Create a high quality / low cost / fast response
commercial launch vehicle
Serving the global small and Medium satellite launch market

Hyperbola-1 User Manual

The Hyperbola-1 launch vehicle is the first launch vehicle independently designed by Beijing Interstellar Glory Space Technology Co. We have full independent intellectual property rights of the whole rocket including the rocket-borne computers (Xingkong1), four-stage solid rocket engines and orbit control engines.

Hyperbola-1
User Manual

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ABOUT US

Mission:

expending human living space

Vision:

the global leader in commercial aerospace

Management philosophy:

act now and do your best

Interstellar Glory is passionately committed to become one of the global leaders in commercial aerospace! Determined to become an outstanding representative in the field of global commercial aerospace!

As the backbone of commercial aerospace as well as an important participant and beneficial supplement of global aerospace, pursuing the aspiration for world-class status in the space sphere!

Our team members are all graduated from top universities at home and abroad. Among them, over 95% graduated from 985 and 211 universities, and more than 90% graduated with master degrees or above. As such an elite team, we will provide professional process, knowledge, design, and services.

The Hyperbola-1 launch vehicle is the first launch vehicle independently designed by Beijing Interstellar Glory Space Technology Co. We have full independent intellectual property rights of the whole rocket including the rocket-borne computers (Xingkong1), four-stage solid rocket engines as well as liquid attitude and orbit control engines.

Hyperbola-1 launch vehicle does not depend on launch site, its production preparation cycle is less than 6 months, and its technical preparation cycle is less than 5 days, which is suitable for high density, high frequency and fast response launch mission.


长安欧尚号

LOADS SERVICE PROCESS FLOW CHART

T0+6m Products and services — Satellite test, launching, fairing, transferring satellite and rocket, launching services.

T0+4m Satellite and rocket docking — Testing (satellites mate to rocket and electromagnetic compatibility), testing (satellites mechanical environment test, unlocking satellite and rocket, as well as separation test).

T0+3m Large-scale system coordination — Launch site, measurement and control, insurance (rocket/satellite), frequency coordination (satellite), launch License (rocket) .

T0+2m Contract performance — According to the contract, the rocket side completes the mission node, and the satellite side pays the service fee by node.

T0+1.5m Business coordination — Confirm client launch requirements,
Complete business contract negotiation, signing business contracts.

T0+1m Technology coordination — Confirm requirements for mechanical, electrical interfaces, environmental conditions, timing, orbit and attitude accuracy, measurement and control, and signing ICD documents.

T0+3d Demand docking — Type of service (main load/carrier), track, weight, geometric envelope, launch time, etc.

T0 Contact us

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长安欧尚号
逐梦

LAUNCH PLAN

1. Rocket Overview

Hyperbola-1 is a four-stage small solid launch vehicle powered by four stage solid engines and supplied by a liquid attitude control engine. It is mainly used for launching missions of low earth orbit satellites and solar synchronous orbit.

According to customers' needs, Hyperbola-1 can be designed into a variety of interfaces.

2. Technical parameters

The length of Hyperbola-1 launch vehicle is about 24 m, the total mass is about 42t, and the takeoff thrust is 770 KN. The main overall parameters are listed in table1.

Table 1 Main Rocket General Parameters

Parameter	one sublevel	Two sublevel	Three sublevel	Four sublevel
Propellant	Butyl hydroxyl Trisomy	Butyl hydroxyl Trisomy	Butyl hydroxyl Trisomy	Butyl hydroxyl Trisomy
Loading capacity (kg)	18000	13000	3850	1050
Working hours (room temperature)	≮56	≮60	≮56	≮50
Specific impulse (room temperature)	245	282(High altitude)	290(High altitude)	290(High altitude)
Thrust (KN)	≮770	≮597	≮195	≮60
Diameter (mm)	1400	1400	1400	1400
Level length (mm)	8678	6665	2616	1895

3. Rocket system composition

Hyperbola-1 launch vehicle can be divided into three systems, including the rocket body structure, power system, control system, electrical system and remote external security system.

