Chapter 9

The Defense Industry of Brazil

Contents

Figure

Table

Chapter 9

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PRODUCTION FOR EXPORT

Brazil emerged in the mid-1980s as the leading arms producer and exporter among the defense industrializing countries, and the sixth largest arms exporter in the world. The Iran-Iraq War, in particular, stimulated arms exports by Brazilian defense companies. Iraq has been Brazil's largest customer, purchasing armored personnel carriers, missiles, and aircraft, often in exchange for oil (see table 9-l).

The termination of hostilities between the two Persian Gulf rivals in 1988 has had a debilitating effect on two Brazilian companies, Avibras and Engesa.[1] Both companies are in financial crisis, despite the conclusion in 1988 of a major arms deal with Libya. The arms embargo against Iraq has further weakened the ability of Brazil to maintain its defense industrial base at 1980s production levels. Not only are Brazilian companies prohibited from exporting to their favored customer, but negotiations for the proposed sale to Saudi Arabia of Engesa's Osorio main battle tank (an estimated $7 billion contract) remain suspended.

Clearly the vulnerability of Brazil's arms industries to fluctuations in the international arms trade tempers the success of the Brazilian defense industrial model. Nonetheless, of the leading developing arms producers (Brazil, India, and South Korea), Brazil's defense industry is the most self-sufficient. Brazil's major defense firms have substantial R&D and production capability, aided by strategic inputs of foreign technology, often through joint ventures.[2]

The role of various Brazilian governments in the development of an indigenous arms industry is an indirect one. Due to budgetary constraints deriving from massive foreign debt, the government has provided little support for these industries through domestic defense procurement. Brazil's defense expenditures over the past 20 years have been relatively insignificant, averaging 1.3 percent of gross domestic product per year (see figure 9-l). As a result, the government has used various fiscal incentives and trade policies to promote an economic environment in which these firms may operate.[3] The most direct form of government support is to encourage linkage between the research institutes of the armed forces and the respective industries: the Aerospace Technical Center (CTA) for the aircraft and missile-related companies, the Army Technical Center (CTE_x) for the armored vehicle industries, and the Naval Research Center (CP_qM) for the naval sector.

In contrast to other developing nations, state ownership of defense industries in Brazil is negligible. With the partial exception of Embraer (a mixed company 51 percent owned by the Air Force and 49 percent by private-sector shareholders), Brazil's defense firms are located in the private transportation and capital goods sectors. The defense sector is diversified in its R&D and production capabilities and includes advanced fighter aircraft, main battle tanks, nuclear-powered submarines, and missiles. Although there are over 500 manufacturers of defense-related equipment, three firms have been largely responsible for Brazilian defense exports: in aircraft, Embraer; in armored fighting vehicles, Engesa; and in missiles, Avibras.[4]

AIRCRAFT

The rise of Embraer (Empresa Brasileira da Aeronautic S.A.) from a fledgling company of 595 employees in 1970 **to the** world's fith largest aircraft manufacturer has been charted by industry observers and defense academicians alike. The evolution of Brazil's aircraft industry has been driven largely by Embraer's concern for profitability and technological learning.[5] Specifically, the indus-

[1]James Brooke, "Gulf Crisis Has Brazil in a Tailspin," *The New York Times, Aug. 27,* 1990.

[2]For an analysis of Brazil's defense industry see Carol Evans, ***Defense Production in the NICs: Case Studies From Brazil and India*** (London: The London School of Economics, spring 1991), passim.

[3]See Patrice Franko Jones, "Public Private Partnership: Lessons From the Brazilian Armaments Industry," ***Journal of Interamerican Studies and World Affairs,*** vol. 29, winter 1987-88.

[4]See Clovis Brigagad, *O Mercado do Seguranca: Ensaio Sobre Economia Politica* @O de Janeiro: Editora Nova Fronteira, 1984).

[5]Renato Dagnino, "A Industria de Armaments Brasileira: Desenvolvimento e Perspectives," O ***Armentismo e o Brasil: A Guerra Deles*** (Sao Paulo: Editora Brasiliemse S.A., 1985), pp. 75-105.

