



**DEPARTMENT OF AEROSPACE  
SCIENCE AND TECHNOLOGY**



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***The Brazilian Sounding Rocket VSB-30:  
meeting the Brazilian Space Program and  
COPUOS objectives***

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**COPUOS**

**United Nations, Vienna, Austria, 10-21 February 2014**

# Objective

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*Introducing the VSB-30 sounding rocket and explaining how this vehicle has been contributing to achieve both the Brazilian Space Program and the the COPUOS objectives.*

# Overview

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- ***The VSB-30***
- ***Achievements***
- ***Conclusion***

# VSB-30 Architecture



- ▶ Two-stage (solid propellant motors)
- ▶ Unguided
- ▶ Rail launched
- ▶ Spin stabilized
- ▶ Payload with recovery and service system



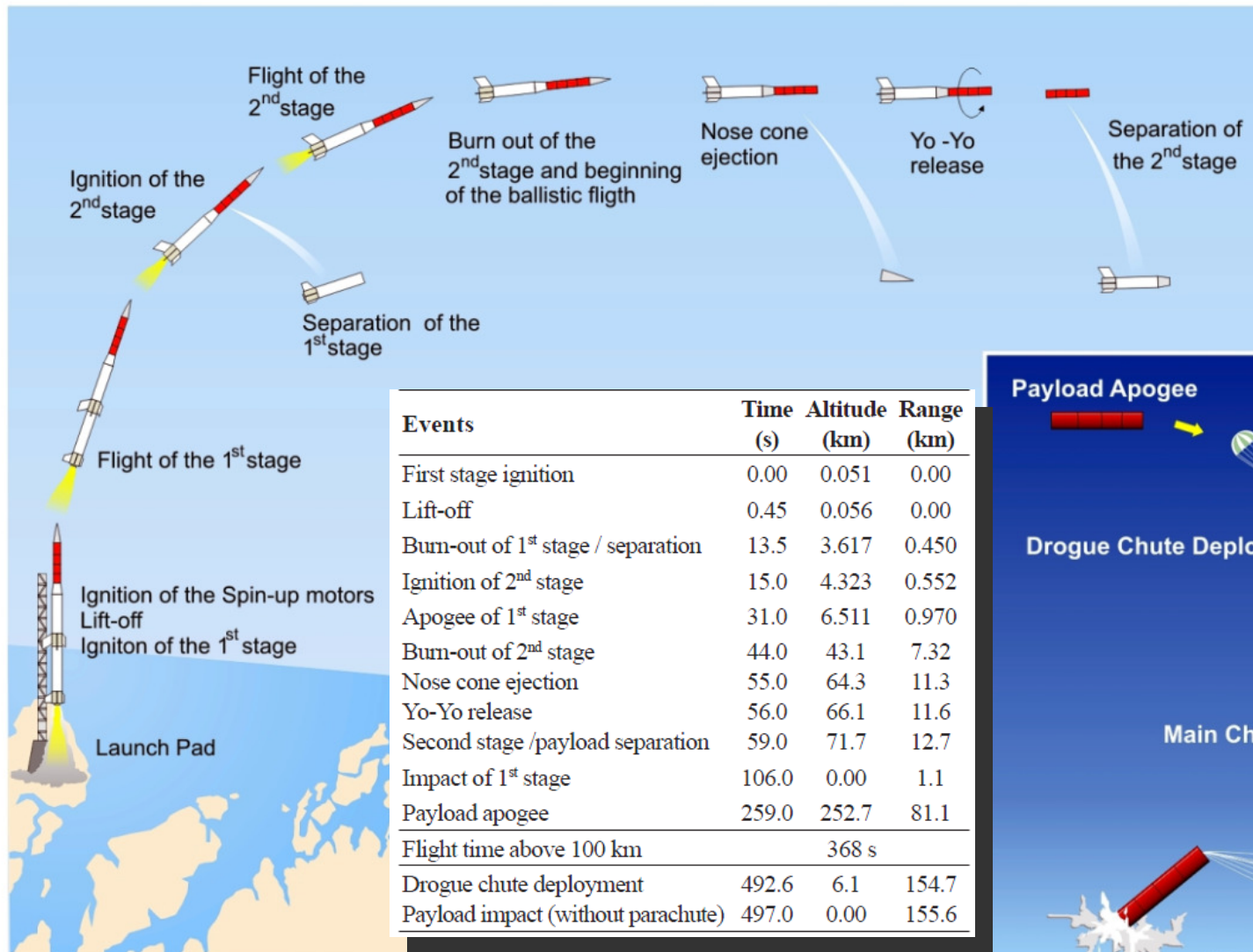
# VSB-30 Flight Characteristics

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- ▶ Payload: 400 kg
- ▶ Payload apogee:  $250 \pm 20$  km
- ▶ Payload ballistic Flight time above 100 km  $> 360$  s
- ▶ Maximum acceleration  $< 14$  g
- ▶ “Booster” impact point  $> 250$  m
- ▶ Payload impact point  $< 3\sigma$  (50 km)

# VSB-30 Flight Sequence



Events	Time (s)	Altitude (km)	Range (km)
First stage ignition	0.00	0.051	0.00
Lift-off	0.45	0.056	0.00
