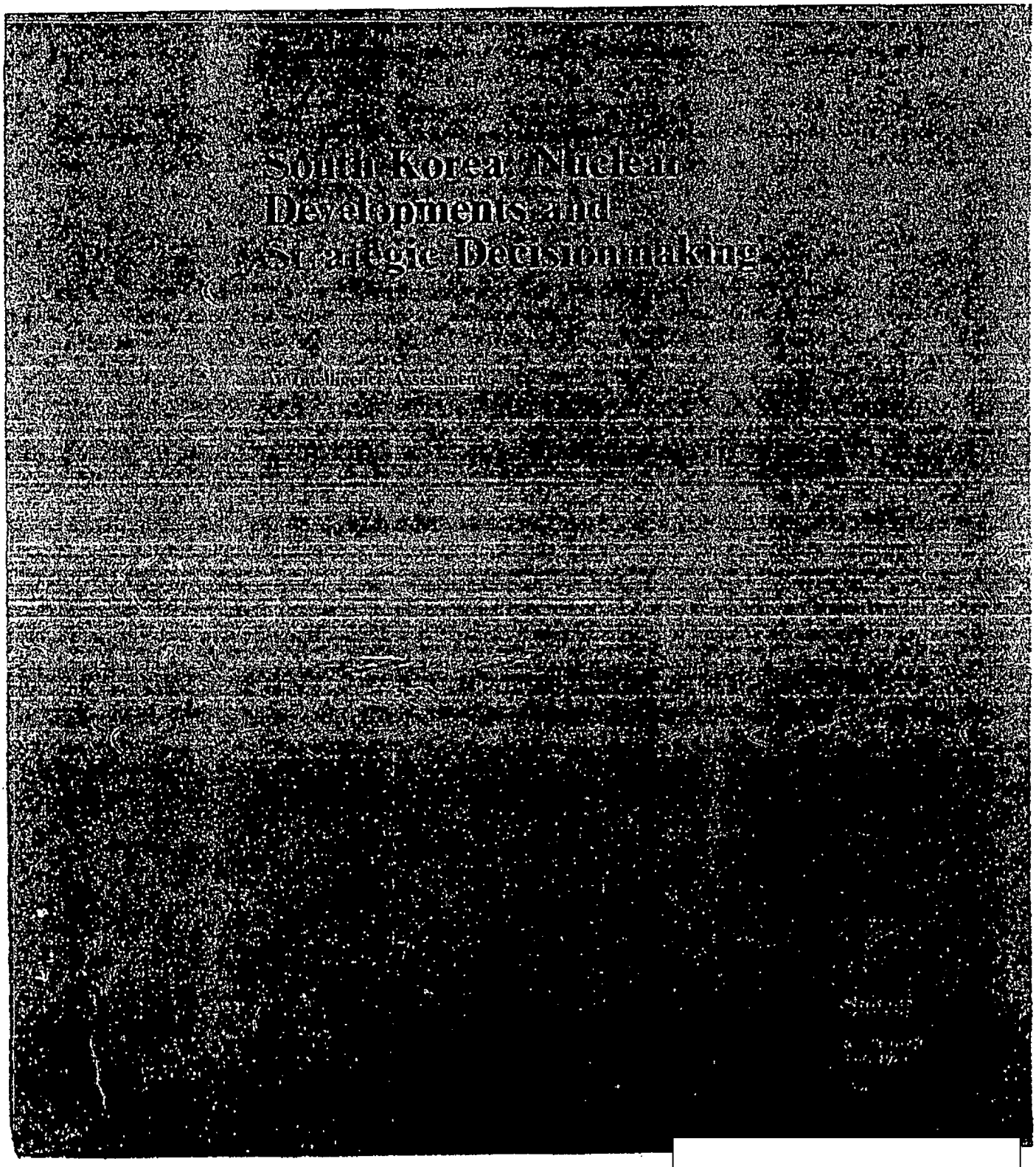

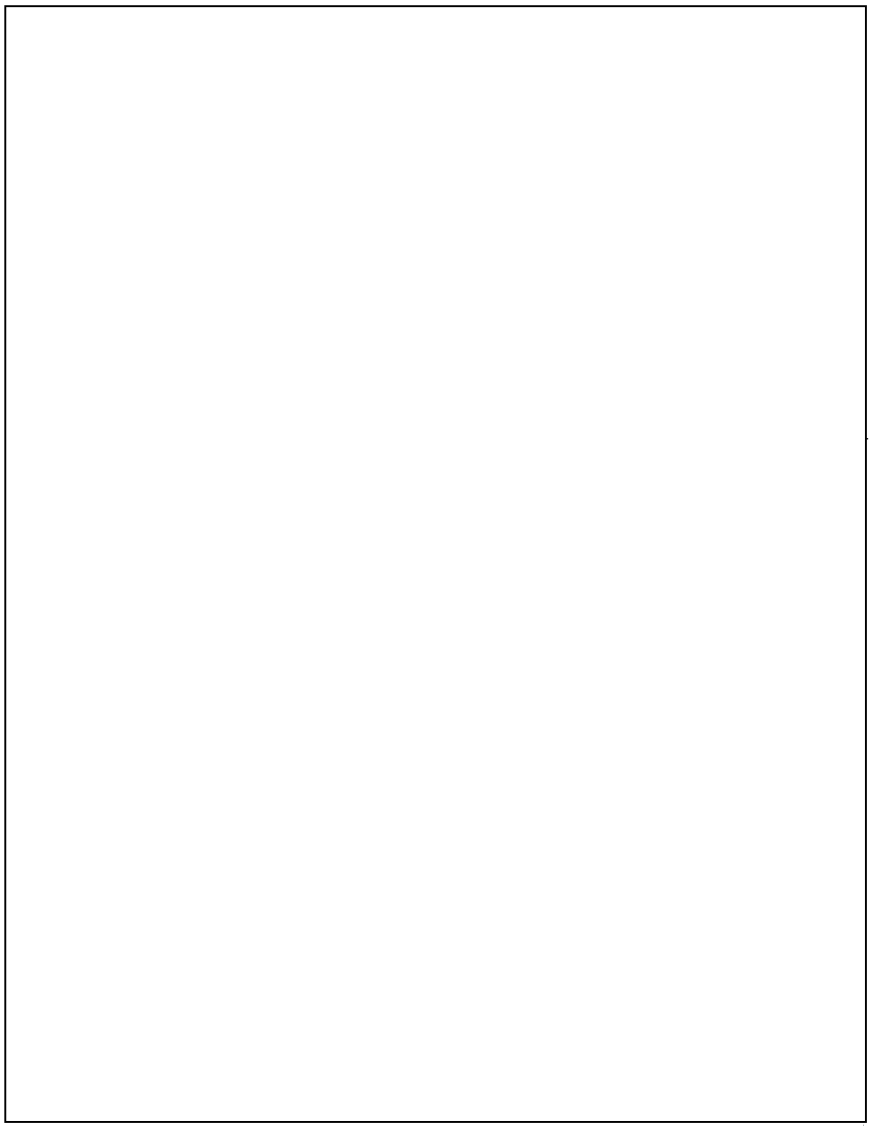

South Korea: Nuclear Developments and Strategic Decisionmaking

Central Intelligence Agency
National Foreign Assessment Center

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Key Judgments

The evidence is clear that President Pak Chong-hui in late 1974 authorized a program to develop nuclear weapons technology.

- At that time, however, he had not decided that Korea would actually build bombs.
- He probably did not expect to confront the need or opportunity to make a decision on the production of either warheads or a delivery system for at least several years.

To maintain a strong alliance with the United States, Seoul seeks to minimize frictions in bilateral relations. Under US pressure, in January 1976 it suspended negotiations for a reprocessing facility; in December 1976 it suspended the whole formal program to develop nuclear weapons technology that it had inaugurated only two years earlier.

Nevertheless, the concerns that prompted Seoul's interest in nuclear weapons remain. Since the Korean war, P'yongyang has shown unabated hostility toward Seoul and has substantially strengthened its offensive capabilities. South Korea's confidence in the US security commitment and, in particular, Washington's willingness to defend it with nuclear weapons has declined.

Officials in the Korean nuclear research community believe that, even while bowing to US preferences on the line of work they pursue, certain activities can and should be undertaken to keep Seoul's nuclear option open. These activities include the Agency for Defense Development's current work in high explosives and its development of surface-to-surface missile technology.

- The explosives research has legitimate conventional weapons applications, but an established capability in this field would be highly advantageous were a dedicated nuclear weapons program resumed.

- The Agency's missile program also has, in the minds of many South Koreans, logical conventional military applications. The present government is obsessed with acquiring a weapons system with which it can threaten P'yongyang—in the political more than the pure military sense—to the extent that North Korea can threaten Seoul with conventional artillery and FROGSs.[1]

A careful search of all available information has turned up:

- No evidence that any nuclear weapons design work is under way at present.
- No evidence that the South Koreans are trying to acquire a uranium enrichment capability.
- No evidence of any current activity related to the acquisition of a reprocessing capability.
- No evidence of stockpiling of fissile material.
- No evidence of work on weapons fabrication.

Even those South Korean officials who see military utility in possessing nuclear weapons concede that decisions on the weapons question will probably not be made before the early or mid-1980s.

- The South Korean Government probably will, however, make decisions in the next several years that could affect the future lead time between a decision to produce nuclear weapons and their actual acquisition.
- Among the decisions that are likely to arise are those concerning whether or not to assemble a prototype and then produce in quantity a surface-to-surface missile, and what to do with the substantial investment Korea has in nuclear research personnel.