Table 9-l—Brazilian Arms Exports, 1977-88

Country	Number ordered*	Weapon system	Year ordered	Delivered*
Abu Dhabi	200	EE-9 Cascavel armored car	1977	
Algeria	2	EMB-1 11 marine patrol aircraft	1982	2
		EE-9 Cascavel armored car	1985	
Angola	2	EMB-111 marine patrol aircraft	1988	2
Argentina	30	EMB-312Tucano trainer	1987-88	30
Belgium	5	EMB-121 Xingu transport..	1982	
Bolivia	3	HB-315B Gavaio helicopter	1984	3
		HB-315B Gavaio helicopter	1987-88	3
	40	Neiva T-25 Universal	1977	
Canada		EMB-312 Tucano trainer	1983	
Chile	2	EMB-120 Brasilia transport.	1982	
	10	Anchova-dass patrol craft	1980-81	10
	50	EE-ll Urutu armored personnel carrier	1981	50
	40	EE-17 Sucuri tank destroyer	1981	40
	6	EMB126 Xavante transport/counter-insurgency	1978	
	20	T-25 Universal Neiva	1979	
	6	EMB-111 Bandeirante	1977	3
	10	Macharen fast patrol craft	1977	
Colombia	14	EMB-126 Xavante transport/counter-insurgency	1982	
Cyprus	120	EE-3 Jararaca scout car	1984-88	120
	120	EE-9Cascavel armored car	1984-88	120
	20	EE-9Cascavel armored car	1984	20
Ecuador	10	EMB-312Tucano trainer	1983	
Egypt	110	EMB-312Tucano trainer	1983	12
		(licensed production:30f orEgypt, 80 foriraq under a Saudi-financed, $180 million loan)	1986	48
France	41	EMB-121 Xingu transport..	1981-84	8
	20	EMB-312Tucano trainer (contingent order for up to 150 based on reciprocal helicopter purchase by Brazil)	1988	
Gabon		EMB-111 marine patrol aircraft	1981	1
		EE-9Cascavel armored car	1981	6
	16	EE-11 Urutu armored personnel carrier	1983-84	16
Guyana	1	EMB-110 Bandeirante transport	1985	1
	1	Model-412 helicopter	1985	1
	30	EE-11 Urutu armored personnel carrier	1984	30
Honduras	12	EMB-312 trainer	1984-85	12
Iraq	300	EE-3 Jararaca scout car	1984-85	300
	250	EE-9 Cascavel armored car	1987-88	200
	80	EMB-312 Tucano trainer	1985	20
	200	EE-3 Jararaca scout car	1987	
	38	Astros ll SS-30 multiple rocket launcher.	1985-87	38
	20	Astros ll SS-60 multiple rocket launcher..	1981-88	20
	13	Astros ll guidance and fire control system	1984-88	13
	640	SS-60 surface-to-surface missiles	1987-88	640
	150	EE-11 Urutu armored personnel carrier	1979-81	150
	150	EE-17 Sucuri tank destroyer	1979-81	250
	750	EE-9 Cascavel armored car	1979-81	750
		MAS-1 Cascara air-to-surface missile	1981	
Iran	50	EMB-312Tucano trainer	1988	

"Blanks indicate data nonpublicly available.

