear industry increasingly chafed; but the future of the AEC itself was in question and it tended to be relatively acquiescent on the question of the future of the enrichment facilities, prepared to entertain a number of possibilities.[53] The most open opposition came from members of the JCAE, some of whom seemed reluctant to see the government lose a monopoly and others who feared that privatization would result in higher enrichment charges and reduced economic viability of nuclear energy.[54] The result was a period of uncertainty in American enrichment policy in which foreign customers of the AEC could not be sure of the ability or willingness of the government to continue to supply their

fuel needs. Two successive price rises with the promise of more to come made the search for alternatives to continued dependence on the United States all the more attractive.[55] The Nixon Administration's responsiveness to domestic political interests was matched by its indifference to the international consequences of its acts.

American policy changes coincided with a technological breakthrough in Western Europe that provided a possible alternative to continued dependence on the United States for enriched uranium supplies. In 1970, after a lengthy process of negotiations, the British, Dutch and West Germans signed an intergovernmental agreement to establish a consortium for the production of enriched uranium on a commercial basis in competition with the United States.[56] The technology used in this process has important proliferation implications: consuming much less electricity than the gaseous diffusion process, centrifuge separation will be economical on virtually any plant scale and could be concealed in a modest-sized laboratory. In the early 1960s the American government was sufficiently concerned about the implications of this technology to persuade the British and German governments to classify their centrifuge research, and to halt private American research on this technology by 1967.[57] But when the tripartite consortium was announced, the American nuclear industry began to pressure the government to give them access to classified research on the centrifuge and on gaseous

diffusion--and argued that the failure to do so would put them at a competitive disadvantage vis-à-vis their European counterparts.[58] The government responded with the Domestic Access Program through which American industries have launched research and development efforts aimed at possible future commercial enrichment ventures.[59]

The tripartitie consortium was not the only international alternative to American enriched uranium to emerge in the years since the NPT came into force. The French relaunched their effort to get European backing for a commercial scale gaseous diffusion plant based on French technology; a French Commissariat à l'Energie Atomique policy goal from the mid-1950s, such a plant had become a national imperative after the 1969 decision by President Pompidou to abandon the French national natural uranium fueled reactor.[60] The Commission of the EEC favored this kind of project as a means of reviving Euratom.[61] And France sought to open its Eurodif Association to non-governmental interests in hope of luring support from the private sector in West Germany and Britain where the governments were already committed to the rival centrifuge process.[62] But in the end, France was forced to go ahead with the financial backing of Italy, Belgium, Spain, and at the last moment, Iran.[63]

The evolution of the French gaseous diffusion project from a venture under the sponsorship of the European communities to one including Spain and Iran is symbolic of the

corrosion of established political ties through international commercial competition in nuclear energy. Intense nationalism had already deprived Euratom of its integrative impact. As one more step in this process, the French gaseous diffusion project passed from a context of maximum potential international political commitments (and therefore, also maximum potential mutual constraints) and became merely another international economic arrangement with minimal political commitments (and therefore, minimal political constraints).

France has also entertained proposals for exporting enrichment plants to Canada and Australia.[64] The tripartite consortium has likewise speculated on future exports of centrifuge plants. In order to head off the development of overseas competition, since 1971 the American government has offered to share enrichment technology with friendly countries.[65] The Soviet Union, South Africa and other nations are entering the commercial enrichment field.[66] Uranium enrichment facilities are clearly becoming an international commercial commodity, and technological innovations like laser isotope separation will become a part of this intense international competition. These trends promise not only to remove any technical barriers to the proliferation of nuclear weapons capabilities but actually to encourage appetites for acquisition of such capabilities.

This kind of commercial competition among industrial countries has undermined arms control policies. For example, in 1973 and 1974 the United States intensified its efforts

to convince the Japanese government to ratify the NPT as part of its larger political objectives in Asia. One of the arguments used by American spokesmen was that it might be impossible for the United States to continue to supply the Japanese nuclear industry with enriched uranium fuels if the Japanese government failed to ratify the NPT.[67] But since the terms for American enriched uranium supplies were being stiffened and the future reliability of American commitments was open to question, the Japanese were already seeking alternative sources of supply, especially for the longer term.[68] At this point the Soviet Union approached the Japanese with an offer to provide enrichment services on terms that were commercially very competitive with those of the United States; but the Soviet Union apparently also demanded prior NPT ratification by Japan.[69] The French had also approached the Japanese government to gain Japanese financing of a French designed plant to be built in Australia.[70] Meanwhile, Japanese utilities became major customers of the French-backed Eurodif Association[71] without Japan having to meet any political preconditions like NPT ratification.

The loss of the American monopoly on the commercial supplies of enriched uranium has eliminated the principal American lever in influencing other nations' nuclear energy policies. This American policy was finally discredited completely in the summer of 1974 when President Nixon offered nuclear reactors and fuels to Egypt and Israel apparently

without any demand that they first ratify the NPT.[72] This offer was an affront to the Japanese and others who were being asked to assume more stringent kinds of commitments, and was an initiative that seemed to negate any advantages to be gained by adherence to the NPT by rewarding those who chose to reject the Treaty.

The congress was sufficiently concerned about the proliferation implications of reactor and fuel exports to the Middle East to reserve the final approval of any such transfers. In the preceding months, Secretary Kissenger had repeatedly offered to share uranium enrichment technology with other industrial nations as an inducement for cooperation in dealing with the oil crisis: the reactor offers to the Middle East may have been part of this broader policy. Administration spokesmen defended those proposed exports with arguments grounded in the conviction that nuclear technology is still a useful means of extending American political and economic influence. It was argued that 1) if we do not do it someone else will--someone less interested in exercising bilateral controls to prevent the abuse of this technology and hardware; that 2) this will increase the political dependence of these nations on America and therefore allow the United States to influence the uses to which the technology may be put; and that 3) such exports are good for business.[73] These same kinds of arguments are often used to justify conventional arms sales to volatile areas.

The first point is probably true, and this is the heart of the problem. International commercial competition has a propulsive effect, accelerating the pace of acquisition of nuclear weapons capabilities and reducing the kind of political restraints that can be exercised. It is not clear whether the initiative for nuclear reactors came from the Egyptians or potential suppliers, nor it is clear how nuclear power fits into Egyptian economic development plans. It does seem clear that the "someone else" in question is more likely France than the Soviet Union, although the latter may step in the wake of the initial check on the American offers.[74] Competition among political allies like the United States, France, West Germany, and Canada in the nuclear field resembles more and more the competition in conventional armaments exports, with even more potentially disastrous effects on international stability. This kind of competition suggests that if nonproliferation objectives are to be met, the agreement of all states capable of exporting nuclear capabilities must be obtained; the United States might be advised to spend less time negotiating with countries like France.