Burn-out of 1 <sup>st</sup> stage / separation	13.5	3.617	0.450
Ignition of 2 <sup>nd</sup> stage	15.0	4.323	0.552
Apogee of 1 <sup>st</sup> stage	31.0	6.511	0.970
Burn-out of 2 <sup>nd</sup> stage	44.0	43.1	7.32
Nose cone ejection	55.0	64.3	11.3
Yo-Yo release	56.0	66.1	11.6
Second stage /payload separation	59.0	71.7	12.7
Impact of 1 <sup>st</sup> stage	106.0	0.00	1.1
Payload apogee	259.0	252.7	81.1
Flight time above 100 km		368 s	
Drogue chute deployment	492.6	6.1	154.7
Payload impact (without parachute)	497.0	0.00	155.6



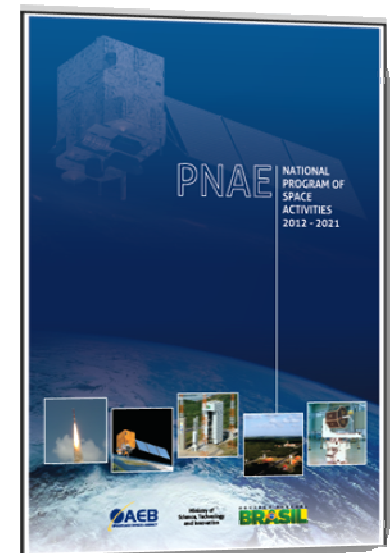
# Brazilian Space Program and COPUOS main objectives

UNOOSA



United Nations  
Office for Outer Space Affairs

- International cooperation in the peaceful uses of outer space
- Continued research on outer space matters
- Promoting and sharing the benefits of space technology
  
- Capacity building in space sector
- Expanding partnerships
- Developing human resources
- Developing and using space technology in Brazil



# VSB-30: Origin and Objectives

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**The VSB-30 was developed to:**

- **Support Brazilian Sounding Rockets and Microgravity programs;**
- **Support European/German Microgravity programs;**
- **Promote space activities for global development;**
- **Strengthen regional and international cooperation.**