The most important factor in South Korea's future nuclear decisions will be its perception of the reliability of the US security commitment and, conversely, the imminence of the North Korean threat. Waning confidence in the United States, particularly if accompanied by a decline of US influence in Seoul, would strengthen the hand of those South Korean officials who want to pursue a nuclear weapons option.

[1] North Korea has had the Soviet-supplied FROG (free rocket over ground) weapon system since 1969. The types of FROGs in the North Korean inventory have a range of 60 kilometers.

South Korea: Nuclear Developments and Strategic Decisionmaking

Strategic Policy

The North Korean Threat

The South Koreans view the threat from the North as a fundamental, although not immediate, problem.

Since the Korean war, P'yongyang has demonstrated unabated hostility toward the Seoul government and no interest in reunifying the peninsula on other than its own terms. Even while occasionally altering tactics, the North has never abandoned attempts to foster revolutionary conditions in the South. Key elements of this strategy over the past decade have included propaganda and psychological warfare, armed raids, attempts on the life of President Pak Chong-hui, efforts to isolate Seoul internationally, and agent infiltration to collect intelligence, build Communist cells, and subvert officials.

In the late 1960s and early 1970s the stepped-up acquisition of weapons from the Soviet Union and China, combined with a major expansion of the North's defense production activities, began tipping the static North-South military balance in P'yongyang's favor. Today the North has an approximate 2-to-1 advantage in numbers of tanks, armored personnel carriers, and artillery. The North also has a substantial edge in numbers of combat aircraft, an advantage that is not offset by the superior quality of the South's US-supplied planes. If P'yongyang achieved surprise in massing these assets for attack, Seoul—only 38 kilometers from the demilitarized zone—would be vulnerable to quick seizure.

A complex of restraints has forestalled a resumption of hostilities since 1953 and provided South Korea the breathing room to concentrate on nonmilitary facets of economic development. These restraints are longstanding and not readily susceptible to unilateral change by North Korea. They include the US treaty commitment to defend the South, the general if unspoken consensus among the major powers on the need to maintain stability on the peninsula, and the strength and tenacity of the South Koreans themselves. The factor that weighs most heavily in P'yongyang's calculations is the US security commitment, and, particularly, the presence of US forces in the South.

The importance of the United States in the peninsula's strategic equation has made Seoul acutely sensitive to what it perceives as any weakening of Washington's commitment. South Korean concerns in this regard began

intensifying after the enunciation of the Nixon Doctrine in 1969 and the decision—conveyed to Pak in March 1970—to reduce US troops in Korea from 63,000 to 42,000. Sino-American moves toward detente raised further apprehensions in Seoul that the United States might seek, above the heads of Seoul and P'yongyang, a Big Power solution for the peninsula. Today, South Korea not only worries about an outside compromise on its fate, but fears that the United States might be secretly willing to deal directly with the North Korean regime.

