basic imagery interpretation report

Brazilian Space Launch Vehicle Program (S)

MISSILE RANGES: STRATEGIC SSM SPACE FACILITIES
BE: Various
BRAZIL

Secret

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RCA-15/[illegible]/82
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INSTALLATION OR ACTIVITY NAME					COUNTRY
Brazilian Space Launch Vehicle Program					BR
UTM COORDINATES	GEOGRAPHIC COORDINATES	CATEGORY	BE NO.	COMIREX NO.	NIETB NO.
NA	See below	See below	See below	See below	See below

MAP REFERENCE

NA

LATEST IMAGERY USED	NEGATION DATE (If required)
Apr 82	

Installation	Geographic Coordinates	Category	BE No	COMIREX No	MRN No
Sao Jose dos Campos Airfield	23-13-46S 035-51-40W				
Sao Jose dos Campos Inst Tech Aero (CTA)	23-13-06S 045-52-21W				
Cachoeira Paulista Lab Rocket Fuel INPE	22-41-00S 044-59-50W				
Piquete Explos Plant Presidente Vargas	22-36-54S 045-12-37W				
AVIBRAS Aerospace Prod Fac	23-13-45S 045-51-10W				
AVIBRAS Santa Branca Plant 2	23-22-00S 046-08-00W				
Barreira do Inferno Space Assembly Fac	05-55-00S 035-15-00W				
Barreira do Inferno Rocket Range	05-55-00S 035-09-00W				
Alcantara Space Launch Facility	02-21-30S 044-26-00W				
Cachimbo Mil Weapons Test Fac	09-21-27S 054-55-15W				

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ABSTRACT

1. (S/WN) This report presents an overview of the Brazilian aerospace program and the major installations related to space research, development, production, and testing. It includes a sounding rocket and proposed space launch vehicle comparison chart, a location map, four tables, and eight annotated photographs.

INTRODUCTION

2. (S/WN) Brazil has embarked on an ambitious aerospace program intended to make it self-sufficient in space technology and capable of producing, launching, and maintaining a satellite in space. To achieve self sufficiency, Brazil has initiated a number of plans and programs which include expansion of facilities presently involved in aerospace research and development (R&D), development of the means to domestically produce the necessary propellants and parts for the propulsion systems, and construction of new test and launch facilities. Current plans call for a launch of a new-generation sounding rocket (Sonda IV) by 1983 and the launch of a four-stage space launch vehicle (SLV) by 1988.[1]

3. (U) Brazil's space program, begun in 1961, has resulted in the successful development of a series of small sounding rockets (Sonda I, II, and III; Figure 1), used mainly for meteorological research. The latest operational sounding rocket, the Sonda III, can transport a 50-kilogram payload to an altitude of 500 kilometers (km). The Sonda IV, currently under development, will be more complex and technically

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advanced. It has a projected capability of transporting a 300-kilogram payload to an altitude of 1,000 km.[2] The proposed SLV is expected to be a four-stage vehicle capable of launching a 120-kilogram satellite into earth orbit at an altitude of 500 to 800 km. The SLV is to be 85 percent Brazilian designed and built, with only certain propulsion and guidance components being imported. The lower stage will probably consist of four or five clustered stages of the Sonda IV rocket, with the second and third stages each made up of one of the other Sonda rockets. Initial plans had called for a joint Brazilian-French liquid-fueled SLV; however, these plans collapsed because of disagreement on the transfer of technology. The first launch of the proposed SLV is currently scheduled for 1988, with three additional launches to follow over the next five years.[1] However, this timetable, already pushed back from 1985, may be further delayed.

4. (S/WN) Most of the major Brazilian aerospace-related facilities (Figure 2) are in the Paraiba Valley, Brazil's most industrialized region. R&D and production work on propulsion systems is performed at the Sao Jose dos Campos Complex. Propellant production is accomplished at Piquete, and the rocket launch site is at Barreira do Inferno. Additional facilities currently under construction include a rocket fuel laboratory for research on liquid propellants at Cachoeira Paulista, a guided-missile production facility at Santa Branca, and a military weapons test range at Cachimbo. A proposed rocket launch site is also scheduled to be constructed at Alcantara.