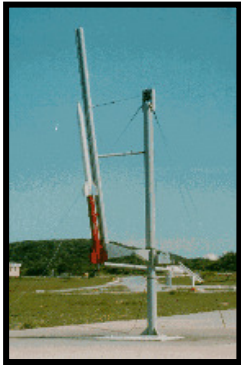




# The Brazilian Sounding Rockets Program



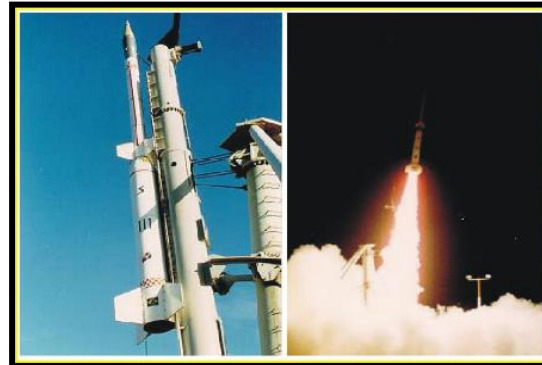
## The Sonda series



SONDA I - 1965



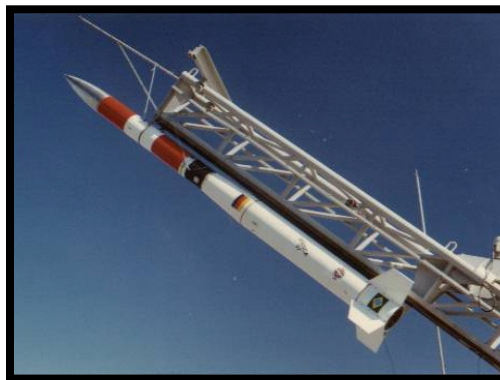
SONDA II - 1972



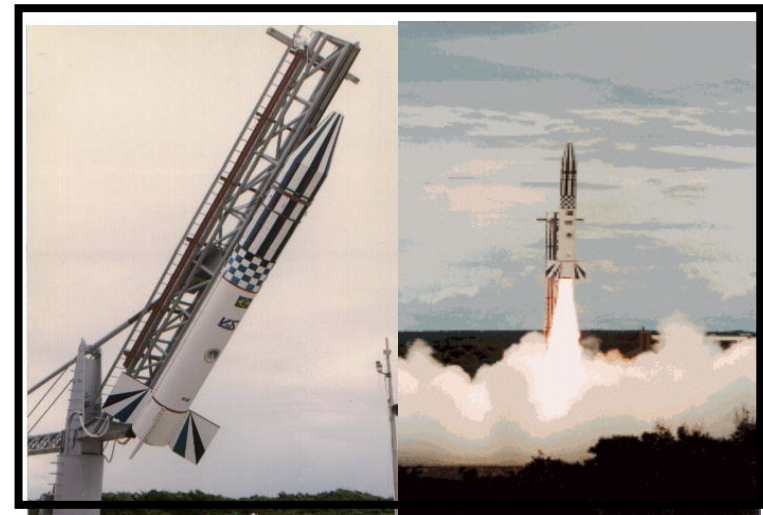
SONDA III - 1976



SONDA IV - 1984



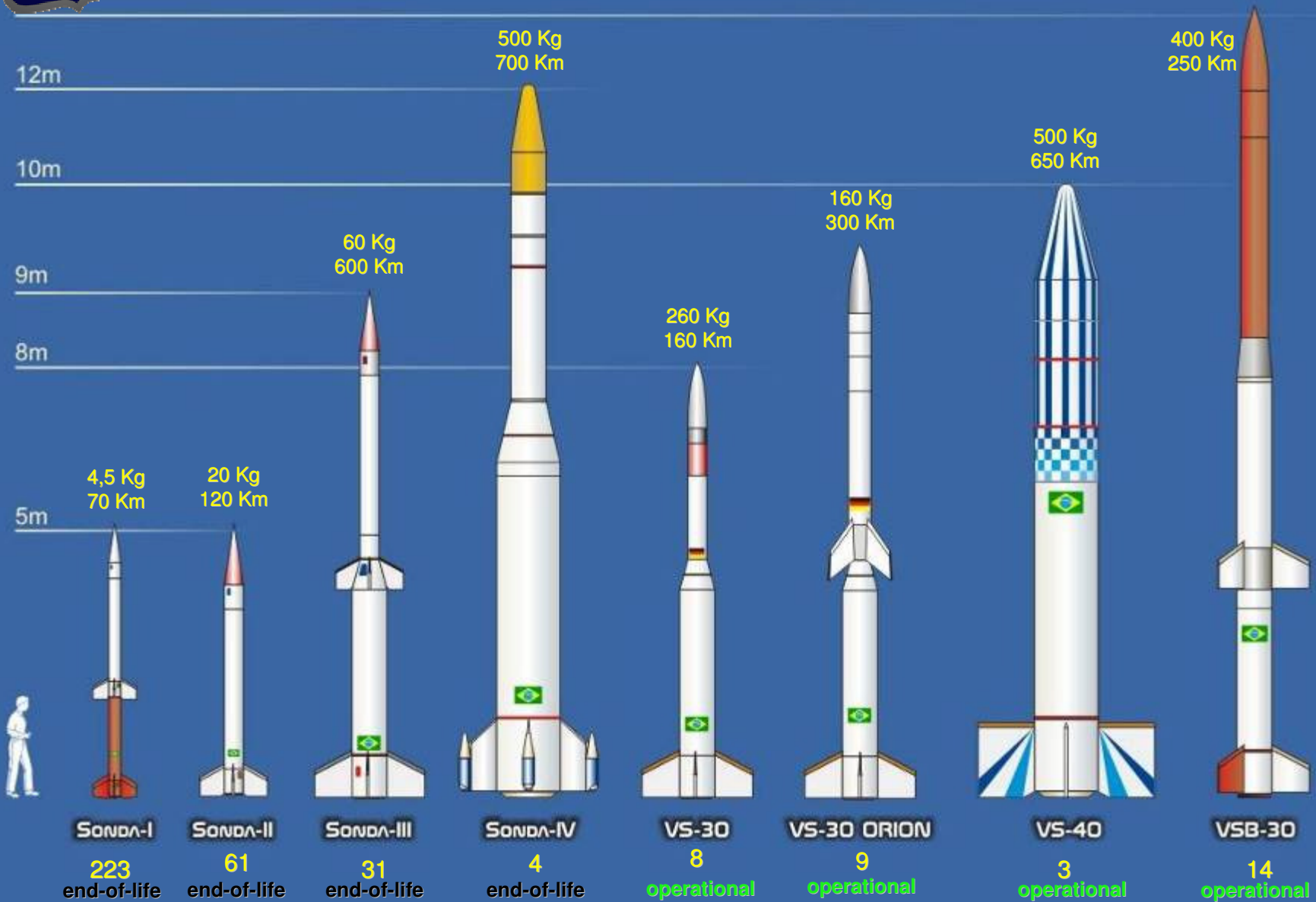
VS-30 - 1996



VS-40 - 2003



# The Brazilian Sounding Rockets *Supporting microgravity programs*



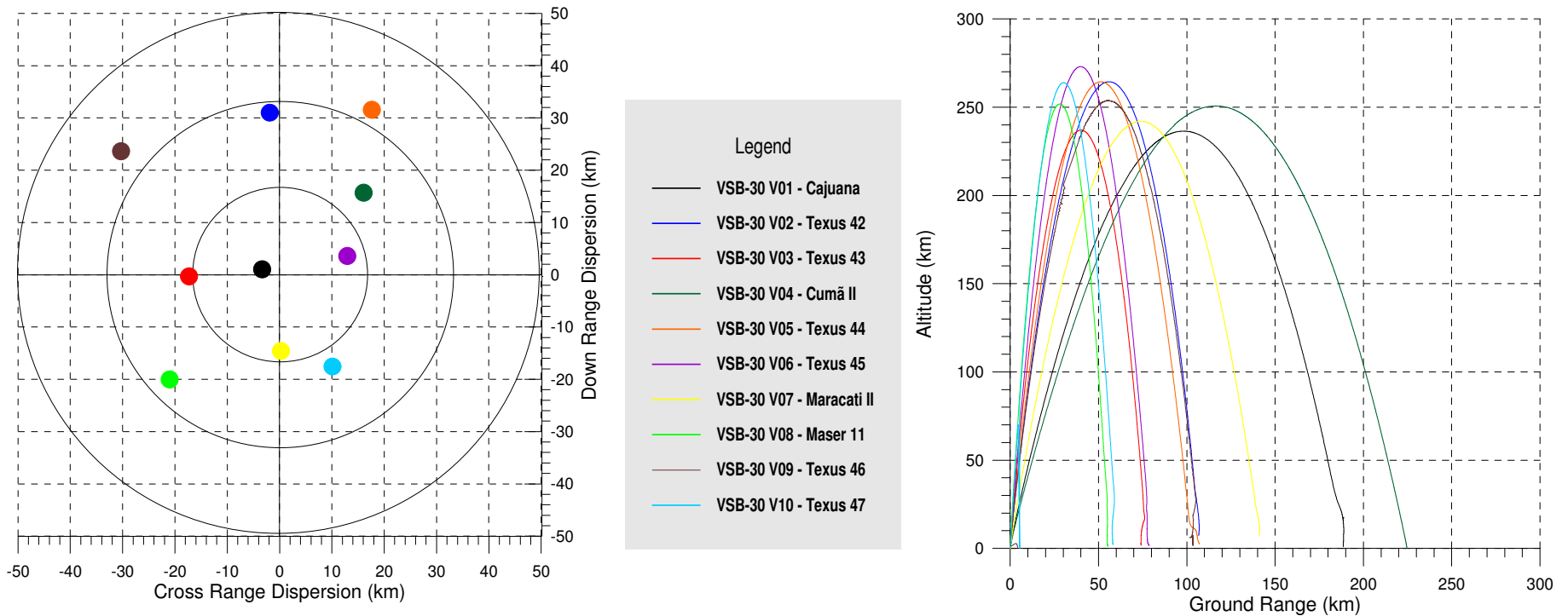


# VSB-30 Launching Campaigns



	Campaign	Flight Number	Launch Center	Date
1	Cajuana	VSB-30 V01	CLA/ Brazil	Oct 2004