In the wake of the US withdrawal from Indochina, officials in Seoul question whether the United States can politically afford to be involved in another continental war in Asia, and they worry that the War Powers Act might cripple the ability of Washington to aid Seoul. More broadly, Seoul is concerned that the increasingly activist role of Congress in foreign affairs undercuts any commitment made by the US executive alone.

The Development of Self-Defense

Although the South Koreans are anxious to maintain and indeed reinforce the US commitment, their security concerns have at the same time driven them to strengthen their own defense capabilities. This has led Seoul down two primary paths: the preliminary consideration of a nuclear weapons option, and the modernization of its conventional arms inventory.

Planning for force modernization began in 1971 when, concurrent with the withdrawal of the US Seventh Division from Korea, a US-Korean committee identified weaponry needs for the South Korean Army. In 1975, following the fall of Saigon, Pak ordered a unilateral review of the earlier plan and an accelerated timetable for defense industry expansion. Seoul hoped that this revised force improvement plan (FIP), to be completed in 1980, would enable the South to meet an attack with only logistic and air support from the United States.

South Korea today is able to produce for its ground forces adequate supplies of small arms and munitions, some types of communications equipment, and assorted wheeled vehicles. With foreign assistance, it is beginning to fabricate light antiaircraft weapons, towed howitzers, and wheeled armored vehicles. Tank production—for which Seoul is investigating the purchase of US and European technology—does not appear feasible before the early or mid-1980s. Although able to fabricate the hulls of light naval craft, Korea must import the propulsion, electronics, and weapons systems for them. Aerospace and missile programs are in their infancy. Production of combat aircraft other than helicopters, and possibly light propeller-driven craft, is not now planned.

In the order in which weapons production programs have been introduced, the development of South Korea's defense industry parallels that of

the North. The North, however, has been turning out arms far longer and has been willing to commit a far larger share of national resources to defense.

While all South Korean power groups share the goal of self-reliance that calls for expanded domestic arms production, there are important differences in opinion regarding the nature of that expansion. Policymakers in the Blue House, and President Pak in particular, view the concept of self-reliance in decidedly political terms. This reflects the need to offset a public perception that the North is militarily superior, and a stronger-than-usual apprehension that the United States will not remain a reliable source of arms. Some of these officials talk of a domestic arms industry eventually capable of filling all weapons needs save those of aircraft. The professional military, in contrast, views that goal as technically and economically unsound.

The drive to modernize the arms inventory has contributed also to a livelier "guns or butter" controversy. The percentage of gross national product (GNP) allocated to the military has increased steadily, from 5 percent in 1975 to an estimated 6.6 percent for 1978—from $950 million to $2.6 billion. Defense officials are seeking levels of 7 percent for 1979 and 7.5 percent by 1981. Economic planners, on the other hand, argue that rapid growth will make possible substantial real increases in military spending even if the defense share of GNP is reduced modestly. They project a South Korean GNP five times that of the North in 1981,[2] and claim that this will allow Seoul to compete militarily.

Considering Nuclear Weapons

South Korean success in meeting its arms-buildup goals is by no means wholly ensured, but neither are these goals fundamentally unreasonable. In the late 1960s and early 1970s—when the nuclear option was under more serious consideration—such goals would have appeared beyond reach. Few officials in Seoul would have then voiced confidence that South Korea could build adequate defenses by conventional means alone. In 1973, for example, the 1971 US-Korean arms modernization plan was in disarray, and domestic defense production was limited essentially to crew-served infantry weapons and small arms ammunition. It was not then as obvious that the South Korean economy was outpacing that of the North. In these circumstances, the nuclear weapons option appeared to some planners a relatively direct and economical route for deterring war.

Only a few, and then very general, statements on the potential missions of an independent Korean nuclear force are available. The primary theme that emerges is Seoul's desire to acquire such weapons as a deterrent—substituting for, should the need arise, the deterrence now provided by the US security commitment. From the outset, South Korean thinking about nuclear

[2] CIA estimates currently place the South's GNP at a little over two times that of the North and project a 3-to-1 advantage for the South by 1981.

weapons has focused on a missile-delivery system. This focus on missile systems implies an interest in acquiring a number of nuclear devices, but indications of specific Korean thinking in this area are not available. It is clear that Seoul has not addressed the question of physical and chain-of-command control of nuclear weapons.

Missile System Missions

Missile work has focused, in turn, on modifications to the US-produced Nike Hercules. In the South Korean inventory as a surface-to-air missile, the Nike Hercules can also be employed in a surface-to-surface mode with a maximum range of 180 kilometers with a 500-kilogram payload. Fired from just behind the demilitarized zone, the missile could reach P'yongyang and two of North Korea's major ports—Nampo and Wonsan.

This does not allow for much flexibility, particularly under battle conditions. Seoul's first priority in missile work, therefore, has been to extend the range of the Nike Hercules in a surface-to-surface mode so it could be targeted on P'yongyang from positions well behind the demilitarized zone. A range of 350 kilometers, the goal Seoul set in 1974 for its missile modification program, would embrace Sinuiju, the Yalu River city where key supplies from China enter North Korea, as well as the cities of Hamhung and Anju. Most military command centers and equipment concentrations would fall within this arc.

In addition to the strategic, nuclear weapons potential of such a delivery system, the South Koreans see conventional, tactical missions for a surface-to-surface missile. For such conventional applications they are working on the development of an improved cluster munition.

- Korean officials are interested in a counter-force weapon to North Korea's FROGs [3] and 130-mm artillery. Although the South has basic military equivalents to both these weapons, North Korea's weapons can reach Seoul, whereas the South's rockets and artillery cannot travel the 150 kilometers to P'yongyang. The present government is obsessed with acquiring a means of threatening P'yongyang—in the political more than pure military sense—to the degree that the North can threaten the South.
- President Pak in 1974 reportedly was also interested in acquiring missiles so South Korea could retaliate in the event of limited aggression from the North. His immediate concern was linked to North Korean attempts in late 1973 through early 1974 to establish claim to waters surrounding the northwestern coastal islands.