The rocket body structure consists of a fairing, a four-stage, a three-stage front segment, a three-stage solid engine, a second/three interstage, a second stage solid engine, a first/second interstage, a first stage solid engine, a first stage rear segment and a grid rudder. As shown in Figure 1.

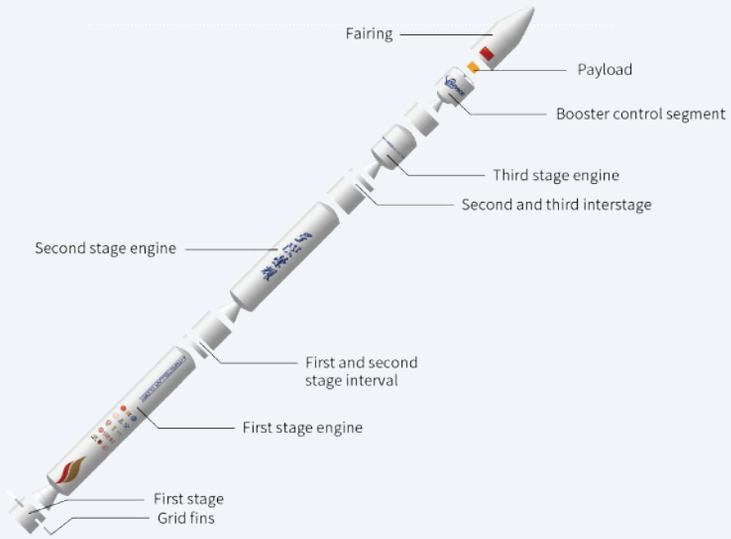

Figure 1 Composition diagram of Hyperbola-1 launch vehicle

4. Carrier Capacity and Orbital Accuracy

The carrying capacity of the Hyperbola-1 launch vehicle is based on the following five premises:

(1) Considering the safety requirements of airspace and the requirements of ground TT&C station.

(2) Carrier capacity includes the mass of satellite and the bracket for satellite

(3) The average radius of the earth at equator is 6378.14 km.

(4) The launch center is located in Gansu province

(5)The typical mission of Hyperbola-1 launch vehicle is 280kg (LEO, 300km). The carrier capacity of different LEOs and SSOs is shown in Figure 2, the accuracy of orbit entry is shown in Table 2, and the separation accuracy is shown in Table3.

Figure 2 The launch capability of Hyperbola-1 launchvehicle (Jiuquan Satellite Launch Center)

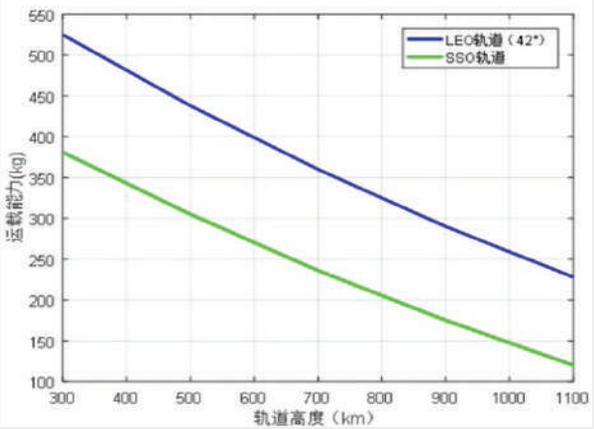

Table 2 Accuracy of orbital entry

Parameter	Symbol	Orbit accuracy
Semi-major axis	|Δa|	⩽5km
Eccentricity	|Δe|	⩽0.003
Orbit inclination angle	|Δi|	⩽0.1deg

Note: The above table shows the precision of the ellipticalorbit with the perigee height of 200 km and the apogeeheight of 400 km&the accuracy of circular orbitH = 500km as an example.