As to the second point, the use of nuclear technology to make others politically dependent on the United States seems increasingly chimerical. Under the best of circumstances, the successful exercise of control over other nations' undesirable nuclear programs--as opposed to the

successful promotion of nuclear energy--has been dependent upon a broad pattern of political interdependence, an effective American monopoly of a relevant technology, and the American government's willingness to use that monopoly for political purposes.[75]

The third rationale seems to be a more potent explanation for these proposed exports, and one that is relevant for other nuclear exporters' policies as well. With serious balance of payments problems, the United States naturally looks to its advanced technologies as a source of overseas earnings. International competition for such exports is likely to make governments less particular about the long-term political implications of their actions and more included to exaggerate the short-term political benefits. Industries are eager to compete for purely economic reasons. But the arms control consequences of these policies continue to grow in importance. International competition in reactors, enrichment facilities and fuel reprocessing plants is only one step short of the point where a nation like France sells nuclear weapons on the open market.[76]

The prospects for the successful exercise of political restraint through nuclear exports are dim at best. Only two things seem relatively certain: that the United States has an economic interest in nuclear exports, and that these exports will increase the nuclear weapons capabilities of countries like Egypt and Israel.

PROLIFERATION AND DOMESTIC POLITICS

The Indian detonation raises the problem of the mix of domestic and foreign policy calculations in a decision to go nuclear. Because of the international impact of the Indian explosion, it is assumed that the decision to demonstrate a PNE was the result of international political calculations of the highest kind. And yet, there are reasons to believe that more mundane domestic political considerations may have been almost as important; one is tempted to say that the test was allowed to take place in spite of its international implications.[77] What is important is that possession of a nuclear capability can become a dynamic element in the decision-making process, influencing estimations of the incentives and disincentives of going nuclear.

Arms control analyses tend to focus on the international milieu as the prime policy determinant, and anti-proliferation policies usually aim at achieving international conditions that would logically decrease incentives to go nuclear. This approach has two kinds of inherent problems: the superpowers' consensus on a stable nuclear deterrent as an arms control objective in practice re-enforces some other nations' incentives to go nuclear; and to the extent that a decision to go nuclear may reflect domestic political conditions, nonproliferation strategies focusing on the international milieu may be only marginally relevant or even counterproductive.

Japan is a case in point. An examination of Japan's exposed position, a neighbor of two nuclear powers in an area where others may emerge, suggests that Japan may seriously consider a nuclear option. Only Soviet and Chinese nuclear disarmament could remove these Japanese strategic concerns. Japan has a nuclear weapons capability based in part on nuclear energy technology imported from the United States. Therefore it is argued that the credibility of American nuclear deterrent commitment to Japan must be maintained lest the Japanese go nuclear. But in fact, domestic political opposition to a nuclear option is strong in Japan among those who are most opposed to reliance on the United States for its nuclear deterrent--the left opposition parties, the scientific community, and public opinion in general. This domestic opposition constitutes the major restraint on those few in Japan who would like to have nuclear weapons. American policies favoring a Japanese conventional military build-up and emphasis on a nuclear deterrent through the Security Treaty are rationalized in part because of their antiproliferation effects. But these policies find most support in Japan among the only political elements that favor nuclear weapons--among some of the military and right-wing factions of the ruling Liberal Democratic Party.[78] In effect, American policies tend to favor those Japanese who are least committed to the goal of nonproliferation.

The application of the general principles of nonproliferation to particular domestic political situations may have equivocal effects.

The domestic political determinants of a nuclear option are inherently more difficult to influence from the outside than the international determinants. American arms control policies have been justified in part as designed to give the United States leverage over the domestic development of nuclear energy in other nations by making them dependent on it for nuclear technology and fuels. But in practice, the United States has been most successful in promoting nuclear energy. The American development of atomic energy establishments in dozens of nations has helped to raise the international level of sophistication in nuclear technology to the point where there are alternatives to dependence on the United States. The existence of these alternatives makes sanctions like nuclear fuel cut-offs a high cost option in political and economic terms with little prospect of long term success.[79] Without this kind of leverage, nuclear exports become an economic exchange like any other.

International commercial competition is part of a broader process through which the political bases for the successful exercise of American influence have been eroded. This erosion and the general trend toward diversity in the international system are crucial because the relevance of expedients like safeguards to the problem of nuclear

proliferation depends on the political milieu in which they operate. Safeguards are only as effective as the political bonds that link the members of the international system. Even in the immediate postwar period, French dependence upon and confidence in the United States were not sufficient to prevent the French from persisting in a nuclear weapons program despite strong American opposition. The improvement of national technical capabilities was a principal means of asserting French independence.[80] In the future nations whose political perceptions and interests are as different from America's as Egypt's, Israel's, and Iran's will be even less restrained by American political pressures than France was in the past, and will use their technical capabilities to pursue their independent interests.

But whereas American policy in the past made the French nuclear option a costly policy choice, present American policy in effect reduces the costs and difficulty of acquiring a nuclear option, exporting on near commercial terms not only weapons-relevant nuclear technology but advanced delivery systems as well. These policies should be reevaluated.

From the beginning the "nuclear dilemma" has been that the peaceful uses of nuclear technology cannot be promoted without promoting nuclear weapons potential. One must be convinced of the overwhelming advantages of the former in order to run the risks of the latter. Since the international political conditions that would render benign the spread of

nuclear technology have failed to materialize, it is necessary to reassess the desirability of nuclear energy from an arms control perspective.

Here there is a convergence between arms control advocates and those at the domestic level who have attacked nuclear energy because of their concerns for public health and safety, and environmental degradation. Analysts who in the past have been concerned with the problem of devising adequate safeguards to detect the diversion of fissile materials by governments from nuclear plants to weapons purposes have now turned their attention to the necessity of devising security measures to prevent the diversion of fissile materials from the nuclear industry by criminals or political dissidents.[81] The opportunities for such mischief, with international ramifications, will grow as the commercialization of nuclear energy continues, especially when and if plutonium becomes a major fuel in the nuclear industry.[82] The need for adequate nuclear security measures must be added to the need for protection against risks to public health and safety, uncertainties regarding nuclear plant performance, the threat of environmental degradation, and the unresolved problems of waste disposal, further reducing the public acceptability and economic competitivity of nuclear energy.[83]

ENERGY POLICY AND NONPROLIFERATION ALTERNATIVES

Up to now, governments have persistently exaggerated the promise of nuclear energy and down-played its negative potential. The energy crisis has made nuclear power more attractive

than ever before, and resulted in projected increases in future dependence on nuclear power. But there are alternatives to these policies that would have both profound domestic economic and political implications as well as a direct bearing on nuclear proliferation prospects. There are indications of interest in some of these measures in Congress.[84] Alternatives range from the most general reassessment of the viability of heavy dependence on nuclear energy in meeting future energy requirements, to more modest attempts to shape the development of nuclear power in ways more consistent with arms control objectives, to limited attempts to monitor the development of independent nuclear weapons capabilities abroad. These latter, more limited kinds of measures are those that depart least from established policies and therefore least threaten established interests; they have attracted the most attention from arms control advocates and have the best chance of being enacted in some part.

The political commitment to greater independence from imported energy sources, the existence of domestic political and economic interests in favor of commercial nuclear energy, and an increasingly competitive international system make it unlikely that more restrictive policies in nuclear energy will be enacted. Only a convergence of domestic political opposition to nuclear energy and the according of a higher priority to the threat of nuclear proliferation could offset the impact of problems like the energy crisis. At present,

such a convergence seems unlikely. But in considering broader, if less likely, kinds of alternatives, the definition of that which is possible may be widened.