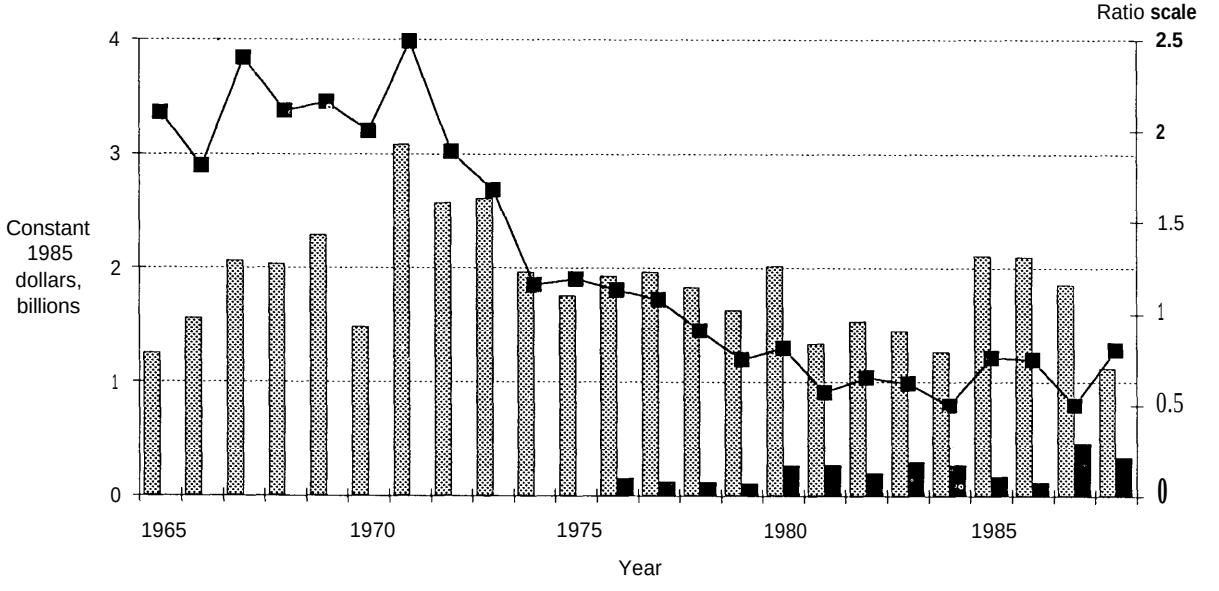
Table 9-l-Continued

Country	Number ordered*	Weapon system	Year ordered	Delivered*
Libya	8	EMB-111 marine patrol aircraft	1986	
	25	EMB-121 Xingu transport	1986	
	100	EMB-312 Tucano trainer	1986	
	100	X-2180mm multiple rocket system...	1987	50
		EE-11 Urutu armored personnel carrier	1986	
		EE-9 Cascavel armored car	1986	
		EE-T1 Osorion main battle tank	1986	
	200	EE-9 Cascavel armored car	1978	200
		Astros ll SS-40 multiple rocket launcher..	1986-88	30
		Astros ll SS-60 multiple rocket launcher..	1987	15
		EE-3 Jararaca scout car	1987	
	3	Astros ll guidance and fire control system (denied by Brazilian government)	1987-88	3
	450	SS-60 surface-to-surface missile	1987-88	450
Madagascar		EMB-111 maritime patrol aircraft	1981	
Morocco	60	EE-11 Urutu armored personnel carrier (17 on loan from Libya prior to delivery)	1986-87	60
Nigeria	50	EMB-312 Tucano trainer	1986	
	100	EE-9 Cascavel armored car	1986	
	5	EMB-110 Bandierante transport	1986	5
Paraguay	10	EMB-110 Bandierante transport	1985	4
	2	HB-305M Esquilo helicopter (licensed from France)	1985	2
		EE-11 Urutu armored personnel carrier	1984	
		EE-9 Cascavel armored car	1984	
	1	Roranima Class patrol craft	1985	1
	9	Xavante transport/counter-insurgency	1980	3
	12	Uirapura	1979	
Portugal		EE-11 Urutu armored personnel carrier	1981	
		EE-9 Cascavel armored car	1981	
Qatar	20	EE-9 Cascavel armored car	1976-77	10
Saudi Arabia		EE-9 Cascavel armored car	1984	
		EE-11 Urutu armored personnel carrier	1985	30
	(2&%)	EE-72 0sorio main battle tank	1985	negotiating
		Astros ll SS-30 multiple rocket launcher..	1988	10
		Astros ll SS-40 multiple rocket launcher..	1987-88	30
		Astros ll guidance and fire control system.	1987-88	4
Sudan	6	EMB-110 Bandeirante transport	1977	3
Suriname		EE-11 Urutu armored personnel carrier	1984	10
Thailand	56	EE-9 Cascavel armored car	1981	56
Tunisia		EE-3 Jararaca scout car	1984	
United Arab Emirates		EE-11 Urutu armored personnel carrier	1985	30
United Kingdom	130	EMB-312 Tucano trainer	1985	licensed production
Upper Volta	1	EMB-110 Bandeirante transport	1981	1
Venezuela	30	EMB-312 Tucano trainer	1986-87	30
	30	EE-11 Urutu armored personnel carrier	1984	30
		EE-3 Jararaca scout car	1984	
	100	EE-11 Urutu armored personnel carrier	1988	
		EMB-312 Tucano trainer	1988	1
Zimbabwe	90	EE-9 Cascavel armored car	1983	10

'Blanks indicate data not publiciy available.