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COMPARISON CHART

DESIGNATOR	NO. OF STAGES	HEIGHT (m)	PAYLOAD WEIGHT (kg)	MAXIMUM ALTITUDE (km)
SONDA I	1		5	120
SONDA II*	1		20-60	80-370
SONDA III	2		50	500
SONDA IV	2		300	1,000
SLV Proposed**	4 (est)		100-120 (est)	500-800(est)

*Sonda II built in 3 versions.
**Payload parameters are for proposed first satellite; does not represent total capacity.

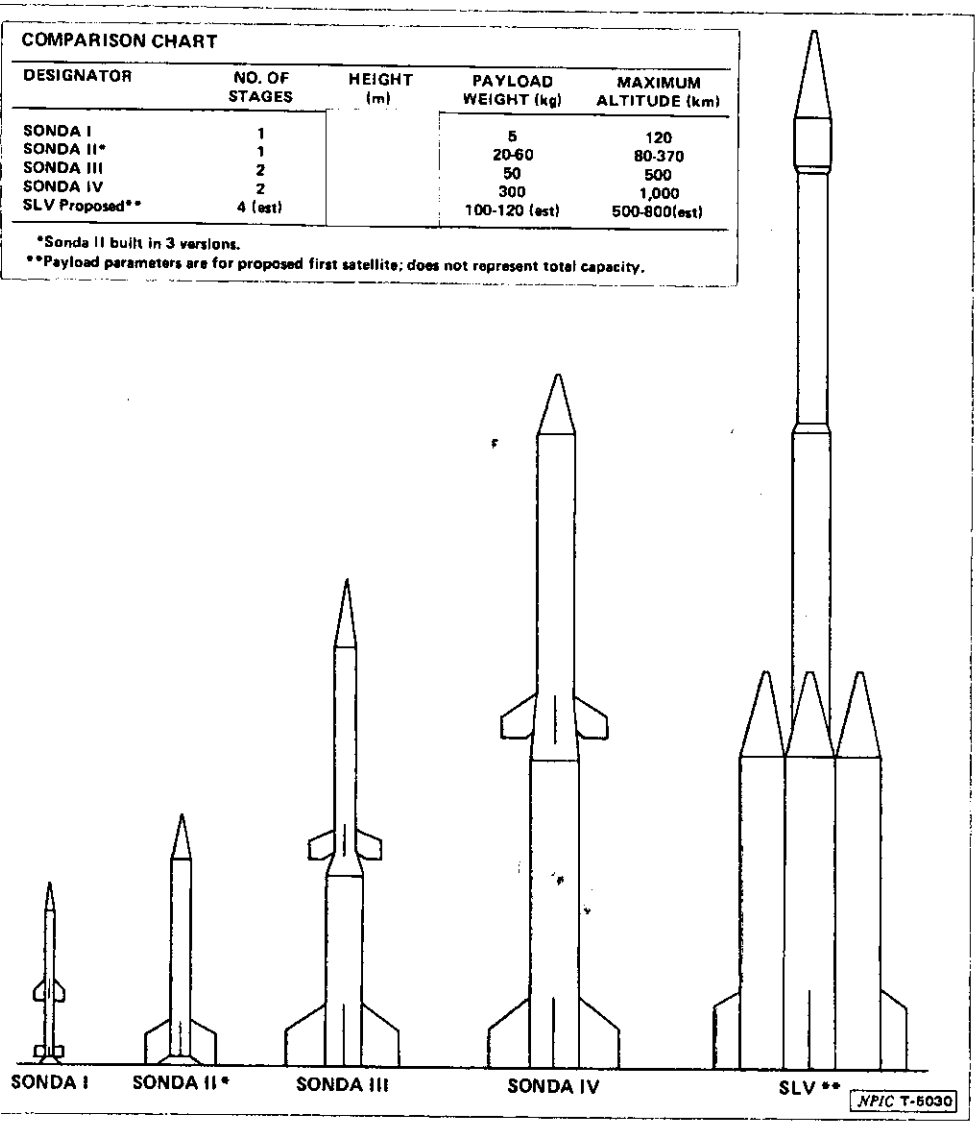

FIGURE 1. COMPARISON OF BRAZILIAN SOUNDING ROCKETS AND PROPOSED SPACE LAUNCH VEHICLE

BASIC DESCRIPTION

R&D Facilities

5. (S/WN) The majority of the R&D for Brazilian military and civilian aerospace projects is conducted at the Sao Jose dos Campos Complex (Figure 3).