1) The measures with the most comprehensive effects in terms of limiting nuclear proliferation are those that would retard the international increase in dependence on nuclear energy. These measures would help impede the growth of bureaucratic and economic interests which form the necessary infrastructure for a nuclear capability and which might serve as a basis of political support for a nuclear weapons option. But most important these steps would make acquiring a nuclear option most costly and obvious. The economic obstacles could be crucial, particularly where investment in national fuel processing and enrichment plants is concerned. In an inversion of the logic that has prevailed up to now in NWSs, in the future a nuclear energy program may be necessary to justify the costs of a nuclear weapons option.[85]

As an alternative to increased dependence on OPEC, nuclear energy represents a kind of "technological fix" for an essentially political problem. But the economic viability of nuclear energy is open to question. It is only with the enormous increases in the price of oil in the last year that nuclear power clearly became economically competitive, and those oil prices must remain high to maintain the competitiveness of nuclear power. But ironically, the oil crisis

has also helped to reduce the attractiveness of nuclear energy by making it increasingly difficult to finance. In America and elsewhere the relatively lower operating costs of nuclear plants is accompanied by higher initial capital investment,[86] and high interest rates have made nuclear power prohibitively expensive to finance. Sixty percent of the nuclear power plants on order or planned have been cancelled in America in the last several months.[87] Economically hard-pressed countries like Britain, Italy, and France are also finding it difficult to finance their projected increased dependence on nuclear power.[88]

The United States has embarked on a limited sort of nuclear moratorium and other nations may be compelled to do likewise. Without massive government intervention, the American nuclear industry is headed for a marked decline. Simply as an arms control measure, it might be opportune to make a political virtue out of economic necessity and proclaim a nuclear moratorium, including the suspension of the export of nuclear reactors and fuel reprocessing technologies.[89]

While each nation has its own distinctive energy problems, this kind of example could help to reduce the image of the "inevitability" of high rates of dependence on nuclear power. Sweden has already set an example in this respect, reducing not only projected growth in energy consumption as well.[90] A moratorium might also help reduce the competetive export drive in politically sensitive nuclear hardware. Without government help, the American nuclear industry would find

it difficult to compete on the international market and other governments might be less inclined to promote the exports of their own hard pressed nuclear industries. But most importantly, this kind of measure would provide a political basis for more restrictive policies in exporting nuclear technology. Unlike its policies regarding nuclear weapons, the United States would be setting the example for the conduct it wants other nations to follow.

The American government is currently under pressure to come to the aid of the domestic nuclear energy industry; the Kissinger proposal to artifically maintain the high price of oil is calculated in part to make investment in alternative energy sources like nuclear power economically viable. The government is also under pressure to give more direct support to the power industry to help finance nuclear installations; without such support, utilities will be unable to meet the goals the President has set for installed nuclear capacity by the year 1985.[91] Should either of these two policies fail to win congressional approval, there could be a positive arms control impact. An optimal solution would discriminate against nuclear power while encouraging the development of alternative energy technologies.

2) A second range of alternatives involves the shaping of the increased dependence on nuclear energy in ways more compatible with arms control objectives. Here, two different courses might be followed. One course, outlined above, would be to reduce government support for nuclear energy and

thereby reduce its economic competitiveness; this would limit future increases in dependence on nuclear power. The other would be to de-commercialize nuclear energy by direct government takeover of the nuclear industry and the subjection of nuclear energy to rigid nonproliferation criteria. Government takeover alone is no panacea; government participation and government regulation of the nuclear industry is high everywhere and has almost universally resulted in government promotion. Government control and government commitment are needed to limit the degree of future dependence on nuclear energy and to more carefully restrict the export of nuclear reactors, fuels, and related technologies.

Domestic measures of this kind include resisting the pressure to recycle plutonium in power reactors and refusing to accelerate the commercialization of the plutonium-fueled fast breeder reactor.[92] In terms of fuel supplies, the ideal would be to maintain the role of governments as the sources of enriched uranium through terms and prices that are low enough to discourage private competition while being high enough to discourage heavy dependence on nuclear energy.

International analogues of these measures would be a refusal to fabricate plutonium fuels for other nations and perhaps reversion to the policy of buying back plutonium produced in American-supplied reactors. The "internationalization" of enrichment plants and reprocessing facilities

would also help limit proliferation. These kinds of proposals seem more likely if governments dominate the fuel cycle than if private economic interests do so.

International cooperation might take the form of a cartel of nuclear exporting nations. This would limit competition among these nations on the basis of a political consensus to seek to limit proliferation. For example, a cartel might prohibit the exports of enrichment technology and fuel reprocessing plants and in return furnish fuels supplies on a secure, long-term basis. Informal agreements among nuclear exporters might achieve the same general aim with fewer negative political problems vis-a-vis clients, but without a formal cartel, it would be difficult to maintain the integrity of the agreement over time.

The principal obstacle here is, of course, the lack of clear political commitment to the priority of nonproliferation which is a prerequisite to the success of these kinds of policies. As energy and international economic problems have grown in importance, nonproliferation has receded as a concern of policy makers. But solutions to energy and economic problems that run counter to the objective of nonproliferation will be very short-sighted. The energy crisis is a part of a more general emerging "new international economic order" based on demands for a "global redistribution of wealth." The inevitable conflicts attending these international adjustments can only be more difficult to cope with when they are accompanied by further nuclear proliferation.

Without an overarching political commitment to nonproliferation, sub-governmental units often work at cross purposes. Here there is a convergence between arms control advocates and those who seek to exert more effective political controls on bureaucratic actors. In the United States, the division of the functions of the AEC into two government agencies may serve to reduce the influence of proponents of nuclear energy in the government and strengthen political controls, with positive collateral effects on nonproliferation.

The assertion of tighter government controls over the international nuclear industry would at a certain point have to face the problem of multinational corporations. Nuclear technology transfers by firms like General Electric and Westinghouse may not always be subject to government review, especially as commercialization proceeds. Government and private industry have differed in their perceptions of the demands of national security in the past,[93] and may be expected to do so more frequently in the future. Here there is a convergence of interests between arms control objectives and the attempts at the national level, in the UN, and in bodies like the EEC and OECD to regulate the activities of multinational corporations.

The emphasis here is on the control of nuclear hardware rather than scientific information, but the fundamental objections to these kinds of controls go back to the roots of the debate over nuclear secrecy. The argument that it is

impractical to seek to restrict information is truer today than in the immediate postwar period. The aim of a more restrictive policy cannot be to prevent a nation from going nuclear; the information necessary to do so has long been available publicly. The more modest aim is twofold: to increase the difficulty and, in particular, the costs of acquiring a nuclear weapons option independently; and to reduce the responsibility of America and other nuclear technology exporters in the process by which other nations move towards a nuclear weapons capability. Whether such modest aims are justified by the political and economic costs of a more restrictive policy is open to question.

But in the determination of the wider costs and benefits of such a policy, another argument made against the restriction of scientific information must be weighed: it is argued that the restriction of scientific information, and by implication the restriction of private economic activity, is wrong in principle, inimical to a free society and to technological progress. These considerations must be weighed against the threat to freedom implicit in the proliferation of nuclear weapons and of the compromises of freedom manifest in nuclear safeguards and security measures. The costs of present policies may ultimately exceed the present costs of alternatives.

