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Implications of a Brazilian-French Space Technology Argeement (b)(3)

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Conclusions

If accepted by Brazil, France's offer of a comprehensive space technology agreement to Brazil could result in one of the most extensive transfers of space technology ever. Although Brazil is unlikely to rush into a costly space program of questionable utility at this time, the French appear serious about proceeding with the sale of their satellite and space-vehicle technology. Nonetheless, we believe that a Brazilian space program would appeal to that country's sense of national destiny, and the terms of the French proposal are compatible with Brazil's desire for technological independence.

If, however, Brazil decides to enter into a space technology agreement with France, we believe:

- An agreement would not be reached before late 1979.
- It probably would provide a comprehensive space program with an ultimate cost in the neighborhood of $100 million.
- Brazil could produce an indigenous satellite launch vehicle (SLV) and a simple satellite by 1985.
- Brazil perhaps could carry out an independent ballistic-missile effort, derived from the French SLV technology, by the late 1980s. The critical constraint on the development of a Brazilian ballistic missile would be the guidance-system and reentry-vehicle technology. (b)(3)

Even if Brazil develops a ballistic missile, the potential for development of a compatible nuclear warhead is limited: (b)(3)

- Brazil, even if it is willing to abrogate international nuclear safeguards, still could not have sufficient plutonium for a nuclear device before the mid-1980s.
- Brazil could not develop a nuclear warhead for a ballistic missile before the late 1980s at the earliest.

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Discussion

Proposed Agreement

The French refer to this proposed agreement as a space technology agreement, although the scope of the technology to be transferred has not yet been defined. As a result, there are a number of large uncertainties associated with its potential impact. In particular, we do not know which systems and subsystems of the satellite and launch vehicle will eventually be produced in Brazil and which will be supplied by France. The full range of implications presented here is largely a result of these broad uncertainties.

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The resulting SLV, however, will not be capable of launching significant satellite payloads. The payload capability will be limited in weight and volume to scientific and small applications satellites. In addition, applications satellites requiring advanced sensor technology would further increase the satellite technology transfer requirements.

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The SLV program would provide Brazil with a significant ballistic missile potential. A jointly upgraded version of the French Diamant-class SLV, which is the type of launch vehicle being considered, could provide a basis for a short-range ballistic missile (SRBM) or possibly a medium-range ballistic missile (MRBM). If, in fact, French technologies and facilities should come to Brazil, the French would have little influence thereafter on their application. Successful absorption of this technology would continue to enhance Brazil's regional prestige. Although no immediate threat, this development could generate regional anxieties in the long term. There appears to be no need for such a complete technology package, other than Brazil's desire for technological independence.

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Motivations and Regional Impact

We do not believe that Brazil is interested in undertaking a costly space program at this time. The outgoing administration of President Ernesto Geisel was scarcely in a position to commit Brazil to such a major effort. The new administration of Joao Figueiredo is finding it necessary to concentrate on domestic economic and political problems, and most likely will be very reluctant to undertake what would be viewed as a major foreign adventure.

The government would find it difficult to justify a space program, because Brazilian policymakers could not present the program as a solution to any overwhelming national problems. Unlike the nuclear program, which was unveiled against the background of a looming Brazilian energy crisis, a space program addresses no crisis—real or imagined—that would serve to rally support.

Moreover, the Brazilian domestic political scene is now more complicated than at any time in recent years and, at the very least, decisions of such magnitude will need more broad-based support than before. The military regime is now committed to increasing the role of civilians in national decisionmaking and, while civilian inputs will not necessarily be decisive, any major new undertaking is likely to be subject to considerably more public scrutiny and debate. Indeed, the vaunted nuclear program is now receiving a great deal of public criticism and, because of escalating cost and serious criticism, there is the very real prospect that the program will be scaled down, although by no means eliminated. At a time when they are having to shave the cost of the nuclear program, Brazilian officials would find it very difficult to enter into a major space technology transfer program that ultimately could cost more than $100 million.

Such considerations do not permanently rule out a missile program, however, since there is no question that its acquisition would fit well with Brazil's sense of national pride and destiny. Indeed, as is the case with the acquisition of the complete nuclear fuel cycle, many view such a capability as another of the benchmarks that Brazil must pass in its march to Great Power status. Brazil conceivably could still be interested in a space program, if only to avoid foreclosing the option of having its own independent weapons launch capability.

For Brazil, which faces no serious military or other security threat from neighboring countries, the military application of nuclear and space technology probably is seen as something to prepare for eventually on a contingency basis, but not as a goal to pursue on a priority basis. While such application of space technology naturally enters the thinking of Brazilian policymakers, it does not appear to be the uppermost consideration at this time. Brazil repeatedly has publicly disavowed any potential military application of its nuclear program, and the Brazilians do not appear to have any weapons development program under way. Moreover, Brazil's nuclear program is already lagging well behind what was initially planned, and the Brazilians recognize that it will be a long time before they can even think of having a warhead—much less one deliverable by missile. They also recognize that, even with a major agreement, it would be a long time—the late 1980s—before they could have an indigenous missile with a nuclear warhead ready for testing.