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[3] A FROG fitted with a conventional warhead (as North Korea has) causes minimal damage; one estimate predicts that each rocket hitting Seoul would kill 10 to 100 people. The South Koreans, however, have tended to view the FROG as a potent weapon of terror.

Nuclear Program Development

The Role of Nuclear Power

South Korea broke ground in 1971 for its first power reactor, initiating one of the developing world's most ambitious nuclear energy plans. According to Seoul's most recent projections, 15 nuclear power plants are to be constructed by 1991, providing 44 percent of the country's electricity-generating capacity.

Seoul believes that nuclear energy is the most promising means for it to reduce its heavy dependence on imported energy sources, especially oil. At present, oil imports—primarily from Saudi Arabia, Kuwait, and Iran—account for about 65 percent of Korea's energy consumption. Seoul's policy options, however, are constrained by a lack of domestic resources. South Korea has no known oil or gas reserves, and its hydroelectric potential is limited. A shift to greater use of coal-fired thermal power plants—which Seoul is planning—will require imported coal.

The nuclear power capacity Seoul is planning for 1991 is equivalent to about 375,000 b/d of oil. Last year, South Korea's oil imports were about 430,000 b/d. Energy demand is likely to continue to grow about 10 percent annually in line with Korea's rapid economic growth, resulting in some modest reduction in its relative dependence on imported energy supplies.

Seoul's nuclear power projections call for bringing on line a 595-megawatt plant this year; six plants with a total capacity of 4,920 MW during 1982-86; and eight plants with a combined capacity of 8,400 MW in the 1987-91 period. The first plant, a light-water reactor (LWR) designated KORI I, is undergoing final tests, while construction on another LWR and a CANDU heavy-water reactor is in progress. Early this year, Seoul awarded contracts to Westinghouse for two additional LWRs (KORI III and IV). Bids for Korea's sixth and seventh power reactors, which will round out the 1982-86 phase of construction, will be tendered in 1978.

Given the high cost of power reactors, foreign financing has been crucial and, so far, has accounted for about 65 percent of total construction costs. Domestic capital needs also have been substantial. Seoul now estimates that its overall power development program will eat up 12 percent of gross investment over the next five years and an even greater percentage thereafter. About half of these funds will be tagged for the nuclear plants.

Research Programs: 1974 to 1976

Through the early 1970s Korea's nuclear research program was essentially limited to the study and production of radioisotopes. In 1974 the Korea Atomic Energy Research Institute (KAERI), an affiliate of the Ministry of Science and Technology, began negotiations to purchase a Canadian NRX-

type heavy-water research reactor and a small French reprocessing facility. The following year, KAERI negotiated a loan with the Belgian Government for the purchase of a research laboratory for mixed-oxide nuclear fuel fabrication.

The reprocessing facility would have handled only about 1 percent of the spent fuel produced by Korea's first power reactor, but this could have separated out enough plutonium to fabricate one nuclear device per year. Acquisition and operation of such a pilot plant, moreover, would have helped Seoul gain the expertise needed to construct indigenously a larger, commercial-scale reprocessing facility. The Belgain facility would have given Korea the last key technology of the back end of nuclear fuel cycle. With it, Seoul could have used the output of a reprocessing plant to fabricate mixed-oxide fuel elements for its power reactors. This would have decreased Korea's need for outside supply of enriched uranium and reduced long-term operating costs of power reactors.

This ambitious attempt to work with the back end of the nuclear fuel cycle soon foundered. Following India's detonation of a nuclear device made with plutonium generated by an NRX-type reactor, Ottawa suspended its negotiations for the sale of a similar research reactor to Seoul. Then, under pressure from the United States and Canada, which used the leverage of pending power reactor sales and credit approvals to bolster their case, KAERI dropped its plans for purchasing both the reprocessing and mixed-oxide-research facilities.

Following these cancellations, Korea initiated a six-year program to design and build its own NRX-type reactor, together with a companion small-scale heavy-water production facility. For this purpose, Seoul in late 1976 created the Korea Nuclear Fuel Development Institute (KNFDI) as a subsidiary of KAERI. This program was itself canceled in December 1976.

The facilities that KAERI was hoping to purchase were an integral part of the institute's long-term plan for nuclear power development. Planners at the Blue House, moreover, viewed them as a necessary component of a covert program within the military to develop a nuclear weapons capability. Beginning in late 1972, a lone physicist assisted by an explosives technician had worked on a nuclear weapon design at the Agency for Defense Development (ADD), a semi-independent adjunct of the Ministry of National Defense.

In 1974 and 1975 a much expanded, dedicated nuclear weapons program took shape, combining missile design work with nuclear and chemical warhead research in a project designated "890." ADD's executive vice president was charged with oversight of the program. Below that level, strict compartmentation was apparently enforced, and the project did not survive long enough to see any integration of effort among the three work teams. The

three programs were budgeted for and administered on noncoordinated time schedules of differing lengths.

President Pak reportedly authorized the nuclear weapons design element of 890 in December 1974. Following this, ADD launched a recruitment effort to repatriate Korean scientists trained and employed abroad. The design team took clear shape in mid-1975, when it was divided into three substantive subgroups working on warhead structure, high explosives fabrication, and computer codes. It is believed that the total warhead design effort employed no more than a few dozen scientists holding doctoral degrees, backed by a somewhat larger number of technicians. Little information is available on the warhead design(s) investigated, but it is known that the group suffered from internal squabbling and technical incompetence and apparently made little progress.

The chemical warhead team, apparently established at ADD in February 1975, employed about 10 principal researchers. By mid-1976, in contrast, the missile team reportedly employed more than 250 researchers and technicians. In addition to several administrative units, the team encompassed five substantive divisions: propellants, mechanics, electronics, testing and evaluation, and computer support.

Research Programs: Present Status

In late December 1976 President Pak ordered the immediate suspension of all activities related to Project 890. He made this decision following conclaves with top Blue House and Cabinet officials who convinced him that the weapons program was a major irritant in relations with the United States. His willingness to suspend 890 was strongly conditioned by the poor performance of ADD to that time and by the lack of any immediate need for nuclear weapons development.