3) Attention to international inspections has intensified as the 1975 NPT Review Conference has neared. Safeguard inspection agreements like those negotiated under the NPT must

be considered as one of the more limited kinds of anti-proliferation measures.[94] Inspection by the IAEA is designed to detect diversion, not to prevent it.[95] But the threat of early detection acts as a deterrent to the diversion of fissile materials to weapons programs. Safeguards are political expedients, not technical solutions to the problem of nuclear proliferation. The commitment assumed by adherence to the NPT and submission to international inspection is a political constraint and can, therefore, make a contribution to nonproliferation. But the principal danger of safeguards is that they might become an end in themselves instead of a step towards an evolving, cooperative international system in which nuclear weapons are less relevant.

The institution of an international safeguards inspection system may indicate a more cooperative, integrative kind of international system. But present demands for more stringent safeguards, coupled with pressure for uniform international nuclear security measures, suggest a rather less optimistic set of expectations. More restrictive measures on the export of nuclear technology are also suggestive of a fundamental pessimism. But it seems unlikely that such measures would have any effect but to confirm already established trends, and would not in themselves cause a negative evolution of the international system.

Over time it seeks likely that safeguards procedures may provide an unacceptable degree of technical assurance. This will in part reflect the size of the operations being monitored: even materials accounting systems which are 99 percent effective, applied to processes through which pass tons of enriched uranium or plutonium, will have a percentage of materials-unaccounted-for (MUF) amounting to dozens of warhead equivalents.[96] While such accounting procedures could become more precise with technical improvements, the increments in precision are likely to be gained only with disproportionate increases in the costs of the operations. In other words, in the future, safeguards may be less effective, or more costly and more intrusive--and conceivably, all three. In a commercially competitive situation, a difference of even a few percent of the total cost of production can mean the difference between economic viability and non-viability. The temptation for governments and industries to cut corners, unrelated to any intent to deviate materials for weapons purposes, will be very strong. Once the integrity of the safeguards system is compromised, the possibilities for deviation of various kinds will increase enormously.

But more importantly, in a world in which the incentive to go nuclear is far from lacking, future nuclear weapons forces are likely to arise either from the unilateral denunciation of the NPT by a nation undetected in any improper deviation, or by a nation not party to the Treaty. This is

not a problem for safeguards: it is a broader kind of political problem. The dominant trends in international politics are such that the political will and technical capability of the nuclear exporters are less effective as restraints, while in countries that import nuclear technology, the political power and technical competence of those groups which might favor a future nuclear option are growing. Under these circumstances, safeguards may simply serve to facilitate and hasten the creation of nuclear weapons options in a score of additional nations.[97]

There are no absolute barriers to acquiring a nuclear weapons force, but there are relative obstacles. There is a range of policy alternatives that could slow the pace of the evolution of nuclear capabilities, particularly in those countries which have yet to achieve a completely independent civil nuclear energy program. Whether the time gained by adopting these alternatives would be wisely used depends on an even wider range of considerations. Current trends favor the subordination of nonproliferation concerns to international economic calculations and domestic political considerations. But the ways in which the choices of advanced industrial countries in international economic and national energy policies affect arms control prospects should still be borne in mind. While it may be tempting to hope that the institution of an international inspection system under the NPT marks the beginning of a positive new era in international

politics, there are also reasons to fear that the problems of the nuclear age have really only just begun.

Footnotes

1. See for example Victor Gilinsky, "Military Potential of Civilian Nuclear Power," in Bennett Boskey and Mason Willrich, eds., Nuclear Proliferation: Prospects for Control (New York: The Dunellen Co., 1970).

2. The difference between the Indian nuclear program and the French program may be one of degree rather than kind. But it does seem that France moved much more directly towards a nuclear explosion than India did. For example, only two years elapsed between France's completion of its plutonium extraction capability and its first nuclear explosion. In the Indian case, ten years separate these two steps--years that were devoted to developing a wide range of programs not strictly related to a military option.

3. B. M. Jasani, "Nuclear Fabrication Plants," in SIPRI, Nuclear Proliferation Problems (Stockholm, 1974), Tables 11.a, 11.b.

4. B. M. Jasani, "Nuclear Fuel Reprocessing Plants," ibid., Table 4. Besides the nuclear weapons states, they are Argentina, Belgium, Czechoslovakia, West Germany, India, Italy, Japan and Spain.

5. See the OECD projections of 50 percent dependence on nuclear generated electricity by 2000 in Nuclear Industry, January 1975; and Geoffrey Greenhalgh, "World Nuclear Programmes," Nuclear Industry International, Vol. 20, No. 226 (March 1975), pp. 164-71.

6. James A. Lane, "The Impact of Oil Price Increases on the Market for Nuclear Power in Developing Countries," Bulletin of the International Atomic Energy Agency, Vol. 16, No. 1/2 (1974), pp. 66-71.

7. Denis M. Slavich and Charles W. Snyder, "Meeting the Financial Needs of the Nuclear Power Industry," Nuclear Engineering International, Vol. 20, No. 226 (March 1975), pp. 161-63.

8. Bertrand Goldschmidt, "International Nuclear Collaboration and Article IV of the Non-Proliferation Treaty," in SIPRI 1974 op. cit., p. 204.

9. Bertrand Goldschmidt, L'Aventure Atomique (Paris: Fayard, 1962), pp. 46-47.

10. See for example Leneice N. Wu, "The Baruch Plan: US Diplomacy Enters the Nuclear Age," Subcommittee on Foreign Affairs, U.S. House of Representatives (Washington: GPO, August 1972). That the climate of opinion in the House was

conducive to the adoption of this kind of proposal may be seen in the July 1946 attack of the HUAC on scientists accused of seeking to end military restriction as part of a plan to form "some kind of world government." See Richard G. Hewlett and Oscar E. Anderson, Jr., The New World: 1939/1946 (University Park: The University of Pennsylvania Press, 1952).

11. Hewlett and Anderson, op. cit., pp. 468-69, 496-98, 523-24, 527, 529; and Goldschmidt, 1962, op. cit., pp. 51-53.

12. The British seemed most concerned with securing French patent rights while the Americans were concerned about a breach of military security through contact with Communist Frederick Joliot-Curie, the head of the Commissariat à l'Energie Atomique. Hewlett and Anderson, op. cit., pp. 331-33.

13. For example, it was considered essential for morale purposes that the Los Alamos lab conduct research on the "constructive applications of nuclear energy" while pursuing its main objective of weapons design and research. Hewlett and Anderson, op. cit., p. 626.

14. When Du Pont exercised its option to give up the management of the Hanford Works immediately after the end of the war, General Electric was persuaded to step in to take over these responsibilities only after the government committed itself to providing $10 million for the construction of a G.E. nuclear research facility at Schenectady. Ibid., p. 629.

15. For a treatment of the American pattern of government ties with private industries in comparison with other countries, see J. E. Hodgetts, Administering the Atom for Peace (New York: Atherton Press, 1964), esp. pp. 90-93.