2	Texus 42	VSB-30 V02	Esrangle/ Sweden	Dec 2005
3	Texus 43	VSB-30 V03	Esrangle/ Sweden	May 2006
4	MICROG1	VSB-30 V04	CLA/ Brazil	Jul 2007
5	Texus 44	VSB-30 V05	Esrangle/ Sweden	Feb 2008
6	Texus 45	VSB-30 V06	Esrangle/ Sweden	Feb 2008
7	MICROG1A	VSB-30 V07	CLA/ Brazil	Dec 2010
8	Maser 11	VSB-30 V08	Esrangle/ Sweden	May 2008
9	Texus 46	VSB-30 V09	Esrangle/ Sweden	Nov 2009
10	Texus 47	VSB-30 V10	Esrangle/ Sweden	Nov 2009
11	Texus 49	VSB-30 V15	Esrangle/ Sweden	Mar 2011
12	Texus 48	VSB-30 V14	Esrangle/ Sweden	Sep 2011
13	Maser 12	VSB-30 V16	Esrangle/ Sweden	Mar 2012
14	Texus 50	VSB-30 V17	Esrangle/ Sweden	Apr 2013

# VSB-30 Flight Performance



Displacement of actual impact points

Apogee and Ground Range

# VSB-30 Scheduled Campaigns

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Launch Date	Project	Vehicle	Launch Site
2015 (TBD)	MICROG2	VSB-30 V11	CLA
May, 2015	HIFIRE 4	VSB-30 V12	Woomera
September, 2014	HIFIRE 7	VSB-30 V13	Andoya
May, 2014	TEXUS 51	VSB-30 V18	Esrangle
November, 2014	MAIUS 1	VSB-30 V19	Esrangle
June/July, 2014	CRYOFENIX	VSB-30 V20	Esrangle
April, 2015	TEXUS 52	VSB-30 V21	Esrangle
April, 2015	TEXUS 53	VSB-30 V22	Esrangle
April 2015	MASER 13	VSB-30 V23	Esrangle
May 2015	MAPHEUS 5	VSB-30 V24	Esrangle