The suspension of 890 contributed to an ongoing reorganization of Korea's nuclear research organizations that had begun when Seoul dropped plans for the reprocessing plant. Over the past two years, Seoul has taken particular care to keep KAERI, which oversees Korea's bilateral cooperation with the United States in the peaceful uses of atomic energy, generally open to foreign scrutiny by keeping it out of sensitive fuel cycle work. The institute has been ordered, moreover, to reorganize itself into teams of applied technology experts supporting the power reactor program and to downgrade the role of self-initiated, theoretical research undertaken by individual scientists. In 1977 KNFDI was ordered to convert its facilities to that of a pilot-scale fuel fabrication center based on the acquisition of a French nuclear fuel research facility. This facility, to be completed in 1982, will enable KNFDI to perform some post-irradiation testing, but not reprocessing, of fuel.

The reorientation of these two institutes reflects South Korea's reorganization of its nonmilitary nuclear research activities along lines proposed by

the United States in early 1976. Major research efforts today concentrate on uranium mining and ore conversion, the fabrication of fuel elements for light-water reactors, and the development of a capability to manufacture power reactor components and plants. They pointedly avoid work with irradiated fuel in the back end of the nuclear fuel cycle.

At ADD, the nuclear weapons designers once assigned to Project 890 are now working with high explosives in the agency's Warheads Directorate, while the old chemical warfare group is reportedly engaged in research with nonoffensive chemical agents in ADD's Materials Development Directorate. It is not known whether these nuclear and chemical warhead researchers drawn from 890 remain discrete groups within the larger work teams to which they are currently assigned.

Although there is no evidence of nuclear weapons design work being conducted at this time, more effort is being directed at high-explosives research and production. This has legitimate conventional weapons applications, but an established high-explosives capability would also be advantageous to Korea if a nuclear weapons progam were resumed. Some of the research is carried out by ADD's Warheads Directorate, where over half of the approximately 160 researchers are believed assigned to the high-explosives group.

Developing the high-explosives system needed to produce a symmetric, spherical implosion is the most difficult part of nuclear weapons configuration. Refinement in weapons design requires extensive testing of high explosives at a site that consists of a firing pad and bunker, along with elaborate instrumentation, for example, ultrahigh-speed cameras, flash X-ray systems, and oscilloscopes. Seoul has acquired some of this instrumentation, but we are not certain where the equipment is installed.

Certain types of laser systems that Korea has been purchasing suggest the beginning of a limited laser isotope separation (LIS) program. We have no evidence that uranium itself is under study—although some of the laser research is being conducted by KAERI. There is no evidence of Korean interest in developing the technology for either the gaseous diffusion or gas centrifuge methods of uranium enrichment.

Missile Research

Today ADD's missile researchers are divided among three of the six directorates of the agency's Advanced Weapons Center at Taejon. Directorate One handles propulsion work; Two, aeroballistics research; and Three, electronics and guidance and control development. A newly established group, whose authority cuts across the boundaries of the six directorates, is responsible for testing and evaluation. It controls, among other facilities, the missile flight test range at Anhung.

These groups are building upon the missile work begun in mid-1974 to develop by late 1978 the technology for a 350-kilometer surface-to-surface missile. That earlier effort, like the present one, used as a basis for its development the Nike Hercules.

As of May 1976 the initial design of the improved missile was near completion. Only its control surfaces and a portion of the hydraulic system would be replicas of the Nike Hercules. The rocket motors, airframe, control system, and onboard guidance system would be dramatically upgraded or entirely redesigned. Using French assistance for both propellant and production technology, ADD succeeded in casting a reduced-scale motor. Static tests on these motors confirmed in mid-1976 Korea's ability to cast a carboxyl terminated polybutadiene-type propellant.

After rejecting more sophisticated options, ADD had decided to incorporate a command guidance system that would modify that of the Nike Hercules to extend its range and accuracy. Modifications to the tracking radar via technology obtained from American firms were believed by ADD to run too high a risk of exposing the program. Seoul, therefore, looked to improving the onboard guidance system by making extensive use of solid-state electronics rather than the vacuum tube technology of the standard Nike Hercules.

The agency had not produced a prototype missile by December 1976, when Pak suspended Project 890, of which the missile program was part. Following this setback, it was not until September 1977 that ADD officials apparently received a green light to renew long-range missile development work.

Current development efforts are primarily directed toward test firing an improved Nike Hercules for President Pak in October 1978. Initial test flights began in April. Although the performance of this missile will not differ significantly from that of the standard Nike Hercules, the ADD prototype is to include a new rocket motor using French propellant and motor technology, a modified missile airframe, and an improved, all solid-state command guidance package.

No production of this missile is planned, but ADD believes the program important and is using it to demonstrate—or give the illusion of—its ability to develop a long-range surface-to-surface missile. The agency hopes thereby to win presidential support for a six- to eight-year project to design a 300- to 500-kilometer missile. In its ongoing development efforts, ADD apparently hopes to incorporate French propellant technology and a British inertial navigation system. If it receives a green light for this project, the agency will place initial emphasis on the acquisition of advanced technology—purchased from abroad and developed at home—and will consider the development of a prototype about 1984 or 1985. It is not yet clear whether this longer range program would also focus on improvements to the Nike Hercules.

Warhead Design

Specific information on the type of nuclear warhead that ADD might contemplate developing for such a missile is not available. However, since the agency's developmental work has so far related to the Nike Hercules, it might reasonably be assumed that the size and characteristics of any nuclear warhead would be strongly influenced by that missile's requirements. Korea's possession of the US-supplied Honest John rocket might further support this development route since this rocket was originally designed for the same nuclear warhead as that fitted to the Nike Hercules.

The Nike Hercules originally had a design payload of 545 kilograms, and the Honest John about 680 kilograms. In both cases, however, the diameter of the warhead compartment would limit the weight of a basic nuclear implosion system to 300 to 350 kilograms. (Fuzing components, power supplies, casing, etc., could easily add 100 kilograms to this weight.) An initial device might well be larger than this, but with testing, the South Koreans probably could meet the constraints.