16. For a legal analysis of the AEC's role see Georges Fischer, L'Energie Atomique e Les Etats-Unis (Paris: R. Pichon et R. Durand Anzias, 1957).

17. See for example Thomas Morgan, Atomic Energy and Congress (Ann Arbor: University of Michigan Press, 1956); and for JCAE-AEC ties see Robert A. Dahl and Ralph S. Brown, Jr., Domestic Control of Nuclear Energy (New York: SSRC, 1951); and Harold P. Green and Alan Rosenthal, Government of the Atom (New York: Atherton Press, 1963).

18. See for example Thomas E. Murray, Nuclear Policy for War and Peace (New York: World Publishing Co., 1960), Ch. 7.

19. Harold Nieburg, Nuclear Secrecy and Foreign Policy (Washington: Public Affairs Press, 1964), p. 70.

20. William B. Bader, The United States and the Spread of Nuclear Weapons (New York: Pegasus, 1968), pp. 26-35.

21. Robert J. Donovan, Eisenhower: The Inside Story (New York: Harper and Row, 1956), Ch. 13. Nieburg cites five different kinds of pressures that led to the relaxation of the policy of nuclear secrecy: 1) the military's desire for more flexibility in dealing with allies regarding nuclear defense; 2) British pressure for nuclear weapons cooperation with the United States; 3) American scientists' demands for greater freedom of communication in research and for new arms control initiatives; 4) the dissatisfaction of industry with government restrictions; 5) the competitive impulse provided by the independent development of nuclear energy in Britain and Canada. Nieburg, 1964, op. cit., p. 73.

22. While Soviet suspicions blocked the creation of an IAEA fissile materials pool, the United States bilateral agreements and the United States-Euratom Agreement also undercut the functions of the IAEA. But in a more general sense, the failure of nuclear energy to develop as rapidly as expected reduced the international role of the IAEA--and was attributed by some to American policies. Both the 1960 McKinney Panel report to the JCAE and the Smyth 1962 Report to the State Department were critical of American policy. The first attributed the failure of American policy to the government's lack of support for commercial nuclear power, and the lack of a massive international joint research effort; the second blamed the failure on the generally bad economic prospects of nuclear energy which made other nations unwilling to compromise their sovereignty through international collaboration with the United States. Nieburg, 1964, op. cit., p. 115, 121.

23. Arnold Kramish, The Peaceful Atom in Foreign Policy (New York: Harper and Row, 1963), p. 18, 230.

24. There are several examples of the doctrine of inevitability. In 1957 the AEC Chairman Strauss expressed the view that "With time the operation of atomic reactors all over the world is inevitable. It can no more be prevented than one could restrict or prohibit the use of fire."[a] A decade later, this idea was still current. "...there are inexorable laws governing the flow of scientific information. Nuclear technology is like any scientific skill; it soon becomes the hallmark of a modern society. ...this skill finds its inevitable place in industrializing and modernizing societies..."[b]

[a] Cited in Warren Donnelly, "Commercial Nuclear Power in Europe: The Interaction of American Diplomacy with a New Technology," U.S. Congress, Jouse

Sub-Committee on National Security Policy and Scientific Development Affairs (Washington: GPO, December 1972), p. 47.

[b] Bader, op. cit., p. 21.

There is a tendency here to subordinate politics to technology without appreciating the dynamic interrelations of the two terms: while in the short run, political decisions are circumscribed by technological parameters, in the longer run technological parameters are the result of prior political decisions. Unlike fire, nuclear energy does not occur naturally; it is the result of a complex set of interrelated material and intellectual structures. Far from being an infallible indicator of "modernity," a nation's level of attainment in nuclear technology is indicative more than anything else of the amount of money devoted to acquiring sophistication in nuclear technology.

25. Cited in Nieburg, op. cit., p. 86.

26. Ibid., p. 69; Goldschmidt, 1962, op. cit., p. 102.

27. Kramish, op. cit., p. 64, 172-87. Goldschmidt, 1962, op. cit., pp. 139-43. Even less plausible are the claims that the US was merely following the example of Russia, Britain, Canada, France, and Japan, closely followed by Sweden, Switzerland, West Germany, and Communist China.[a] Of these nations, in 1953 only Britain can be considered a serious commercial rival in the American dominated world market.

[a] Nieburg, op. cit., p. 86.

28. The successful operation of the Calder Hall reactor from October 1956, seemed to establish Britain's primacy in nuclear energy.[a] Considerations of commercial competition with the British were of sufficient concern to lead one analyst to conclude that American willingness to finance Euratom research but not the OEEC's nuclear energy agency research was due to Britain's participation in the latter but exclusion from the former.[b]

[a] Henry Nau, National Politics and International Technology (Baltimore: The Johns Hopkins Press, 1974), p. 131.

[b] Donnelly, op. cit., p. 114.

29. To compensate for this shortfall, the 1956 McKinney Panel Report recommended the promotion of 1,000,000 kwh abroad by 1960, more than projected American domestic nuclear capacity. "Report of the Panel on the Impact of

the Peaceful Uses of Atomic Energy," Joint Committee on Atomic Energy, Vol. 1, January 1956 (Washington: GPO, 1956), p. 97.

30. Basically, there were two types of agreements--research and power agreements. Their success was a result of the United States government's willingness to 1) allocate fuels; 2) adopt firm pricing policies; 3) give authority for American companies to deal directly with foreign customers, without the AEC as intermediary; 4) and provide financial aid for fuel purchases.[a] There were also generous terms for research reactor purchases--half the cost (up to $350,000) was an outright gift, the other half financed through the United States Import-Export Bank. By 1960 when these terms expired, twenty-six reactors had been exported under these provisions.[b] The terms of power reactors were more of a problem since the principle had been established that the United State's government should offer foreign customers no better terms than domestic customers. Since there was political opposition in Congress to direct government financing of electric power, especially among conservative Republicans, the terms for the export of power reactors were less attractive than for those of research reactors. The lack of interest abroad in importing American power reactors under these bilateral terms led to the special arrangements under the United States-Euratom Joint Program in 1958.

[a] Donnelly, op. cit., pp. 38-44.

[b] Kramish, op. cit., p. 179.

31. These revisions were the result of the kinds of pressures described above (cf. footnote 21). While they liberalized the terms of nuclear secrecy in order to promote commercialization, they also allowed limited sharing with Great Britain in nuclear weapons technology. While Dulles and Eisenhower were prepared to extend this nuclear aid to France, at least in nuclear submarines, the JCAE was adamantly opposed, the result being a policy of discrimination among allies that retarded French nuclear development but provided them with the political determination to persist. Bader, op. cit., pp. 26-35; Nieburg, op. cit., p. 184. See also George Ball, The Discipline of Power (Boston: Little, Brown, 1968), pp. 96-107.

32. The European nations demanded collectively the same right to self-inspection that Britain and Canada enjoyed under their Tripartite Agreement with the U.S. While some in Congress undoubtedly saw this concession as a contribution to European unity, Dulles at least made it clear that Administration support for Euratom went only so far as promoting nuclear energy, explicitly rejecting Euratom's broader

political aspirations.[a] By blocking European efforts at the independent construction of a uranium enrichment facility, while promoting LWRs dependent upon enriched uranium fuels, the American policy promoted a Community nuclear industry dependent upon America.