SOURCE: Office of Technology Assessment, from data in Stockholm International Peace Research Institute, SIPRI Yearbooks, 1970 through 1990, World *Armaments and Disarmament.*

Figure 9-l-Brazilian Defense Expenditures and Exports, 1965-66



SOURCE: Office of Technology Assessment, from data in International Institute for Strategic Studies, The Military&/ame(kndon: Brassey's,various years) and Stockholm International Peace Research Institute, SIPRi Yearbook, various years, *World Armamenfs and Disarmament.*

try has developed using four concomitant approaches:

1. commitment to indigenous design and manufacture,
2. joint ventures with foreign aircraft producers to acquire and upgrade technological capabilities,
3. phased introduction of domestic components, and
4. product development balanced between military and civil aircraft for domestic and export markets.[6]

Three planes—the Bandeirante, the Tucano, and the Brasilia-have marked Embraer's indigenous technological advance. The Bandeirante was developed at CTA in response to the general aviation riced for **a small** passenger and freight aircraft, which could operate on the short and often unpaved airstrips characteristic of the country's interior. Although the Bandeirante is primarily configured as a 19-seat aircraft designed for regional passenger and cargo transport, its design is enormously flexible. For example, using the same airframe, the Bandeirante also comes in versions for air drop, search and rescue, maritime surveillance, and ambulance missions.

The export success of the Bandeirante stemmed not only from its design flexibility but also from Embraer's strategy of market segmentation and price competitiveness. For instance, despite its intermediate-level technical sophistication, the Bandeirante was exported to both developed and developing countries. By 1990, 500 units had been produced and were operating in 24 countries, primarily in the United States (over 147 units), and in Brazil itself.[7]

With the success of the Bandeirante, Embraer was able to establish an international reputation in the commuter airline market-a base from which it was well placed to profit from the rapid development of this market segment with its new product, the EMB-120 Brasilia. U.S. carriers presently flying the Brasilia include Texas Air Corp, Britt Airways, and

[6]Interview with Embraer company official.

[7]Embraer company data.

Air Midwest. The two principal attractions of the Brasilia are its performance (its 300 km cruising speed makes the Brasilia the fastest in its class) and its price and financing package.[8]

With the development of the Tucano turboprop trainer, Embraer's first indigenously designed military aircraft, the company followed its traditional policy of satisfying the domestic requirements of the Brazilian Air Force while targeting an export market niche. With a low price tag of $1.9 million, and over 600 aircraft sold worldwide, the Tucano has become the sales leader in the military turboprop trainer field. The Tucano also was the first military sale by a Brazilian company to a member of NATO. In 1985, the British Royal Air Force selected the Tucano over established domestic and European competitors such as the Swiss Pilatus PC-9 and British Aerospace's Hawk.

COLLABORATIVE PROGRAMS

Embraer has used joint ventures to develop the company's technological capabilities and to offset the risks and costs of new production programs. Among these joint ventures, the AMX fighter and the CBA commuter aircraft programs best illustrate the above strategy.

When Embraer wanted to introduce the Bandeirante's successor, a 19-seat, pressurized pusher-prop commuter aircraft, it sought a major joint venture with Argentina's Fabrica Argentina de Materials Aerospaciales (FAMA). The cockpit and the fuselage of the Brasilia will be used, and a new engine developed by Garrett-a "twinprop pusher' mounted on the rear-will push the plane as opposed to traditional propeller engines that pull the plane forward.[9] Production and financing is divided: 67 percent for Embraer and 33 percent for FAMA.[10]

The project, which has contributed the most to Embraer's technological development (through spillovers into other products) and the least in terms of profitability, is the AMX collaborative project with Italy's Aeritalia and Aermacchi. The Brazilian company has a 29.7-percent share in the program, while the shares of Aeritalia and Aermacchi are 46.5 and 23.8 percent respectively. The Brazilian Air Force will receive a total order of 79 AMXs to replace the aging Xavantes and Italy's Air Force will take the remaining 187.[11]