6. (S/WN) Military R&D for space vehicles, missiles, and aircraft is the responsibility of the Aerospace Technical Center (Centro Tecnico Aerospacial—CTA). The CTA, sponsored by the Brazilian Air Force Department of Research and Development, is a university and research center consisting of four institutes. The two institutes directly involved with the space program are the Aerospace Institute (Instituto do Atividades Espaciais—IAE) and the Institute of Industrial Coordination (Instituto do Fomento e Coordenacao Industrial—IFI). The IAE is responsible for the research, development, and prototype construction of scientific and military rockets; the IFI acts as coordinating agency between the CTA and private industry. The other two institutes, the Institute of Research and Development and the Aeronautical Institute (Instituto de Pesquisas e Desenvolvimento—IPD—and Instituto Tecnico Aeronautica—ITA, respectively), are involved with theoretical work relating to the Brazilian aerospace industry.

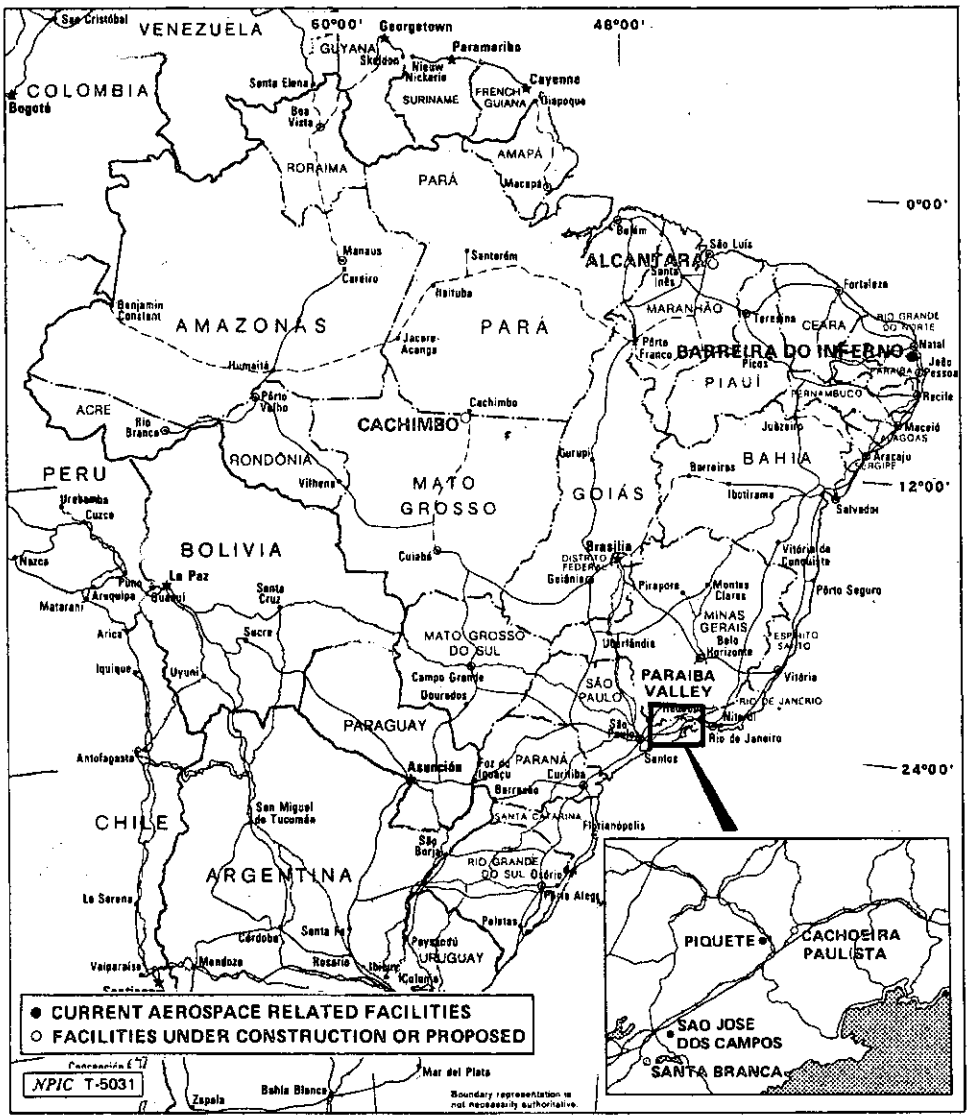

FIGURE 2. LOCATIONS OF BRAZILIAN AEROSPACE-RELATED FACILITIES

7. (S/WN) The IAE (Figure 4 and Table 1), the largest of the four institutes, developed the Sonda rockets and has been developing the electronics, guidance, instrumentation, and propulsion systems for the proposed SLV. The IAE consists of a large administration/engineering area, a solid-propellant pilot plant, a pilot plant for rocket fuels, a wind tunnel area, and a projectile test area. The administration/engineering area contains five laboratory/engineering buildings, a laboratory building, five administration / support buildings, and a probable aeroballistic test range. The solid-propellant pilot plant contains four propellant preparation buildings, two propellant processing buildings, a checkout building, a rocket motor test cell with diffuser, one nondestruct test building, two laboratory/engineering buildings, two probable engineering buildings, and seven bunkered storage buildings. The pilot plant for rocket fuels contains a large, multistory laboratory building, with four horizontal storage tanks at the west end, and three support buildings (one annotated on graphic). The wind tunnel area contains a closed-circuit wind tunnel, an instrumentation building, a laboratory building, and an electronics equipment building. The projectile test area contains a projectile test range, a test track, a control building, and an instrumentation/camera building. Several laboratory/engineering buildings and major test facilities were added to the IAE between 1977 and 1981.