[a]Donnelly, op. cit., pp. 75-76.

33. The United States-Euratom Joint Program was enthusiastically supported by the American nuclear industry because of the stimulus it was expected to give the commercialization of nuclear power.[a] The government responded with especially attractive terms for reactors--of the total $350 million estimated capital cost of the proposed 1,000 NWe installed capacity to be exported, the U.S. government arranged for financing $135 million through the Import-Export Bank; the foreign utilities were expected to finance the $150 million equivalent to conventional plant costs, and the difference of about $65 million was to be variously financed.[b] Given the projections in A Target for Euratom--goals based on American data that could be met only through imports of American technology and hardware--the United States expected an enthusiastic response. While European Governments were interested, European utilities were concerned about the high costs and uncertain performance of nuclear plants--and while deadlines for submitting projects were extended, eventually only three reactors were brought under the aegis of the program, one of which would have been built even without this aid.[c] Industry sources in America were very disappointed--by 1960, it seemed that commercial nuclear energy was farther away than ever before.[d] But the generally negative assessment of the Joint Program must be seen in a broader perspective: the export of three LWRs created a certain momentum, and those supplied to France and West Germany were crucial in determining future national choices among various types of reactors. This program also gave an impetus for the formation of overseas subsidiaries, joint ventures, and licensing arrangements between American nuclear industries and European counterparts which were to have important long term implications.

[a]U.S. Congress, Joint Committee on Atomic Energy Hearing, "Proposed Euratom Agreement," 85th Congress, 2nd Session, 1958, p. 267, 329.

[b]Donnelly, op. cit., p. 105.

[c]Nau, op. cit., p. 138.

[d]Chauncy Starr in Bulletin of the Atomic Scientists, XVI, January 1960, p. 31.

34. This may have been true of the Italian Latina plant and of the Japanese Tokai Mura plant. The desire for independence should not be equated, of course, with the desire for a nuclear weapons option. It should also be noted that until 1964, the economic advantage of the American over the British reactor types was not well established; reactor orders of the natural uranium fueled type after that date (like Argentina's) are much more indicative of a desire for nuclear independence since they are taken against the background of the general consensus on the economic superiority of the American enriched uranium fueled reactor type. See for example Duncan Burn, The Political Economy of Nuclear Energy (London: Institute of Economic Affairs, 1967).

35. Regarding these early reactor export competitions, see Lee C. Nehrt, International Marketing of Nuclear Plants (Bloomington: University of Indiana Press, 1966).

36. For an early treatment of the arms control implications of exporting LWRs see Arnold Kramish, "A Reexamination of the Nuclear Proliferation Problems Presented by World-wide Requirements for Enriched Fuel: Relating the February 1965 Options to Today," RAND, P-3923, August 1968.

37. These subsidies take various forms. In the United States, the most important are the direct subsidization of nuclear research and development; government production of enriched uranium at prices that do not reflect the full market value and without capital commitment on the part of industry; government provision of waste disposal services; the insurance subsidy provided through the provisions of the Price Anderson Act; and increasingly the cost of safeguards and security measures that are partly borne by the government. See Ralph Nader, "Who Benefits," The Center Magazine, March/April 1975, p. 33.

38. Because nuclear technology is so capital intensive and the profits have been as yet rather slim, only the largest enterprises can maintain themselves in the nuclear field. In Europe, this has led to government sponsored consolidations resulting in markets dominated by a single British government consortium, one major and one minor group in France both working under license to American multinationals, and a giant German group. Of the major industrial countries, Japan and Italy show the least degree of concentration in the nuclear sector--but in each case the three or four major combines in the nuclear field operate as licensees of foreign companies.

39. See for example Achille Albonetti, "Accesso degli Stati militarmente non-nucleari--che hanno rinunciato alla produzione, all'acquisto e all'utilizzazione delle armi nucleari--alle technologie per l'utilizzo dell'energia nucleare," Nazione Unite, Conferenza degli State non-dotati di armi nucleari, giugno 1968.

40. For representative Indian statements see U.S. Arms Control and Disarmament Agency, Documents on Disarmament, 1967, pp. 229-39, 430-40. For Brazialian statements see ibid., pp. 225-27, 368-72.

41. "Final Communique," Conference of Non-Nuclear Weapons States in Ibid., pp. 677-84.

42. Ibid., pp. 312-15.

43. Ibid., pp. 613-15.

44. A practical objection to immediate inspection of the United States nuclear industry is the technical and financial strain it would place on the IAEA.

45. Lawrence Scheinman, Atomic Energy Policy in France under the Fourth Republic (Princeton: Princeton University Press, 1965), pp. 76-79.

46. ACDA Deputy Director Adrian Fisher described Article IV as constituting a "legal obligation of the parties to cooperate" in peaceful nuclear technology. See ACDA, Documents on Disarmament, 1968 (Washington: GPO, 1969), p. 14.

47. Goldschmidt in SIPRI, op. cit., p. 205.

48. In signing the NPT, the governments of West Germany, Italy and others felt it necessary to make lengthy statements of their own interpretations of the Treaty.

49. The United States now faces this problem with the reported requests of the Iranian government for nuclear fuel reprocessing facilities.

50. While European countries had begun to question reliance on the United States for fuel supplies at least as early as the mid-1960s, Japan didn't give much official attention to the problem until 1971 when the JAEC set up an enrichment study group. See the Japan Atomic Energy Commission White Paper (Tokyo, 1973), pp. 51-59.

51. This has been under study by the AEC and the Atomic Industrial Forum since 1966. In June, 1968, the AIF released a report urging the prompt transfer of enrichment plants to the private sector.[a] Industry's enthusiasm began to flag

as the terms of takeover became clearer. As early as 1970, an industry spokesman noted that the more that was learned about the enrichment process the less interested industry was in an immediate takeover.[b]

[a] USAEC, Annual Report to Congress, 1968 (Washington: GPO, 1969), p. 31.

[b] Nuclear Industry, December 1970, pp. 19-20.

52. Nuclear Industry, November 1969, p. 3. The Administration's adoption of this policy fit its budgetary priorities in that the burden of financing needed plant expansion would fall to private industry.

53. The AEC was caught between the White House and the JCAE on the question of the future of the enrichment facilities. While a majority of the Commissioners supported the Administration move, albeit with reservations, the Commissioner closest to the JCAE dissented. See the statements of Seaborg et al. and Ramey in Nuclear Industry, July 1971, pp. 6-9.

54. The JCAE's Hosmer Came to favor a TVA-like government enrichment corporation;[a] Holifield opposed the privatization plan in part because of the negative effects he judged this would have on the economic competitiveness of nuclear power.[b] Over time, industry leaders seemed to come to a similar conclusion since ultimately financial considerations compelled them to abandon for the time being any attempt to take over the government's gaseous diffusion complex.[c]

[a] Nuclear Industry, October 1973, p. 3.

[b] Nuclear Industry, February 1970, p. 38.

[c] Edward Cowan in The New York Times, July 17, 1974;

55. In hearings before the JCAE, an AEC spokesman admitted that these price hikes had been enacted by the AEC without consultation with the State Department or foreign customers. U.S. Congress, Joint Committee on Atomic Energy, Congress, 1st Session, 1971, Part 2. p. 13.