Following the pattern of the automotive industry, the aircraft industry is also becoming more interdependent and internationalized, despite its strategic value. Embraer has become a subcontractor to other aircraft industries and has been obliged increasingly to negotiate offset contracts for its exports. Embraer executives argue that offsets are central to ensuring foreign contracts, particularly in the advanced industrialized countries, where rationalization of defense-related industries has had important employment ramifications. This willingness to provide offsets was an important factor securing the sale of the Tucano to the British Royal Air Force. Thirty percent of the aircraft (the wings, landing gear, and canopy) is made in Brazil and 60 percent is fabricated under license from Embraer by Short Brothers in Northern Ireland.[12] The Tucano is also licensed-produced by Egypt, though Embraer produces and ships all of the parts to Egypt for assembly. A more recent subcontract arrangement involves the manufacture by Embraer of 207 advanced composite external wings for McDonnell Douglas' new MD-1 1 wide-body trijet. This offset is in connection with Varig's proposed purchase of an unspecified number of MD-11 aircraft.[13]

Brazil's economy, with its $120 billion debt and its need for exports, is precisely why Embraer has so heavily favored development of products attractive to its export customers. Embraer also avoided the mistake countries starting aircraft industries (such as India) have made of relying almost exclusively on domestic military procurement. The company has maintained a balance between military and civil aircraft production from the start. In 1987, for example, Embraer exported aircraft worth $320 million, which represented 68.1 percent of total production. Out of the 31.9 percent that constituted domestic sales, the civil market accounted for 25.7

[8]Brasilia, the capital of the country, is built in the shape Of an airplane.

[9]"Embraer Begins Marketing New EMB-123 Version," *Aviation Week and Space Technology,* Oct. 13, 1986, p. 128.

[10]Embraer company data.

[11]Embraer company data.

[12]Interview with Embraer official.

[13]Interview with Embraer official.

percent. International sales are divided 33.4 percent for military and 67.6 percent for civil.[14]

ARMORED VEHICLES

A few years ago, television viewers saw the Colombian army storm the justice ministry in an attempt to dislodge terrorists, who were holding several judges hostage. Visible were several Cascavel armored cars, part of a fleet of 100 purchased in 1981 from Brazil's leading arms export company, Engenheiros Especializados S.A., known as Engesa.

Engesa's meteoric rise from a small equipment and transport producer to a major armored vehicle manufacturer attests to strong private entrepreneurship, product development through linkage to the Brazilian and translational transport industries, and to government-university research centers, as well as international marketing abilities. Engesa's export performance has been remarkable. The company has exported its armored and reconnaissance vehicles to over 20 countries in the Middle East and Africa. Annual export earnings amounted to over $53 *millon* for the 1977-82 period and $122 million for the 1983-88 period.[15]

In **terms** of product development, all of Engesa's armored fighting vehicles and armored personnel carriers share the same characteristics: simple and flexible design concepts, low **cost, good performance** and reliability, **ease** of use, and simple maintenance. These characteristics are the major selling points of Engesa's products to its customers in the developing countries.[16]

The company's strong engineering and technical base is reinforced through linkages to other military, industrial, and university centers: the Engineering Institute, CTE_x, National Research Institute, and the Institute for Research and Technology. Not only has Engesa tapped into available technological developments in related metallurgical, electronics, and chemical industries, but this form of technology sharing also provides a way of selecting highly trained and educated future employees.[17]

Engesa's sales and marketing **strategy is** pivotal in helping to explain Brazil's success in achieving the number six position among the world's leading defense exporters. The company has had to overcome many barriers to entry in the highly competitive international arms market, not least of which includes lack of export financing (e.g., that provided by the U.S. Foreign Military Financing program) and lack of military and government sales support. Engesa's sales and marketing executives attribute the company's success in export markets to the fact that the company's sales teams are extraordinarily well prepared. 'They have assessed the competition and its capabilities, they know Engesa's product capabilities thoroughly, and team members are interoperable in terms of their technical and financial backgrounds. "[18] A related factor is the company's well-known after-sales support in **terms of** guaranteed **access to** spare parts, training for system operators, and maintenance (including front-line repair during the Iran-Iraq war). Engesa is well positioned to take advantage of Brazil's nonaligned position in the international system and its affinity with other developing nations.[19]