The warhead probably would be a simple conservative design with the fissile material—plutonium—in a solid ball surrounded by a uranium tamper. The high-explosive system would also be of conservative design, with a cast high-explosive lens system and cast inner charge. Warheads of this type are relatively easy to design and fabricate and make reliable, serviceable weapons. In the size class under consideration here, however, they have the disadvantage of relatively low yields for a given amount of fissile material. Even so, depending on the type of fissile material available and on a number of design variables, such a warhead could have yields from a few kilotons up to several tens of kilotons.

A warhead as described above could be adapted to non-missile-delivery systems without changes made in the basic design, an important consideration in a small-weapons program. The weight and diameter would be small enough to permit external carriage on several of the fighter aircraft in the South Korean inventory. Such a device would also lend itself readily to use as an atomic demolition munition. The South Koreans might conceivably be able to develop even smaller implosion weapons, but only at the cost of reduced nuclear efficiency, greatly increased technical investment, or both.

International Nuclear Exchanges

With the supplier nations unwilling to sell Seoul certain sensitive nuclear technology that it desires, South Korea has explored the possibility of technology exchange with other developing countries. It turned first to Taipei, in 1974. So far the only joint South Korean - Taiwanese effort under way involves prospecting for uranium in Paraguay. An agreement apparently reached in late 1976 to share some missile expertise may have been made obsolete by Korean purchases of missile technology from Europe.

Major areas of nuclear cooperation that might be exploited cooperatively by South Korea and Taiwan include heavy-water production, spent fuel reprocessing, plutonium handling and processing, large research reactor design and operation, and the construction of light- or heavy-water power reactors. Seoul's assessment of the political pitfalls inherent in cementing such a sensitive relationship—and the potential reactions of Taipei itself, given the Korean interest in eventually developing ties with mainland China—will limit the pace and scope of any cooperation.

Korea has also sought aid from India. Here Seoul's interest lies primarily in heavy-water production technology and the operation of facilities using heavy water. In early 1978, nearly two years after the subject was broached, New Delhi indicated a willingness to provide technical assistance in the construction of a CANDU heavy-water power reactor in return for favorable trade concessions from Seoul. Korea, however, may now feel that it can acquire this specific assistance directly from Canada—the producer of the CANDU.

Otherwise, Seoul's nuclear dealings with the developing world focus on securing uranium and sharing experiences in the management of power reactor programs. Further progress in Korea's own nuclear development could increase the potential for more meaningful exchanges of technology, as could expanded precedent for cooperation among nations that have nuclear programs but not weapons.

Decisionmaking Patterns

Managing Nuclear Programs

Policy planning for Korea's suspended nuclear weapons program was erratic, even haphazard. Cabinet discussions—or discussions involving at least a part of the Cabinet—had reportedly begun as early as 1969, but the decision to initiate a weapons program in late 1974 was made by President Pak without formal Cabinet backing. Pak authorized the program solely on the basis of a nonspecific briefing he received. A written study assessing the pros and cons of developing, deploying, and using nuclear weapons was not, and still has not, been produced. Until Project 890 was canceled, a lack of regular consultation among Blue House, Cabinet, and research institute officials delayed Seoul's—and especially Pak's—appreciation of foreign reaction to Korean nuclear activities.

Pak's refusal to assign oversight responsibility for the weapons program to a subordinate in the Blue House or an interministerial team spawned a host of managerial deficiencies. His belief that the nuclear weapons program was too sensitive to allow the delegation of supervisory responsibility was only partially accountable for the casual management arrangement. In the 1974-76 period nearly all of the Korean research institutes had undertaken development projects beyond their competency and means, and they were

operating essentially as unguided rockets. ADD, for example, in making its strategic weapons development fund requests, had the overriding objective of maximizing its budget allocation. To this end, it intentionally exaggerated its own capabilities and depreciated the difficulty of organizing sophisticated programs.

In December 1976 in tandem with his cancellation of Project 890 at ADD and the NRX-design project at KNFDI, Pak transferred responsibility for guiding Korea's nuclear programs and overhauling the work of its research institutes to Blue House secretary O Won-chol. O, the second senior secretary for economic affairs, oversees industrial and scientific research activities related both to nuclear affairs and to conventional arms production.

O has placed top priority on channeling the work of the overt side of the nuclear community—KAERI and KNFDI—into areas deemed acceptable by the international community. He has also stressed the need to direct research activities away from the realm of "pure" research. He believes that Korea lacks the capability to pioneer new technology at this stage and that its limited monetary and personnel resources can be better invested in inducing technology transfers. On this premise, the research institutes would serve primarily to handle technology transfers and apply them to the nuclear program.

To lessen the power of the institutes to determine their own research priorities, O has sought to gradually transfer planning responsibility for nuclear research work to a Cabinet forum. His primary tool of control is the budgeting process, and he is submitting individual research proposals—some authorized earlier by Pak—for Cabinet review. In essence, O is attempting to have planning for Korea's nuclear power and research activities approximate the coordinated decisionmaking process used for long-term economic development programs.

The Perception of Foreign Reaction

Korea has failed to give much thought to what the strategic repercussions would be in northeast Asia if it were to manifest a nuclear weapons program. Instead, Seoul's concern with foreign reaction to its nuclear activities has usually focused on tactical questions such as Western tolerance of specific research and development programs.

In initiating Korea's covert weapons and delivery system work, ADD carried the burden of argument, concentrating almost exclusively on technical issues in presenting programs for authorization. Its arguments, as well as those propounded by other elements of the scientific research community, follow several typical lines.

- At this stage, Seoul should not assess the utility of nuclear weapons or address the question of producing them, but should concentrate on

developing minimum research capabilities as a hedge against an uncertain future.

- The likelihood that procurement of sensitive technology from abroad will become more difficult in the future dictates that Korea start gathering expertise and equipment now.
- Foreign observers should appreciate that Korea establishes thresholds in its weapons work. In the case of the chemical warhead program, for example, ADD rationalized that there would be no adverse US reaction if research were confined to bench-scale synthesis and testing, and stopped short of construction of a pilot manufacturing facility.