56. International Herald Tribune, March 5, 1970. Initially, the consortium involved little technical exchange: essentially three national prototype plants were built with technological sharing planned for later stages. See Edward Wonder, "Uranium Enrichment in American-European Relations: The Politics of Providing New Enrichment Capacity," October 1974 (mimeo).

57. It has been argued that this attempt at controlling an undesirable line of technological development simply reduced American capabilities without impeding the development of the European capabilities. See Victor Gilinsky and Bruce L. R. Smith, "Civilian Nuclear Power and Foreign Policy," RAND: P-3592-1, February 1968.

58. The New York Times, June 22, 1971, p. 39.

59. Nuclear Industry, July 1971, pp. 5-10. This program was designed to give as many as twenty-five American industries access to gaseous diffusion and centrifuge technology so as to allow them to evaluate the prospects for a private enrichment venture. The stringent requirements for access dampened the interest of industry and they demanded more open policies on the part of the AEC.

60. Atomo e Industria, November 1, 1969.

61. The Commission eventually recommended a four stage program that would have included centrifuge technology as well as gaseous diffusion. See Achille Albonetti, "l'Economie Energetique et la Politique Nucleaire Europeenne" (Paris: Institut Atlantique, mars 1972), pp. 74-75.

62. Donnelly, op. cit., p. 134.

63. Clyde Farnsworth in The New York Times, January 1, 1975. The terms of the agreement call for Iran to put up $1 billion (1/3 the plant's estimated cost) in return for 10 percent of the plant's output of enriched uranium.

64. Asahi Journal, August 6, 1971, pp. 117-19.

65. American offers to share gaseous enrichment technology with "friendly countries" and for "due compensation" elicited considerable interest on the part of other governments in 1971 but neither the terms nor the timing were favorable to this proposal. The offer was revewed again in the winter of 1973-74 when Secretary Kissinger offered to share enrichment technology in return for cooperation among the industrial countries in meeting the challenge of the oil crisis. These offers provoked opposition in Congress and within the administration, and were not taken very seriously abroad. See James Reston, International Herald Tribune, January 31, 1974.

66. See David Smith, "What Price Commercial Enrichment?" Nuclear Engineering International, July 1974, pp. 572-84.

67. Mainichi, November 26, 1969; and The Japan Times, January 29, 1974. The assurances of the IAEA that Japan would be accorded equal treatment under inspection provisions with the Western European members of Euratom, and the pressure from the United States led the Japanese Atomic Industrial Forum to change its position and urge ratification of the NPT. Asahi, March 7, 1973.

68. The Japan Atomic Energy Commission decided on a program aimed at securing short-term supplies from the United States, medium-term diversification of supplies through international cooperation in enrichment ventures, and a long-term national enrichment capability within the decade of the 1980s. JAEC 1973 White Paper, op. cit., pp. 51-59.

69. Mainichi, January 18, 1974. And Newsweek, February 4, 1974, p. 37.

70. While sensitive about Japanese and other foreign investment in Australian raw materials, especially uranium ores, the Australian government has agreed to a feasibility study aimed at the realization of an enrichment plant that would use Australian uranium, Japanese capital, and third-party technology. Cooperation with the centrifuge consortium nations is possible, but Japan's nuclear energy laws prohibit the kind of classification of technology that Holland has demanded; cooperation with France would be easier if limited to the purchase of technology--but the Australian government will not permit France to purchase uranium ores unless France signs the NPT and submits to inspection by the IAEA. See Asahi, May 14, 1974; Kenneth Randall in The Far Eastern Economic Review, November 15, 1974, pp. 39-41. and Nuclear Engineering International, February 1975, p. 74.

71. Japanese companies have contracted for 1,000,000 SWU/y from 1980-90 out of a total plant capacity of 9,000,000 SWU/y. Le Monde, Selection Hebdomadaire, 19-25 décember, 1974, p. 8.

72. Apparently it was only after these offers were made public that the administration gave any thought to special precautions that nuclear exports to volatile areas like the Middle East might require. Even those who were generally critical of these offers were not prepared to require NPT ratification as a precondition for nuclear aid. See for example the editorial in The New York Times, June 10, 1974.

73. See the statement of Under Secretary Sisco in "The Export of Nuclear Technology," Special Report n. 9, Department of State, Bureau of Public Affairs, October 1974.

74. A Soviet-Egyptian power reactor agreement has been announced. See Nuclear Energy, November 1974, p. 51.

75. Although American policy makers seem confident of their ability to manipulate other nations' nuclear policies, there is little evidence to suggest that this is likely to be successful in the future.

A pertinent example is the American attempt to block the development of the Italian nuclear naval propulsion program. Italian aspirations in naval propulsion were opposed in the late 1950s and early 1960s because they aimed at development of a nuclear submarine. While the United States aided Britain's submarine program and considered aiding France's, it chose to oppose Italian ambitions. Then, Italian plans shifted to a surface naval vessel. While the United States were prepared to aid German and Japanese surface naval propulsion programs, the Italian ship was opposed by the United States government: financed by the Italian navy, it was considered by the United States a military use of nuclear energy. But by the late 1960s, the United States no longer had an absolute monopoly of enriched uranium fuels necessary to block the Italian program: the French Commissariat à l'Energie Atomoque agreed to provide the fuel load for the land-based reactor prototype and promised the first fuel load the completed ship. At present, it seems very unlikely that the ship will be built due to Italian domestic bureaucratic and budgetary problems. In the past the United States was successful in blocking a nuclear program of which it did not approve. But domestic political and economic obstacles are now the only effective check on this particular program. See Steven J. Baker, "Technology and Politics: The Italian Nuclear Program and Political Integration in Western Europe," unpublished Ph.D. dissertation (Los Angeles: University of California, September 1973), pp. 125-29.

76. France is reportedly prepared to sell nuclear submarines to Iran.[a] The West German and Brazilian governments are negotiating for the sale by German industries of several nuclear reactors, a fuel reprocessing plant, and a uranium enrichment plant based on the nozzle separation process.[b]

[a] The Washington Post, December 12, 1974, p. 33.

[b] Nuclear Engineering International, April, 1975, pp. 305-6.

77. The international situation has provided Indians with repeated opportunities to debate a nuclear option since the late 1950s. The cumulative impact of the international

crises of 1970 and 1971 in which Indian security and prestige seemed to be diminished may be sufficient to explain the Indian decision to demonstrate a nuclear device. But it is also interesting to explain why the decision was not altered after India's triumph in the Bangladesh war in late 1971, which appreciably improved India's international position, and why the test was allowed to take place only days before the international Aid India Consortium met to consider Indian economic aid requests, opening India to international scorn and possible economic sanctions. The growing power of the Atomic Energy Department and of those in the military who had long favored a nuclear demonstration was very likely crucial to the decision; the increasing independence of the Indian nuclear energy program was also probably a consideration; and finally, the anticipated favorable impact on public opinion--giving P. M. Gandhi's government a rare opportunity to demonstrate its effectiveness in the midst of an increasingly chaotic domestic situation--was surely a relevant consideration. These kinds of domestic political considerations help to explain a sequence of events difficult to adequately account for otherwise. Where these kinds of domestic political conditions prevail, a future decision to go nuclear may result from considerations even less linked to objective international conditions than the Indian decision appears to have been; international crisis may be at best the occasion for the final incremental step in an essentially bureaucratic policy process. For a treatment of Indian nuclear policy that stresses the domestic aspects see Peter King, "How Wide is a Nuclear Threshold? India and the Bomb," Australian Outlook, August 1971.