The Osorio main battle tank (MBT) exemplifies the way Engesa approaches development of new weapon systems. First, following the Saudi Arabian requirement for a light main battle tank, the company conducted a market feasibility study of other developing countries, where bridges and roads could not support 60-ton MBTs such as the U.S. M1A1 or the French AMX. Second, Engesa searched for the best available armor, engines, suspension system, electronics, and gears. In keeping with its strategy of finding suppliers who would share the development costs, Engesa succeeded in attracting many international defense equipment suppliers because the Osorio program represented the only new tank development project in the 1980s and 1990s. For example, Dunlop, supplier to the British Challenger I MBT, was willing to provide the Osorio's hydropneumatic suspension system (which keeps the tank lower on the ground than the more conventional

[14]Data provided by the Commissao Valores Mobilizacao, Rio de Janeiro, 1988-89.

[15]Engesa company data.

[16]See Peter Locke, "Brazil: Arms for Export," *Arms Production in the Third World*, M. Brzoska and T. Ohlson (eds.) (London: Taylor & Francis, 1986).

[17]Interview with technical director of Engesa, August 1989.

[18]Interviews with directors of Engesa's commercial and marketing divisions, AU@ 1989.

[19]Engesa, *Military Products* (Sao Paulo: Engesa, n.d.).

torsion bar suspension). Within Brazil, Engesa could rely once more on the translational automotive industry, particularly West German companies, to supply the smaller 85 km/hr engine and the gear box.[20]

The development of this MBT also reflects the inherent difficulties facing a company based in the developing world in moving up the high-technology ladder to the production of more advanced weapon systems. First, the financial resources required are enormous. Since Saudi Arabia gave the go-ahead for prototype production of the Osorio in 1985, Engesa proceeded to spend $60 million in R&D and prototype development. It had been widely rumored that Saudi Arabia had provided financial assistance for the initial R&D costs. (When asked whether such reports were accurate, company officials said that they had not been able to "recover" the money previously offered.)21 Despite an announcement in August 1989 by the Saudi Government to buy 318 Osorios (renamed Al Fahd, the Leopard), the contract worth $7.2 billion has yet to be finalized.[22] In April 1990, after laying off 3,000 workers, Engesa filed for bankruptcy protection.

MISSILES

Since the early 1980s, Avibras has been one of Brazil's leading export companies. It is a privately owned Brazilian firm with a reputation for professionalism, a low-profile image, and great autonomy from government agencies as well as from the armed forces. Avibras' activities are concentrated in defense-related areas: space research and satellite communications, rocket and missile development, and electronics and chemistry (propellants and explosives). The company is located in Sao Jose dos Campos in Sao Paulo state, the center of aerospace activity in Brazil.

The company's first project was in space design and research. It was contracted by the CTA'S Institute for Space Activity (IAE) and the National Space Research Institute (INPE) to assist in the Sonda I, II, III, and IV experimental sounding rocket and satellite launch vehicle research programs. Avibras contributed its expertise in design, electronics (related to guidance), and propellants (special solid fuels). In addition to these space-related activities, Avibras has developed meteorological radars and **satellite communication antennas and their associated Earth stations** for the IAE's satellites, which are being launched by the European Space Agency. In this respect Avibras has made possible an important linkage between Brasilsat and Intelsat-the **satellite** organizations for Brazil and for the world.

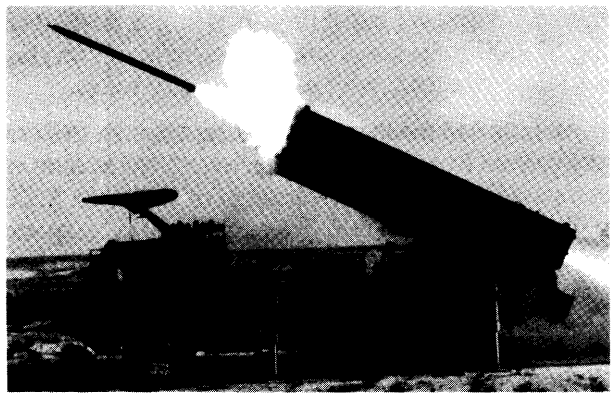


Photo credit: U.S. Department of Defense

***The* Avibras Artillery Saturation Rocket Bombardment System Astros II multiple rocket launcher deployed by the Royal Saudi Army during the Persian Gulf War. The unit can fire rockets from 9 to 70 km with high explosive and cluster munitions. It is known to be in service in Brazil, Libya, Iraq, and Saudi Arabia.**