Table 3 Separation Accuracy

Parameter	Satellite
Pitching Angle	＜3.2°
Yaw Angle	＜3.2°
Roll Angle	＜1.5°
Pitch angular velocity	＜1.1°/s
Yaw angular velocity	＜1.1°/s
Roll angular velocity	＜0.5°/s

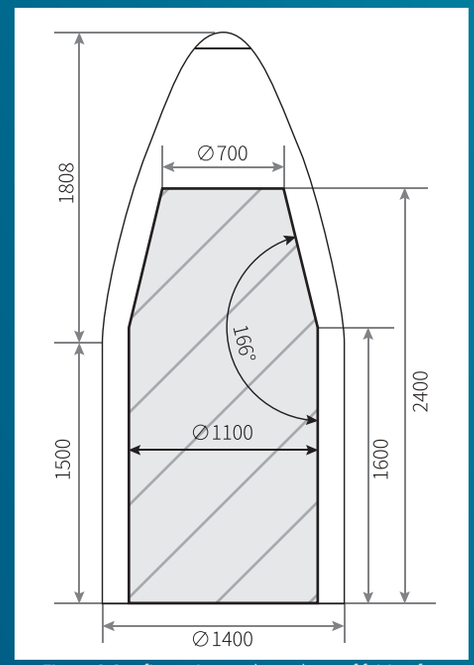

Figure 3 Configuration and envelope of fairing for Hyperbola-1 launch vehicle

5. Fairing

The function of the satellite fairing is mainly to protect the satellite against the impact of aerodynamic force, aerodynamic heating, noise and so on during launch through an atmosphere.

The heat generated by high-speed airflow is absorbed or isolated by the satellite fairing, so that the ambient temperature in the fairing is controlled within a certain range. Noise generated by airflow and rocket engine operation can be reduced to the allowable range of satellite through satellite fairing.

After the rocket flies out of the atmosphere, the satellite fairing can be thrown away. The shape and envelope of the fairing of the Hyperbola-1 launch vehicle satellite are shown in Fig. 3 below.

6. Satellite-Rocket Interfac

6.1 Mechanical Interface

The standard GJB4228-2001 "Dimension Spectrum of Satellite-Launch Vehicle Docking" is used to provide userswith a general interface for large satellites, as shown in Figure 4.

When using the launch plan, the small satellite installation board is arranged in the circumference of the mainsatellite, as shown in Figure 5.

Several main satellite can be installed in a drawer type with layers, as shown in Figure 6.

Medium-sized satellites are installed at the well beam above the equipment cabin in the way shown in Figure 7.When launching several small satellites, central bearing column shell is used to install the guide rail, as shownin Figure 8.

The microsatellite distributor adopts a multi-layer and circular layout. Each layer of the distributor is equippedwith eight satellite interface devices. Five layers can install 40 microsatellites, as shown in Figure 9.