78. America's self-proclaimed role as "watchdog" over Japan's political evolution, justified as helping to avoid the extremes of the Communist left and militarist right, is full of equivocation.[a] In particular, there is evidence that American policies are designed to reduce the Japanese public's opposition to nuclear weapons.[b]

[a] See Albert Axelbank, Black Star over Japan (Tokyo: Charles C. Tuttle Co., 1972), Ch. 10.

[b] See T. J. Pempel, "Japan's Nuclear Allergy," Current History, vol. 68, n. 404 (April 1975).

79. Although Indian preparations for a nuclear test could not have gone unnoticed by the United States government, there is little evidence of American pressures to prevent India from testing--despite Indian dependence on the United States for economic aid and supplies of enriched uranium

fuels for its America-supplied power reactors. Clearly, the administration calculated that such pressures would be ultimately unsuccessful and/or too politically costly to even attempt.

80. See Robert Gilpin, France in the Age of the Scientific State (Princeton: Princeton University Press, 1968).

81. See Mason Willrich and Theodore B. Taylor, Nuclear Theft: Risks and Safeguards (Cambridge, Mass.: Ballinger Publishing Co., 1974).

82. Given the limited quantities of exploitable uranium ores, the future economic viability of nuclear power may depend on plutonium as a fuel. This will be all the more true if plutonium-fueled liquid metal fast breeder reactors (LMFBR) are developed commercially.

83. Security measures like those outlined by Willrich and Taylor will be essential as dependence on nuclear energy increases; but while they may be relatively unobtrusive when applied to fifty American power reactors and related facilities, they will be very intrusive when applied to hundreds of reactors and related facilities. The size and scope of the powers that a federal nuclear security force must have to operate effectively are additional reasons to question the advisability of the heavy dependence on nuclear energy. While the nuclear industry does not necessarily agree with all the Willrich and Taylor recommendations, there is industry support for the idea of a federal nuclear security force. See for example the AIF's James E. Sohngen's comments in Willrich, Taylor, 1974, op. cit., Appendix E.

84. With the retirement of Congressmen Holifield and Hosmer and the division of the AEC's functions between the Energy Resources and Development Agency and the Nuclear Regulatory Commission, the Congressional initiative seems to have passed to critics of nuclear energy like Senator Ribicoff and the Senate's Government Operations Committee. Ribicoff has proposed to tighten controls over nuclear exports, a controversial move opposed by nuclear industry spokesmen and government bureaucrats. For example, ERDA head Robert D. Seamans warned that the unilateral tightening of export controls "could cripple U.S. nuclear exports" and could cause a "dangerous erosion of our influence in international nuclear affairs." Stephen E. Nordlinger, Baltimore Sun, May 1, 1975.

85. If a nuclear option is a question of national security, of "high politics," one would expect cost to be no object. To the extent that a nuclear weapons option may be a matter

of national prestige and/or domestic politics, cost factors could be critical. In the future, and for some of the potentially most troublesome nations, these "low politics" kinds of considerations may be most important. The nuclear weapons capabilities of less developed countries may be very sensitive to the economics of nuclear power. See for example Ciro Zoppo, "Toward a U.S. Policy on Nuclear Technology Transfer to Developing Countries," California Arms Control and Foreign Policy Seminar, Santa Monica, July 1971.

86. Jerome S. Katzin, "Effects of Inflation and Recession on Nuclear Project Financing in the U.S.A.," Nuclear Engineering International, March 1975, vol. 20, n. 226, pp. 184-86.

87. See President Ford's statement in Nuclear Industry, January 1975, p. 7.

88. See for example Michel Turin, Centrales Nucleaires: Un Pari Au-dessus de Nos Forces," Entreprise, n. 1012, 30 january-5 february 1975, pp. 54-60.

89. This might be construed as a contravention of Article IV of the NPT, scrapping any pretension at giving NNWSs technological compensations for Treaty adherence. For international political reasons, it might be better to undertake domestic policies that would restrict the export of nuclear technology without any direct Treaty contravention. The apparent suspension of the international shipment of fissile materials by the NRC might be an example. The NRC was able to counter the complaints of European critics by arguing that the suspension resulted from a change in domestic administrative procedures. See Clyde Farnsworth in The New York Times, April 23, 1975.

90. From a "transnational politics" perspective, it is interesting that Prime Minister Palme claims to have taken his energy programs from the Ford Foundation's 1974 study, A Time to Choose. For a comprehensive survey of Swedish nuclear energy policy see Jerome H. Garris, "The Atomic Energy Debate in Sweden and the U.S.," draft prepared for delivery at the Annual Conference of the Society for Advancement of Scandinavian Studies, Madison, Wisconsin, May 2, 1975.

91. The Ford proposals call for an additional 200 nuclear plants on line by 1985, and proposes government help to achieve this goal through speeding-up licensing procedures and improving the utilities' financial position. Nuclear Industry, Vol. 22, n. 1, January 1975, pp. 7-8.

92. Some parts of the United States government have taken steps in this direction. The NRC has suspended plans for plutonium recycle in LWRs for three years[a] while the EPA has called for a delay of four to twelve years in the development of the LMFBR.[b]

[a] David Burnham, The New York Times, May 8, 1975.

[b] Edward Cowan, The New York Times, April 28, 1975.

93. For example, Westinghouse was in favor of supplying Italy with the fuel necessary for its naval propulsion program. See footnote 75 above.

94. See for example Paul C. Szasz, "International Atomic Energy Agency Safeguards," in Mason Willrich, ed., International Safeguards and Nuclear Industry (Baltimore: Johns Hopkins University Press, 1973), pp. 73-141.

95. Lawrence Scheinman, "Safeguarding Nuclear Materials," Bulletin of the Atomic Scientists, Vol. XXX No. 2, April 1974.

96. For a general treatment of this kind of problem see Edwin M. Kinderman, "Industrial Implications of Safeguards," in Willrich, Ed., op. cit., pp. 201-23. The AEC is reportedly unable to account for several tons of enriched uranium as a result of its operations; whether this is the result of the enormous scale of operation or bad materials accounting procedures is not clear. See David Burnham, The New York Times, Sunday, December 29, 1974, p. 26.

97. ACDA Director Fred Ikle has voiced similar concerns. The nations mentioned in this context--Argentina, Brazil, Israel, Libya, Taiwan, South Korea, Pakistan--are not the nations that the superpowers have been most concerned about in the past as prospective sources of nuclear proliferation, nations like West Germany and Japan. But several are nations that have relied primarily upon imported sources of nuclear technology, especially from the United States. See Leslie Gelb, The New York Times, April 10, 1975, p. 3.

Guernica (1937) by Pablo Picasso
Extended Loan from the artist to The Museum of Modern Art, New York City, N. Y.