8. (S/WN) The principal agency for civilian space research, the National Institute of Space Research (Instituto Nacional de Pesquisas Espaciais—INPE), is collocated with IAE (Figure 4). Founded in 1961 by CTA engineers, INPE was originally named the National Commission for Space Activities (Commissao Nacional de Atividades Espaciais—CNAE). INPE concentrates on pure and applied research projects in all aspects of space technology. Although this institute works primarily on civilian projects, including meteorological, atmospheric, and ionospheric research, it also directs military-related space projects. INPE assisted with the design of the Sonda rockets and currently is heavily involved in the design of satellites and their support systems. In addition, INPE directs the Barreira do Inferno Rocket Range and also operates two satellite ground stations and four modern satellite tracking stations.[3]

9. (S/WN) The INPE headquarters facility consists of a laboratory/engineering area, a meteorological/astrophysics area, and an administration/support area. The laboratory/engineering area contains three laboratory/engineering buildings and four support buildings (one annotated on graphic). The meteorological/astrophysics area contains an astrophysics laboratory/engineering building with two dish antennas and one helix antenna on the roof, a meteorological dish antenna adjacent to the building, two probable laboratory/engineering buildings, an administration/engineering building, two probable control buildings, two probable satellite communications antennas, a dipole antenna, and two instrumentation/control buildings. The administration/support area includes four administration/engineering buildings and a recreation area. Recent expansion in the meteorological/astrophysics area has been the addition of the administration/engineering building since 1980 and one of the probable satellite communications antennas and two dish antennas in 1981.

10. (S/WN) INPE has been constructing a laboratory for rocket fuel adjacent to their satellite ground station at Cachoeira Paulista, 65 nautical miles (nm) northeast of Sao Jose dos Campos (Figure 5). The laboratory will be responsible for research on liquid propellants.[4] Construction of the new facility was first observed in October 1980. Presently, the facility contains a large, C-shaped, multisectional probable administration/engineering building; a probable laboratory building; at least four support buildings; and several individually secured storage buildings. The facility is partially wall secured.