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If Brazil were to decide to go ahead with an agreement with France, it is unlikely that anything would be formalized before late 1979. This would give the new president time to assess carefully the Brazilian domestic scene before he gets involved in the kind of commitment that is implied in a Brazilian-French space program. A decision to acquire space technology adaptable to military use would almost certainly draw strong criticism of Brazil from Argentina and other Latin American countries. It is equally certain, however, that this criticism would have little, if any, impact.

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Before signing a space technology transfer agreement, Brazil would try to get provisions specifying state-of-the-art technology and the transfer of as much expertise as possible. If the Brazilians at a later time came to view this particular French SLV technology as basically obsolete or second class, they would probably quickly lose interest. Furthermore, their need for substantive and demonstrative technology transfer probably would preclude any agreement to have France simply provide launch services for a Brazilian satellite. Such services are available elsewhere and have not interested Brazil to date. The Brazilians probably would not even be satisfied with a "turnkey operation" on launch facilities, but would insist on being in a position to build SLVs and launch facilities on their own by the end of any technology transfer agreement. This desire for true independence has characterized their long and, at times, trying search for sophisticated nuclear technology; and there is every reason to believe that it would apply to space technology as well.

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This Brazilian desire for maximum technology transfer may also preclude an agreement now, because of Brazil's questionable ability to absorb this technology. One of Brazil's main concerns in the much publicized nuclear agreement with West Germany is the provision of technical knowledge, not merely German-manufactured equipment. There have been numerous indications that the Brazilians' level of expertise simily is not sufficient to absorb as much as they want at the pace they are demanding

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Technical Impact

Space Program

Brazil has had an active space program since 1961. The cooperating civilian and military institutes have been able to develop a series of small sounding rockets. The technical knowledge offered by the French would be new and not all could be absorbed quickly, especially liquid-propellant booster technology and guidance-system and satellite-manufacturing technology. If the French moved to make the facilities and techniques available to Brazil as soon as possible, it probably would still be the mid-1980s before Brazil could produce an indigenous SLV.

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Brazil has developed a series of small solid-propellant sounding rockets: Sonda I, Sonda II, and Sonda III. The largest of these, the Sonda III, can carry a 50-kg payload to about 500 km altitude. A much larger sounding rocket, the Sonda IV, has been in development since 1975. Initially Brazil thought it might be able to use the Sonda IV later as the second and third stages of an SLV. This idea apparently is part of the broader French proposal being considered.

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Although motors for Brazilian rockets are cast in facilities in Brazil, the propellants reportedly are acquired from Italy. The largest motor currently produced is the first stage of the Sonda III (0.55 meter in diameter and 3 meters long). French-supplied technology probably would help Brazil increase the motor diameter to 1 meter with some increase in length. Brazilian rockets currently do not have thrust vector control. The secondary-injection thrust vector control offered by the French will be adequate for the upper stage application, but Brazilian production of some of the components may not be acquired quickly.

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The use of a liquid-propellant booster—for the first stage—would be completely new to the Brazilians. They have not worked with production or storage of liquid propellants, nor have they any background in production of liquid-propellant engines. For Brazil to have an indigenous liquid-propulsion capability, a comprehensive transfer of this technology would be necessary, including facilities for tests, production, and launching

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Brazil has no indigenous satellite development capability. It has developed sounding rocket payloads, including simple telemetry packages. However, in order for Brazil to be able to produce its own satellite, all phases of satellite development would have to be acquired, such as basic design techniques, test and production facilities, and technologies for production of the basic components. For experimental or simple scientific satellites, these technologies could be absorbed within five years. For satellites of greater complexity, no real Brazilian expertise could be developed in less than five to 10 years.

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Overall, the SLV and satellite technology offered by France probably could be absorbed in five to 10 years. The technology for solid-propellant motors and liquid propellants and liquid-propellant engines could be absorbed without major difficulty. However, production of some specialized components will require continued French assistance. This is particularly the case with the guidance-system and satellite technology, where components require precision manufacturing techniques not already present in Brazil. Historically, such techniques have not been rapidly assimilated in any country.

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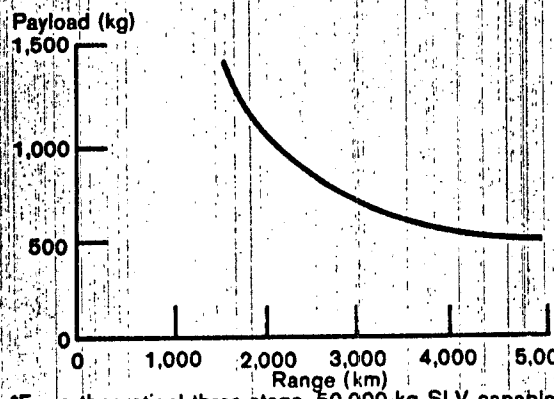
Missile Potential

Brazil has no ballistic missile capability at this time. It has developed a series of small artillery rockets based on its own sounding rockets. The design and production of the artillery rockets are carried out by the same institutes that handle the sounding rockets.