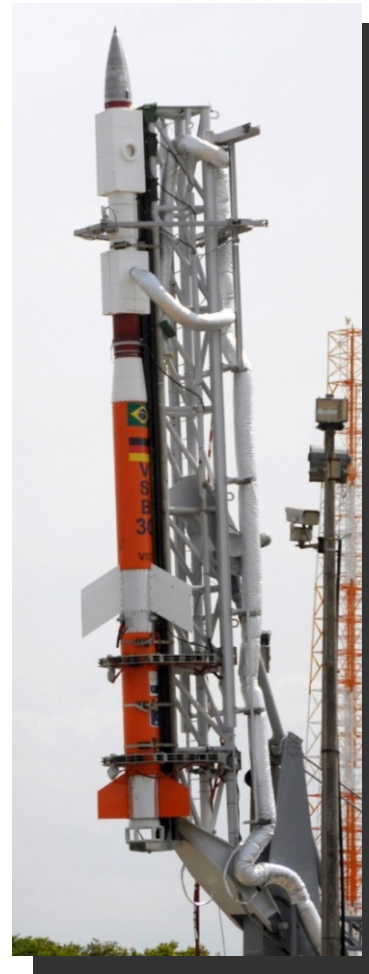


# The VSB-30 Certification

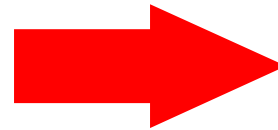
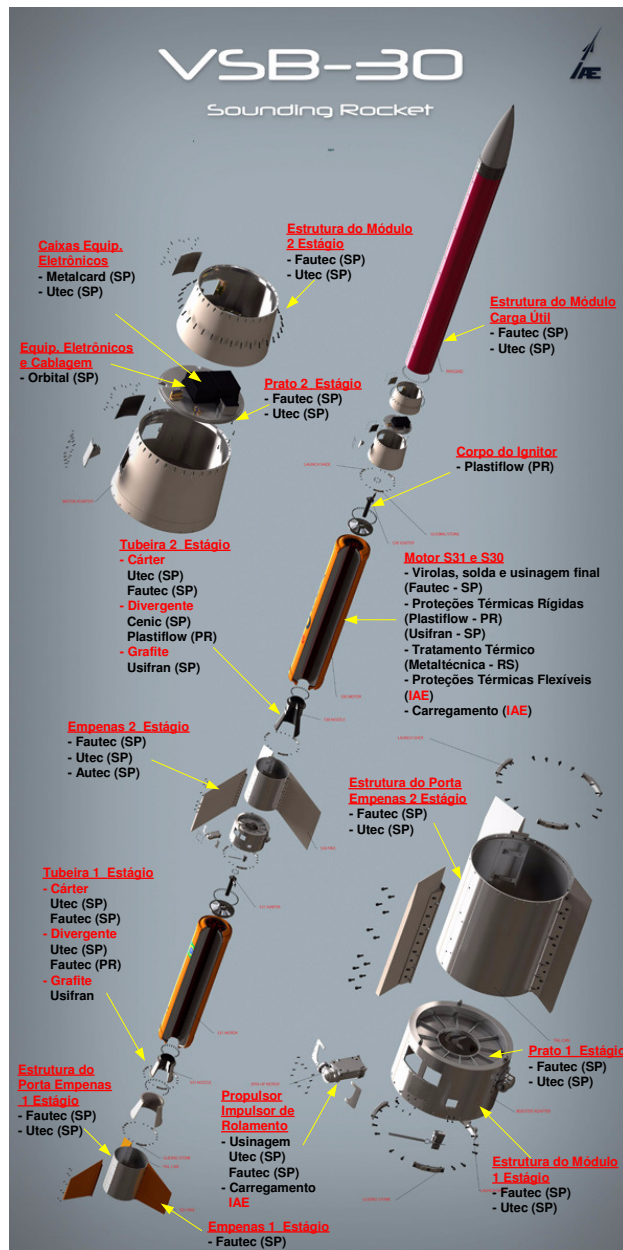