Propulsion and Guidance

11. (S/WN) Brazil has not yet attained technological self sufficiency in the areas of propulsion and guidance, which accounts for the non-Brazilian 15 percent of the SLV. Currently, IAE and INPE have only pilot facilities for R&D on propulsion- and guidance-related components. Both IAE and INPE are reportedly working on the development of thrust vector control and inertial guidance. The recent construction of new laboratory/engineering buildings at IAE and INPE may be related to such research. IAE is also engaged in some small-scale rocket motor case production at a small modern laboratory for filament winding using fiber glass.[5]

Propellant Facilities

12. (S/WN) Nearly all solid propellants for Brazil's current missile and aerospace systems are produced at the Piquete Explosives Plant Presidente Vargas (Figure 6 and Table 2). Intermediate products presently produced include nitroglycerin, nitrocellulose, nitric acid, and sulfuric acid, while final products include single- and double-base propellants, TNT, dynamite, and various other explosives.[6] Brazil currently does not have the capability to produce the large quantities of composite-modified, double-base solid propellants needed for the proposed SLV. When Brazil does acquire this capability, this plant is the most likely to be involved in solid-propellant production for future aerospace systems, including the proposed SLV. Although operational since 1909, the Presidente Vargas plant has undergone a recent modernization program. A significant aspect of this modernization was the construction of a French-built,

(Continued p. 9)

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Table 1.
Instituto do Atividades Espaciais and Instituto Nacional de Pesquisas Espaciais
(Items keyed to Figure 4)

This table in its entirety is classified SECRET/WNINTEL

Item No	Description	Dimensions (m) L	W	H	Remarks
IAE					
A. Admin/Engineering Area					
1	Lab/engr bldg				Const 73 - 77
a	Sect				
b	Sect				
c	Sect				
2	Admin spt bldg				
3	Admin spt bldg				
4	Admin spt bldg				Main sect
5	Admin spt bldg				
6	Lab/engr bldg				Completed Oct 77
a	Sect				
b	Sect				
c	Sect				
d	Sect				
7	Lab engr bldg				Completed 77 dimens for each wing
8	Instrumentation/control bldg				Const 79 - 81
9	Lab/engr bldg				Const 73 - 77
10	Lab bldg				Const 73—77
11	Lab/engr bldg				Const 79 - 81
12	Admin spt bldg				Const 79—81 dimens for each wing
13	Control bldg				Const 79—81
14	Prob aerobalistic test range				Const 79—81
a	Firing position				Const 79—81
b	Control position				Const 79 81
B. Solid-Propellant Pilot Plant					
15	Propellant prep bldg				Bunkered const 79 81
15a	Sect				Bunkered const 79 - 81
b	Sect				Bunkered const 79—81
c	Sect				Bunkered const 79—81
17	Propellant preparation stor bldg				Bunkered const 79 81
18	Propellant preparation stor bldg				Bunkered const 79—81
19	Control bldg				
20	Rocket motor test cell with diffuser				
21	Nondestruct test bldg				
22	Checkout bldg				
23	Prob engr bldg				
24	Prob engr bldg				
a	Main sect				
b	High bay sect				
25	Lab engr bldg				
26	Spt stor bldg				Main sect
27	Poss warehouse				
28	Bunkered stor bldg				
29	Propellant processing bldg				
30	Stor bldg				
31	Propellant processing bldg				
32	Lab engr bldg				
a	High bay sect				
b	Low bay sect				
33	Warehouse				Bunkered
34	Bunkered stor bldg				
35	Bunkered stor bldg				
36	Bunkered stor bldg				
37	Bunkered stor bldg				
38	Bunkered stor bldg				
39	Bunkered stor bldg				
40	Special handling bldg				Bunkered