ADD, KAERI, and KNFDI have not been insensitive to the risk to US-ROK relations that their weapons, research reactor, and reprocessing work have posed, but they have been willing to entertain a higher level of risk than have other elements in the government.

What patchwork attempts were made to assess the political implications of the nuclear weapons program in 1974-75 led Pak and some of his senior advisers to conclude that Washington would tolerate this work. Blue House staffers at that time drew an analogy between the cases of South Korea and Israel. The United States, they reasoned, provided Israel with billions of dollars in defense assistance, including the most modern weapons in its inventory, even while Washington suspected Tel Aviv of developing a nuclear weapons program. The Koreans went on from there to conclude that the United States—while opposing short-term weapons work in Korea—would eventually recognize and tolerate Korea's need to have an independent nuclear capability.

In an area less controversial than nuclear weapons—that of reprocessing—the Koreans also recognized but initially played down the potential risks. KAERI, for example, believed reprocessing to be justified on economic grounds, even while admitting the political sensitivity of this activity. As a consequence, it sought to block US knowledge of or involvement in its attempt to purchase a French facility.

A serious focus on US reaction to these nonmilitary programs did not develop until late 1975, when Washington began to press Seoul on the reprocessing issue. At that juncture, elements of the Korean Government that had passively accepted work in weapons development and the back end of the fuel cycle emerged as bureaucratic foes of the nuclear research community. This group, although not formally organized as a lobbying force, generally has comprised Blue House secretary O Won-chol, the Economic Planning Board, Korea Electric Company, and the Foreign Ministry. As noted above, the United States dissuaded Korea from proceeding with reprocessing by linking the issue to the sale of power reactors. In convincing Pak to suspend the weapons program in December 1976, O Won-chol, as spokesman, argued that ADD's work threatened Korea's relations with the United States.

Nuclear Interests and Choices

Power Reactors: Asset and Vulnerability

Planners in Korea recognized from the outset that the development of nuclear energy could be a vulnerability as well as an asset should their country opt for nuclear weapons. In the early 1970s the potential advantages dominated their calculations, although the power reactor program itself was initiated for economic reasons alone.

The operation of power reactors, in the first instance, provided the impetus for moving from purely theoretical nuclear research to an applied technology program that would justify and cover the basic cost of work in various aspects of the nuclear fuel cycle. Seoul envisioned the operation of power reactors leading to reprocessing that would provide the opportunity to recover plutonium for possible use in weapons.

Having failed to acquire a reprocessing capability, Korea today gives equal importance in its thinking to the potential vulnerabilities of its power reactor program. In addition to fearing the suspension of reactor fuel supply if foreign nations do not like the direction of its nuclear development, Korea is concerned that the supplier nations cannot be relied on, in a simple commercial sense, to provide adequate fuel supplies.

To minimize its long-term dependence on outside fuel supply, and possibly also to maximize its future freedom to reprocess, Seoul is in the preliminary stages of considering reliance on heavy-water reactors for its second generation of power reactor development. Eight plants are scheduled to come on line between 1987 and 1991; bidding on these reactors may begin in 1978, two years ahead of schedule.

The attraction of heavy-water reactors is that they use natural uranium fuel instead of the enriched uranium fuel needed for light-water reactors. Were Seoul to acquire a heavy-water-production capability together with the ability to fabricate its own heavy-water reactors, it would achieve eventual independence in constructing and operating new power reactor units. To this end, Korea is discussing with both the Canadians and West Germans the possibility of signing contracts for a number of heavy-water reactors, with gradual localization of reactor fabrication in Korea. KAERI, the main advocate of switching to future reliance on heavy-water reactors, hopes that Korea would attain by completion of the fourth reactor the ability to duplicate additional units with only limited assistance.

Along with its discussions on heavy-water reactors, Seoul has raised the question of purchasing a heavy-water production facility. The Canadians have already refused this request because of its sensitivity, and Korea expects Germany to do the same. A private Korean enterprise has a contract with a Canadian firm for an economic feasibility study on the construction of a

small-scale heavy-water facility, however, and this study might provide Korea sufficient technical data to build its own plant.

For the generation of reactors that will come on line through 1986, Korea has made little effort to select technology that would lead to greater independence. Early this year, Seoul contracted for its third and fourth light-water reactors, and it is expected to choose similar models for its sixth and seventh units. Thus, by 1979, when bids for this first generation of reactors should be completed, Korea will probably have committed itself to light-water reactors—and by extension, to outside sources of enriched uranium supply—for all but one of its first seven reactors. Tied up in these six plants will be an investment of roughly $5 billion and a generating capacity of 4,850 MW, almost the equivalent of the current power supply.

Obtaining Fissile Material

Should Korea decide to develop nuclear weapons, the most critical question facing it—in terms of technical feasibility and safeguards circumvention—would be the acquisition of fissile material.

The route requiring fewest facilities, in number and type, to produce weapon-grade material would be uranium enrichment. Korea, however, lacks the technology base to make any of the major methods of enrichment possible before 1985 or even 1990. In thinking about fissile material, therefore, Seoul probably would focus its sights on plutonium.

- Weapon-grade plutonium is obtained by reprocessing irradiated fuel.
- Fuel irradiation occurs in the operation of either power or research reactors.
- If reprocessing is overt, plutonium can be stockpiled under safeguards. Then, when conditions warrant the violation of safeguards, it can be used in the final stage of weapon fabrication.

Planners at KAERI in the early 1970s recognized the importance of reprocessing to a nuclear weapons program, but they were primarily interested in reprocessing as it related to long-term nuclear power development. An institute flow-chart current in 1975 called for the acquisition of a reprocessing "research facility" to begin that year. The initial operation of a commercial-scale reprocessing facility was forecast for 1982-85, with some of its processed spent fuel being used in fast breeder reactors from 1987 or 1988 onward.

Korea has suspended attempts over the past two years to acquire a reprocessing capability, but the role that working with irradiated fuel played in early planning suggests that the reprocessing issue could be raised again. Seoul is not legally barred from reprocessing if safeguards of the International Atomic Energy Agency apply as required by Korea's ratification of the Non-Proliferation Treaty. The possibility always exists, however, that foreign

threats to withhold aid in nuclear or nonnuclear areas could force Seoul to drop plans for overt reprocessing.