Type Certification Nº 001T2009

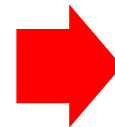
October 15th, 2009



# VSB-30: National industry participation



Industry: 75%



PROPELLANT PLANT

ACCEPTANCE TESTS

DIMENSIONAL INSPECTION

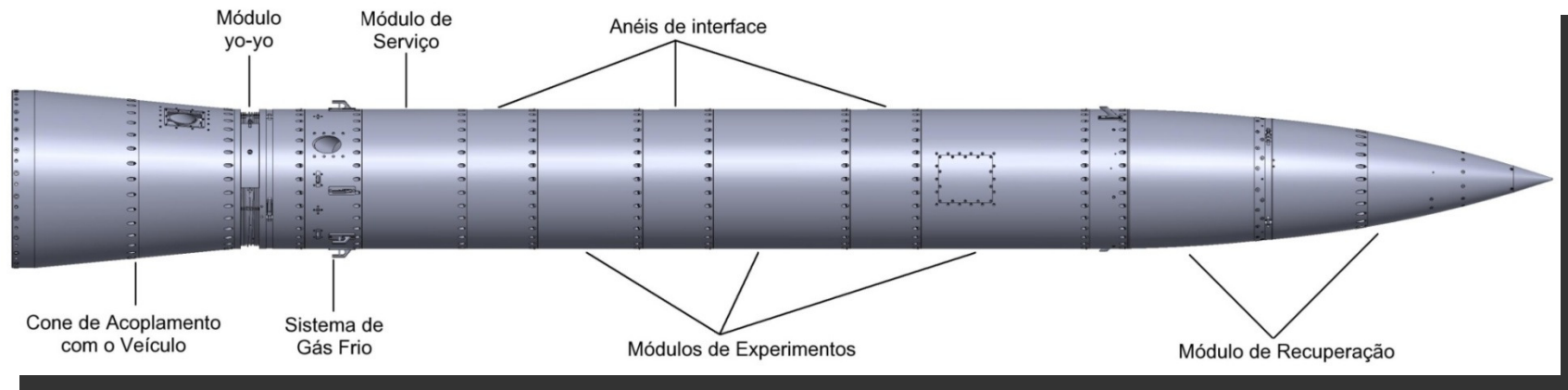
QUALITY CONTROL

TECHNICAL DOCUMENTATION

INTEGRATION

# Related projects

## Microgravity Suborbital Plataforma (PSM)





# Related projects

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## ATMOSPHERIC REENTRY SATELLITE (SARA)

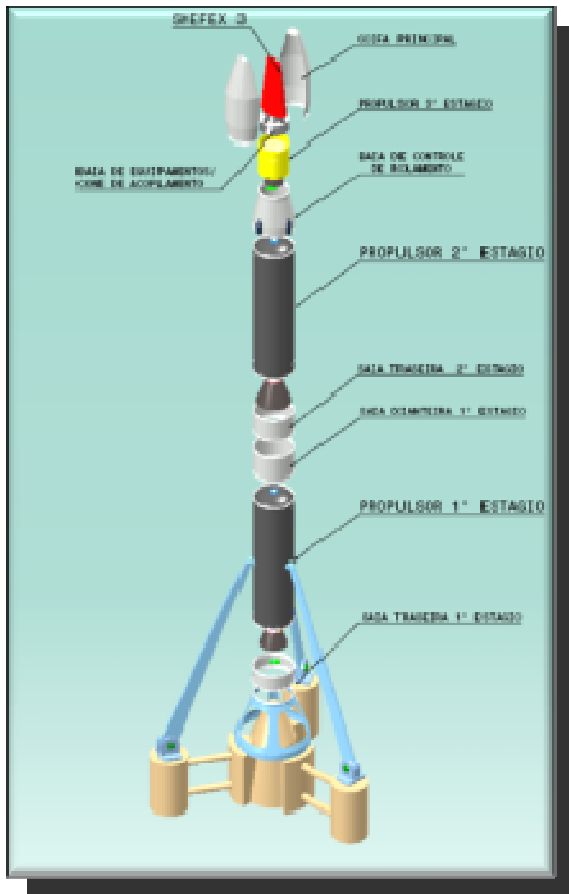
- Orbital and suborbital platform
- Reentry capability
- for microgravity experiments
  - Payload - 300 kg
  - LEO - 300 km