Item No	Description	Dimensions (m) L	W	H	Remarks
C. Pilot Plant for Rocket Fuel					
41	Spt bldg				
42	Lab bldg				
a	High bay sect				
b	Prob checkout sect				
D. Wind Tunnel Area					
43	Lab bldg				
44	Electronics equip bldg				
45	Closed circuit wind tunnel				
a	Body of wind tunnel				
b	Fan sect				
46	Instrumentation bldg				
E. Projectile Test Area					
47	Control bldg				Const 79—81
48	Test track				Const 79—81
49	Radome				Const 79 81
50	Instrumentation camera bldg				Const 79—81
51	Projectile test range				Const 79—81
52	Control bldg				Const 79—81
INPE					
F. Laboratory/Engineering Area					
1	Lab engr bldg				
2	Lab engr bldg				
3	Spt bldg				
4	Lab engr bldg				
G. Meteorological/Astrophysics Area					
5	Instrumentation control bldg				
6	Prob satellite communications dish antenna				
7	Prop satellite communications dish antenna				
8	Prob lab/engr bldg				
9	Dipole antenna				
10	Instrumentation control bldg				
11	Astrophysics lab/engr bldg				
a	Meteorological dish antenna				
b	Helix antenna				
c	Dish antenna				
d	Dish antenna				
12	Admin engr bldg				Const 79—81 dimens for each sect currently being expanded
13	Prob lab/engr bldg				
a	High bay sect				
H. Admin/Support Area					
14	Admin engr bldg				
15	Admin engr bldg				
16	Admin engr bldg				
a	High bay sect				
b	Low bay sect				
c	Main sect				
17	Admin engr bldg				

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double-base, propellant production line. Construction on the production line had begun by April 1978 and was externally complete by May 1981. In addition, a modern nitroglycerin production line was installed by the West Germans in the late 1960s, and the Germans are reportedly assisting in the modernization of the nitrocellulose production process.[6] A new acid treatment facility was also constructed between May 1978 and May 1981.

13. (S/WN) The plant consists of an ingredients preparation area, a nitrocellulose production area, a probable nitroglycerin production area, a double-base propellant-production area, and an administration/engineering/transshipment area. The ingredients preparation area contains two probable mix/blend buildings, at least two ingredients preparation buildings, at least one probable case preparation building, and 18 support buildings. The nitrocellulose production area contains a receiving building, a nitrator building, a probable boiler tub house, a probable ingredients preparation building, a probable beating and pulping building, a probable poaching building, a probable blending house, a probable wringer house, a warehouse, and an acid storage area. The probable nitroglycerin production area includes a probable ingredients mix building, a probable nitrator building, two probable wash/separator houses, a probable filtration building, and a probable acid recovery building with ten adjacent horizontal acid storage tanks. The double-base propellant-production area consists of a case preparation building, one probable casting building, two probable curing buildings, two probable mix/blend buildings, a probable packaging building, two probable warehouses, and six support buildings (one annotated on graphic). In addition, there are production lines for TNT, other high explosives, and explosive powders. The installation is road and rail served and uses a nearby electric power station.

14. (S/WN) In support of its plans to be self-sufficient in propellant production, the Brazilian Government has approved construction of two related facilities for the production of polybutadiene and ammonium perchlorate, which it currently imports. Polybutadiene, a resin used as fuel, and ammonium perchlorate, an oxidizer, are the main ingredients used by Brazil for the production of solid-propellant motors. Large quantities of these materials will be needed in the Sonda IV and the proposed SLV programs. Brazil currently has the capability of casting solid-propellant motors using small quantities of these materials, as evidenced by their Sonda I, II, and III sounding rockets. The polybutadiene plant is to be in the vicinity of and will use the facilities of the Sao Jose dos Campos Refinery and Storage Facility (REVAP; _____), one of the largest oil refineries in Latin America.[1] The refining capabilities necessary to initiate polybutadiene production have been installed at the refinery since 1979, but to date no construction of a polybutadiene plant has been observed. Similarly, no construction relating to ammonium perchlorate production has been identified. Both plants were originally scheduled to be completed by 1984. 25X1

Aerospace Production Facilities

15. (S/WN) The major aerospace-related production facilities are in the Sao Jose dos Campos Complex (Figures 3 and 7).