Barring a reversal in the trends of US opposition to the spread of plutonium technology and of supplier nations' caution in exporting reprocessing facilities to the developing world, Seoul's hopes of acquiring a reprocessing facility would appear to hinge on its constructing a plant itself. Korea probably could assemble a small facility, perhaps of the size it hoped to buy from France, within three or four years if it encountered no major stumbling blocks in procuring components.

Overt reprocessing of irradiated power reactor fuel would require the identification of fuel that the original supplier was willing to have Seoul reprocess. The United States and Canada not only retain a reprocessing veto over the fuel they have supplied, but are also imposing a veto over any fuel irradiated in their reactors. It is not yet clear whether such stringent controls would apply to reactors that Korea might purchase from France or Germany. Seoul would have a great deal more freedom to maneuver if it could both build and fuel reactors itself, most likely by following a heavy-water development route.

The diversion of spent fuel elements from power reactors to support clandestine reprocessing or to bypass full accounting in the case of overt reprocessing would be very difficult. To obtain enough plutonium for one weapon, for example, two complete assemblies would have to be secretly removed from a light-water reactor in which each assembly is individually safeguarded. With a heavy-water reactor such as the CANDU, about 250 fuel assemblies would have to be diverted. Since only nine or so assemblies are normally removed each day from a CANDU, diverting even one on a continuing basis would run a high risk of detection.

Seoul would be free to reprocess irradiated fuel if it, overtly or covertly, constructed and provided itself the fuel for a plutonium-producing reactor. It could probably assemble a large reactor of this sort within four or five years. If Korea followed this path, it would be likely to build a heavy-water research reactor, expecting to use the expertise in fuel handling and reactor construction gained by operating at least one, and possibly up to nine, heavy-water power reactors.

Options and Decisions

Although President Pak in late 1974 authorized a program to develop nuclear weapons technology, he had not decided that Korea would actually build bombs. He probably did not expect to confront the need or opportunity to make a decision on the production of either warheads or a delivery system for at least several years. Similarly, in the late 1970s there is no perception of immediate needs or opportunities for acquiring nuclear weapons.

At the outset, Korea viewed Project 890 and efforts to purchase a reprocessing facility as precautionary measures carrying a tolerable level of

potential risk. Even officials who thought the development of nuclear weapons imprudent or unsuitable for Korea's defense needs were willing to tolerate the experimental research at ADD. Only later, when relations with the United States seemed imperiled, did they find that work intolerable.

Today Seoul places the highest priority on maintaining a strong alliance with the United States and to that end seeks to minimize potential points of friction. Pak and his military colleagues recognize that they still need Washington's support to:

- Serve as the most effective deterrent to war.
- Offset P'yongyang's ties to Moscow and Peking.
- Increase Moscow and Peking's interest in maintaining stability on the peninsula.
- Assist in the modernization of the South Korean armed forces.

Nevertheless, while hoping for the best in terms of long-term support from the United States, all planners in Seoul recognize that they will have to keep assuming more responsibility for their own defense. Some officials—concentrated primarily in ADD and KAERI, but apparently including at least a small part of the military as well—believe that such "self-defense" may eventually require nuclear weapons development.

Given the sophisticated technology requirements set by the type of nuclear weapons system Seoul has considered developing, some planners believe that their country should do more than rely on advances in civilian nuclear technology to shorten the lead time to a bomb. The strongest pressures in this regard arise quite naturally from the nuclear research community. Since late 1976, ADD, KAERI, and KNFDI have been only marginally successful in winning authorization for the lines of research they would like to pursue. Nevertheless, even the restricted work of these research bodies is moving Korea part of the way toward a capability to later initiate a dedicated weapons program.

The research includes ADD's work with missile technology and high explosives and KAERI's examination of the heavy-water route for future power reactor development. In the view of many in Korea, these activities are justified in terms of civilian power and conventional arms development. Although not supported by all important elements of the Korean leadership, this work is tolerated because it keeps Seoul's options open without translating into any kind of commitment to nuclear weapons.

More critical activities—such as the stockpiling of fissile material and warhead design, to say nothing of weapons fabrication or deployment—are not under discussion at present. Even those officials who see military utility in possessing nuclear weapons concede that decisions on the proliferation question will probably not be made before the early or mid-1980s.

A choice between proceeding with weapons production and forgoing the nuclear option may not be necessary even then. Nonetheless, decisions and assessments that will likely be made in the early 1980s could affect the future leadtime between a South Korean decision to produce nuclear weapons and their actual acquisition. A number of these decisions will be made in the normal evolution of nuclear power development.

- If ADD wins approval this year or next for a long-range missile development program, it would be ready in the mid-1980s to propose the production of a prototype. Seoul might then have to decide whether to produce missiles in quantity.
- The selection of heavy-water technology for future power reactor development could strengthen Seoul's interest in acquiring a heavy-water production capability. Attaining this, in turn, would facilitate the independent operation of a heavy-water research reactor.
- Seoul will have to decide what to do with the substantial investment it has in nuclear research personnel at ADD, KAERI, and KNFDI. It is not yet clear whether these scientists would seek or be diverted to employment in the private sector if Korea continues to eschew work in the back end of the nuclear fuel cycle and weapons design.
- The sheer growth of its power reactor program, coupled with a growing spent-fuel disposal problem in the mid-1980s, might provide Seoul with the rationale for reprocessing.

The most important factors in Korea's calculations regarding nuclear weapons will not be questions of technical feasibility. Rather they will be successive reassessments of the US security commitment, the threat posed by North Korea, and Seoul's success in building its conventional arms strength. If the United States completes its ground troop withdrawal in the early 1980s, Seoul will be forced to weigh P'yongyang's near-term incentives for attack. Irrespective of the ground troop question, however, South Korea will continue to question whether the United States would employ nuclear weapons on its behalf. Waning confidence in the US nuclear umbrella, particularly if accompanied by a decline of US influence in Seoul, would strengthen the hand of those who want to pursue a nuclear weapons option.