The greatest concern from the US policy viewpoint is the possibility that Brazil might be given the capability to develop a ballistic missile as a result of the space agreement. This possibility does exist, although some other critical technologies—those applicable to weapons use only—would have to be acquired or developed. The propulsion system of the SLV would have direct application to a ballistic missile. If the guidance system were to be produced in Brazil, it too would have some direct application. Technologies for reentry-vehicle design and materials would still need to be developed. There is also a possibility that the structure of the SLV would need to be modified in order to accept the likely increase in payload weight.

Payload-Range Curve for Possible Brazilian SLV Derived Missile System*



*For a theoretical three-stage, 50,000-kg SLV capable of placing a 300-kg payload into a 700-km circular orbit.

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The upgraded Diaman'-class SLV could be a basis for the development of a ballistic missile. The figure depicts the range and payload estimates for a theoretical missile system based on an SLV capable of placing a 300-kg satellite into a 700-km circular orbit. However, beyond the development of a warhead that would fit the weight and volume constraints, Brazil would, as already noted, have to (1) develop a suitable reentry vehicle, (2) possibly make significant modifications to the SLV structure to support the increased payload weight, and (3) acquire or develop a suitable guidance system. Any indigenously produced missile could not be available before the late 1980s.

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The propulsion system of the proposed SLV, including its propellant, could be suitable for a ballistic missile. Although it might be desirable to have an all-solid-propellant system for greater mobility and storability, the combining of liquid- and solid-propellant stages could still provide a viable missile. However, the liquid-propellant stage would make the missile less mobile, create some additional storage problems, and impede the missile system reaction time.

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Excluding the warhead, the guidance-system technology probably is the most critical. The type and quality of the guidance system have a direct impact on the accuracy and reliability of the weapon system. A command guidance system, while suitable for SLVs, is not desirable for a ballistic missile, because of its susceptibility to interference. Inertial systems, however, are applicable to both. Therefore, any weapons potential that the future SLV might have will be directly affected by the type and quality of guidance system made available by the French.

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Nuclear Weapons Potential

Brazil has very little indigenous nuclear capability, comprising only basic research at several research centers. In particular, Brazil has no capability to produce the fissile material essential for nuclear weapons, or to construct fissile-material production facilities. The comprehensive nuclear agreement which Brazil signed with West Germany in June 1975 could give Brazil such capabilities. The accord includes plants both for uranium enrichment and for spent-fuel reprocessing.

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The enrichment plant has been the subject of heated debate in Brazil, because of the cost and because Brazilian scientists feel that Brazil is a guinea pig for the unproven Becker jet-nozzle enrichment technology.[1] The plans now call for construction of only a small series of enrichers—not enough to produce even reactor fuel—by 1982, and of a small commercial plant by 1989. The commercial plant, even if it is built, will be under strict safeguards and could not be used to produce weapon-grade material without major plant modification or batch recycling of material, either of which would be an obvious abrogation of international safeguards. It may be possible for Brazil to design and build an independent jet-nozzle plant by the late 1980s; but any such facility built before 1994 is to be covered by international safeguards, and the difficulty of hiding such a facility would discourage a clandestine project.

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[1] The Becker jet-nozzle enrichment process, which is to be supplied by West Germany, is a viable but uneconomical process for uranium enrichment.

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A pilot spent-fuel reprocessing plant is now scheduled for completion in 1984, with a larger plant probably to come in the late 1980s or early 1990s. Thus far, however, not even a site has been chosen for the pilot plant. Nor is it at all certain that West Germany ever will deliver the plant. If the plant should indeed be built, it would take several months to produce sufficient plutonium for a nuclear device, even if the entire output of the plant were diverted to such an effort. Such diversion, again, would be an obvious abrogation of safeguards. If Brazil were willing to accept the consequences of such abrogation, it possibly could have enough plutonium for a nuclear device by 1985.

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We have no reason to believe that Brazil presently has a nuclear weapons design program. However, despite its lack of nuclear experience, there is little doubt that Brazil has the basic technical ability to design a simple implosion device, if a decision is made to do so, and to manufacture it if and when plutonium becomes available. Development of the device into a weapon in the 500- to 1,000-kg class suitable for delivery by a ballistic missile would be a much more demanding task, but not necessarily beyond Brazil's capabilities. We are not now in a position to offer realistic estimates as to how long such development might take. Given the fissile material situation of Brazil, it is clear that a useful weapon could not be available before the late 1980s at the earliest. We very much doubt that Brazil would undertake development and deployment of implosion weapons without at least one nuclear test.[2]

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[2] The task of developing a weapon would be greatly simplified and the test requirement possibly obviated if Brazil could pursue gun-assembly designs. Such designs are pointless for Brazil, however, as long as highly enriched uranium is not available there in quantity—a condition not likely to obtain for the foreseeable future.

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