16. (S/WN) The major producer of aerospace equipment and missiles is AVIBRAS, a firm established in 1961 as CTA's first contractor. It produces rockets, missiles, satellites, their associated electronics and other support systems for civilian and military use; it also developed the solid propellant for Brazil's rockets. In 1980, AVIBRAS exported over 20 million dollars worth of sounding rockets and small tactical missiles. AVIBRAS' involvement in space activities began in 1965 with its participation in the Sonda I project and continues today with the production of most components for the Sonda IV and proposed SLV.[7]

17. (S/WN) The main AVIBRAS aerospace production facility at Sao Jose dos Campos (Figure 7) consists of a multisectional building which reportedly covers a much larger underground work area. Since May 1981, the aboveground portion has gradually been disassembled. A small production area at the west end of Sao Jose dos Campos Airfield is probably also associated with AVIBRAS and may be involved in the production of missiles, rockets, and their subsystems (Figure 7). It includes two assembly/fabrication buildings, three bunkered probable storage buildings, and a probable electronics area with two large parabolic dish antennas. Many possible rocket/missile crates have been observed in the area. AVIBRAS probably uses a nearby stone quarry for testing motors and other components; however, no test activity has been observed on satellite imagery.

18. (S/WN) AVIBRAS is currently planning to move its major operations involving solid propellants, rocket motor cases, and missile testing to an isolated island in a lake near the Santa Branca Dam, 12 nm south of its present site.[7] No evidence of construction was observed when this area was last imaged in October 1980.

19. (S/WN) EMBRAER (Figures 3 and 7), Brazil's leading aircraft manufacturer, is also involved in production and nondestruct testing of rocket and missile airframes. It cooperates closely with CTA and

AVIBRAS. Established in 1969, EMBRAER has continually been expanding and has become a major exporter of aircraft, especially the Bandeirante utility aircraft. EMBRAER occupies the northeast side of Sao Jose dos Campos Airfield, along with its aircraft manufacturing subcontractors, AEROTEC and NEIVA. The EMBRAER area includes 12 assembly/maintenance buildings, five hangars, three administration buildings, a control tower, and five support buildings.

Launch and Test Facilities

20. (S[ ] Brazil's only major launch area is the Barreira do Inferno Rocket Range (Figure 8 and Table 3) on the Atlantic Coast. It is operated by the Brazilian Air Force under the auspices of INPE. Since its opening in 1965, over 2,000 domestically- and foreign-built sounding rockets have been launched from there, including the Nike-Ajax, Nike-Cajun, Nike-Iroquois, Javelin, Aerobee, Black Brant IV, and the Brazilian Sondas.[8] 25X1

21. (S/WN) The rocket range contains six launch pads, five with erectable launch rails; a launch support area; a propellant storage area; a command and control area; an extensive tracking and telemetry system; and a support area. Tracking facilities include an American-built Baker-Nunn optical tracker and a French-built Thomson CSF radar system, which assist in monitoring and transmitting data for the European Space Agency's Ariane launch facility at Kourou Space Center-Launch Areas [ ] 25X1 in French Guiana.

22. (S/WN) Final assembly and inspection of the Sonda rockets is performed at the Barreira do Inferno Space Assembly Facility (Figure 9), which is 5.5 nm west of the launch facility. The facility consists of a probable vertical checkout stand with water reservoir; four assembly/subassembly buildings, one with a probable laboratory/engineering section; a final assembly building; two probable inspection stations; a checkout building; an administration building; three storage/support buildings; and two storage tanks. Rocket transporters and various other trucks have occasionally been seen there.

23. (S/WN) The Brazilian Government has stated that Barriera do Inferno is considered too small to be used for the SLV program. The Brazilian Government, therefore, has reportedly expropriated a 500-square-km area adjacent to Sao Luis Bay on the Atlantic Ocean for construction of a new launch complex (Alcantara Space Launch Facility). Current plans call for the facility to become operational in 1988 with the launch of the first proposed SLV.[1] As of [ ] no construction had been seen in the area. 25X1

24. (S/WN) Despite construction of a new facility, INPE plans call for continued use and upgrading of the Barriera do Inferno Rocket Range. No expansion was observed at the rocket range through April 1982.