# Related projects

## MICROSATELLITE LAUNCH VEHICLE (VLM)

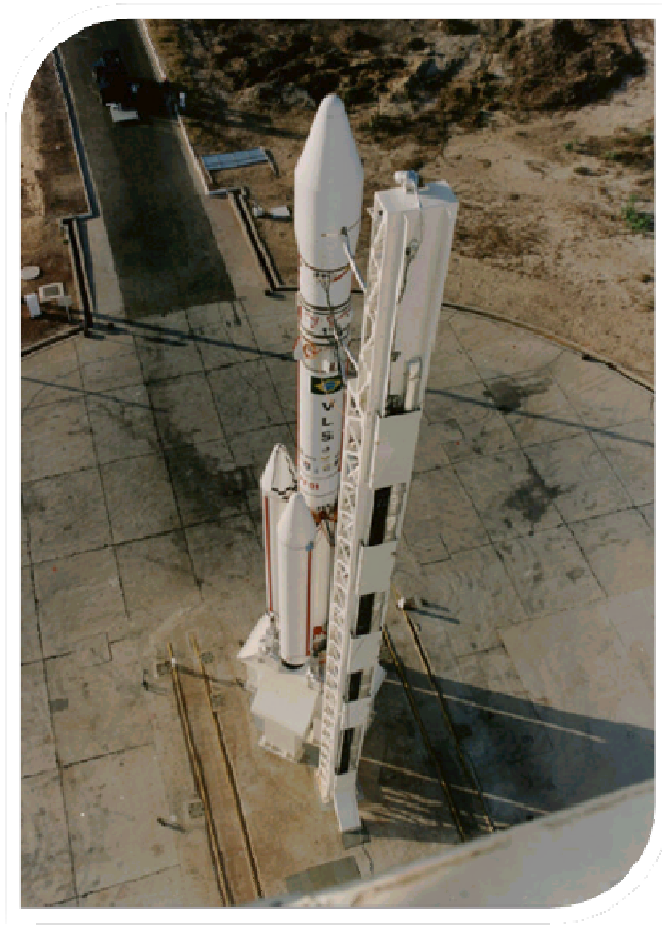
- Solid propellant three-stage rocket
  - Payload – microsattellites up to 150 kg
  - LEO – up to 300 km
- Cooperative development between Germany (DLR) and Brazil (DCTA)



# Related projects

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## SATELLITE LAUNCH VEHICLE (VLS-1)



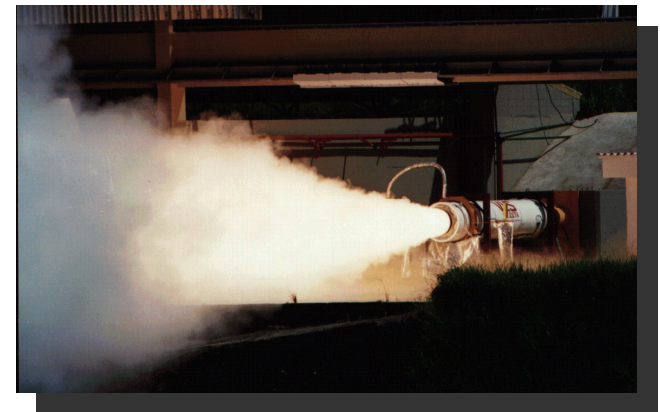
- Payload – up to 250 kg
- LEO – up to 700 km



# Support Infrastructure

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**LABORATORIES, MOTOR TEST INSTALATIONS, PROPELLANT PLANT**





# Support Infrastructure

## Launch Centers



# Conclusion

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***The development and use of the VSB-30 has been contributing to achieve both Brazilian Space Program and COPUOS objectives by:***

- Carring out activities in outer space for peaceful and constructive purposes and for global development;
- Promoting and sharing the benefits of space technology;
- Strengthening regional and international cooperation;
- Promoting Human Resources development; and
- Enabling Brazil to develop and use space technology.



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**Thank you for your attention.**

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