In addition **to its space and communications programs,** Avibras is also at the forefront of tactical rocket and missile production among the developing nations. Its most important program is the Astros II (Artillery Saturation Rocket Bombardment System), employed against targets at 9 to 70 km, with rockets of 127mm, 180mm, and 300mm. The latter rocket uses a system consisting of an armored launch vehicle, an ammunition supply, and a fire control vehicle (all manufactured by Avibras' Tectran division). This system was used extensively by Iraq (Avibras' largest customer) during its war with Iran, and by Libya. Avibras also markets air-to-ground missiles and a full line of bombs: napalm, cluster, and runway destruction. In addition, Avibras has assisted in the prototype development of the SM-70 Barracuda coastal defense missile, which is to equip the Navy's corvettes, originally indigenously de-

'Company data.

[21]Interview with Engesa commercial/marketing director, August 1989.

[22]Robert Godoy, "Tanque pode render ate U.S. 7 Bilhoes," *O Estado do Sao Paulo*, Aug. 22, 1989, p. 11.

signed for Exocet capability. It also has developed the SS-300 long-range missile, capable of carrying a nuclear warhead, with a range of 170 miles.

Avibras had the largest export earnings in 1987 of any private Brazilian company: over $340 million as compared to the export earnings of Engesa's $300 million. Over the last 5 years Avibras' exports equaled approximately $700 million.[23] Avibras has had increasing difficulty obtaining the necessary financing for the development of new weapon systems and has sought foreign financing for front-end developmental costs—for instance, the Astros II was funded partially by Iraq, and Libya has provided some financing for the long-range missile program.[24]

ORBITA

Orbita is an association of five aerospace-related companies, which was formed in 1986. It consists of Engesa and Embraer, each with 40 percent participation, with the remainder divided among three companies: Esca, an aerospace company interested primarily in air traffic control and radar systems with 11 percent; Imbel, the Brazilian Army ammunition and propellant factory with 5 percent participation; and Parcom, the splinter group that left D.F. Vasconcelos in 1989 at 4 percent.[25] The association, which at present operates from Engesa's Sao Paulo headquarters (though it is expected to have its own facilities on Embraer's land in Sao Jose dos Campos), is largely a paper company, as none of its three main missile projects—the air-to-air missile MAA- 1 Piranha for the AMX aircraft; the surface-to-air missile MSA-31; and the surface-to-surface anti-tank missile MSS-12 have proceeded beyond the prototype development phase.

CONCLUSION

Fueled by the Iran-Iraq War, Brazil's defense exports peaked during the 1978 to 1986 period. A substantial amount of these arms transfers consisted of arms-for-oil transactions.[26] Not surprisingly, Brazil's largest military customers are from the oil-rich Middle East.

Brazil's defense cooperation agreement with Saudi Arabia and Brazilian sales of short-and medium-range missiles to Libya and Iraq have drawn sharp criticism from Washington. Sensitive to the potential impact of nuclear and defense technology proliferation in the region, the U.S. State and Commerce Departments have imposed restrictions on technology transfers to Brazilian defense firms. In response, Brazil's Foreign Ministry has argued that such measures were initiated primarily to prevent the entrance by Brazilian defense firms into the higher technology end of the international arms trade, which has been long dominated by established U.S., Soviet, and European companies.[27]

[23]Data provided by the Bank of Brazil's Foreign Trade Division, CACEX.

[24]Interview with Avibras company official.

[25]Orbita corporate video presentation, Sao Paulo, November 1988.

[26]Interview with officials from Brazil's Foreign Ministry, Itamaraty, and CACEX, Brasilia, August 1989.

[27]Interview with official from Brazil's Foreign Ministry, Itamaraty, Brasilia, August 1989.