25. (S/WN) Brazil is also constructing a new test range at Cachimbo Military Weapons Test Facility (Figure 10) to support a medium-range tactical missile program. The range, a 44,000-square-km tract, was purchased by the government for use as a proving ground. As of [ ] the range consisted of 25X1 three firing blocks, one probable tracking position, one possible control building, and several small support buildings. A new airfield (Cachimbo New Airfield, [ ] 25X1 is adjacent to the range. Brazil's only other operational test area, the Marambaia Proving Grounds [ ] 25X1 southwest of Rio de Janeiro, handles only small-arms and ballistics systems.

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Table 2.
Piquete Explosives Plant Presidente Vargas
(Items keyed to Figure 6)

This table in its entirety is classified SECRET/WNINTEL

Item No	Description	Dimensions (m) L	W	H	Remarks
A. Ingredients Preparation Area					
1	Prob mix/blend bldg				
2	Ingredients prep bldg				
3	Prob case prep bldg				
4	Acid stor bldg				
5	Prob mix/blend bldg				
6	Ingredients prep bldg				
B. Nitrocellulose Production Area					Built by West Germans 1968—1969
7	Prob wringer house				Bunkered
8	Prob blending house				Bunkered
9	Prob poaching bldg				Bunkered height for higher sect
10	Prob beating & pulping bldg				Bunkered
11	Acid stor area				
12	Prob ingredients prep bldg				
13	Nitrator bldg				
14	Prob boiler fuel house				
15	Warehouse				
16	Receiving bldg				
C. Probable Nitroglycerin Production Area					
17	Prob ingredients mix bldg				Revetted
18	Prob filtration bldg				Revetted
19	Prob wash/separator house				Revetted
20	Prob wash/separator house				
21	Prob nitrator bldg				
22	Acid stor tanks				
23	Prob acid recovery bldg				
D. Double-Base Propellant-Production Area					Installed by French 78—81
24	Prob curing bldg				
25	Prob curing bldg				
26	Spt bldg				
27	Prob mix-blend bldg				
a	Low-bay sect				Revetted
b	High-bay sect				
28	Prob packaging bldg				
29	Case prep bldg				
30	Prob mix-blend bldg				Revetted
31	Prob casting bldg				Revetted
32	Prob warehouse				
33	Prob warehouse				

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Table 3.
Barriera do Inferno Rocket Range
(Items keyed to Figure 8)

This table in its entirety is classified SECRET WNINTEL

Item	Description
A. Western Tracking Facility	
1	Control bldg
2	Thomson CSF tracking antenna
3	Antenna
B. Support Area	
4	Admin bldg
5	Supply-maint bldg
6	Security-admin bldg
C. Interferometer	
D. Tracking Area	
7	Baker-Nunn optical tracking bldg
E. Command and Control Area	
8	Instrumentation bldg
9	Meteorological-remote sensing bldg with radome
10	Admin bldg
11	Control bldg
12	Communications bldg
13	Generator bldg
14	Helipad
F. Propellant Storage Area	
15	LOX stor
16	Liquid-propellant stor
17	Solid-propellant stor
G. Launch Support Area	
18	Payload prep bldg
19	Vehicle prep bldg
20	Spt bldg
H. Launch Area	
21	Blockhouse
22	Meteorological-instrumentation tower
23	Nike launch pad with launch rail
24	Launch pad with tripod and launch rail
25	Meteorological rocket launch pad
26	Launch pad with launch rail
27	Helium supply station
28	Aerobee launch pad with launch rail
29	Sounding rocket pad with launch rail

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IMAGERY

S/WN) All applicable satellite imagery acquired through April 1982 was used in the preparation of this report

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*Extracted information is classified SECRET [redacted] 25X1

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(S) Comments and queries regarding this report are welcome. They may be directed to [redacted] Science and Technological Team, Third World Forces Division, Imagery Exploitation Group, NPIC, [redacted] 25X1 25X1 25X1