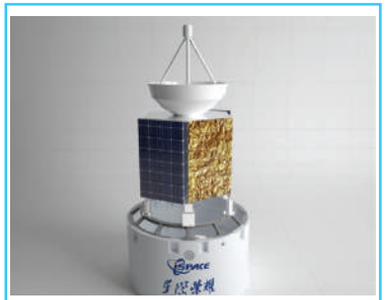

Figure 4
Large Satellite Installation

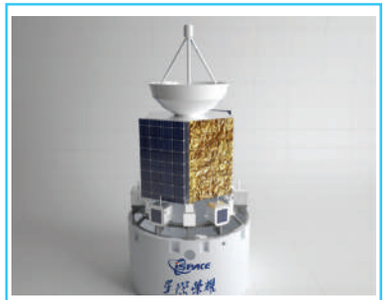

Figure 5
Installation of small satellites around the mainsatellite

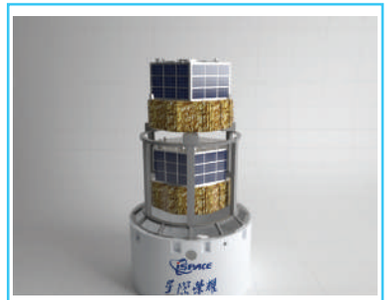

Figure 6
Cage-drawer Satellite Installation

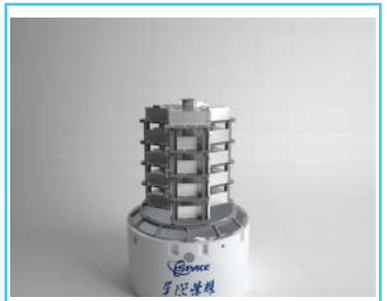

Figure 7
Installation of Medium-sized Satellite

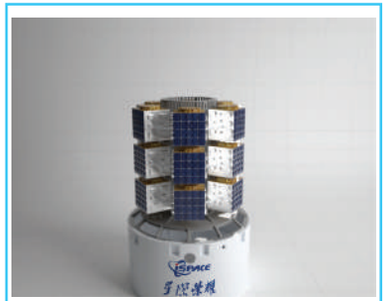

Figure 8
Small Satellite Installation

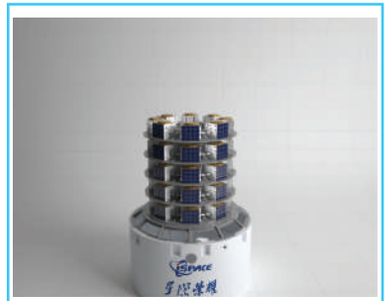

Figure 9
Installation of microsatellites

6.2 Electrical Interface

After the launch center satellite is hoisted anddocked with the rocket mechanically andelectrically, the satellite is usually connected withthe rocket through the satellite-rocket separationconnector. The type of satellite-rocket separationconnector is usually determined by the satelliteside. The satellite side provides the rocket sidewith half of the disconnection connector (referringto the plug/seat connected with the satellite inthe rocket cable network). At the same time, thesatellite side provides the necessary operation toolssuch as processing, installation, test and inspectioninstructions. Specific installation location and coredefinitions are negotiated by both parties andspecified in the interface control document.

7. Mechanics environment of satellite

The conditions at the interface between satellite and rocket are given in this section. Unless noted otherwise, the axis is the vehicle' s axis, and the transverse direction is perpendicular to the axis.

7.1 Fundamental Frequency Requirements

The first-order natural frequency of the whole satellite is not less than 20Hz under the fixed support condition.

7.2 Static Conditions

In order to ensure that the structure has sufficient strength and that no damage to the strength of rocket flight, the satellite should be tested or analyzed according to the static design conditions in Table 5.

Table5 conditions for satellite payload designs

	Axial overload (g)	Lateral overload (g)
Transonic speed	2.0~3.0	1.5
Maximum Overdrive	9.2	0.5
Shutdown condition	±1	0.5
Ground operation	±1	2

Note:

The satellite design load is equal to the use load multiplied by the safety factor, which is not less than 1.25.

· The transverse load represents any direction perpendicular to the longitudinal direction in which it acts.

· Transverse and longitudinal loads coexist.

· Axial overload is positive for compression and negative for tension.

· For special loads, the effects of small or zero overloads need to be considered.

7.3 Load appraisal and acceptance test

The deviation of mechanical environment test is carried out in accordance with GJB1027A "Test Requirements for Vehicles, Upper Stages and Spacecraft".

7.3.1 Sinusoidal vibration testing

The low frequency sinusoidal vibration test conditions of the satellite are as follows:

Table 6 Satellite Low Frequency Vibration Test Conditions

Position	Frequency range (Hz)	Acceptance conditions	Qualification conditions
satellite and rocketinterface	5~10	2.0mm	3.0mm
	10~100	0.8g	1.2g
Scanning rate (oct/min)		4	2

7.3.2 Random vibration testing

The high frequency random vibration test conditions of the satellite are as follows:

Table 7 Satellite High Frequency Vibration Test Conditions

Position	Frequency range (Hz)	Acceptance level		Appraisal level	
		Test time (min)	Root mean square Acceleration (g)	Power spectral density (g2/Hz)	Root mean square Acceleration (g)
satellite and rocketinterface	20~150	3dB/oct	6.94	3dB/oct	9.82
	150~800	0.04		0.08	
	800~2000	-6dB/oct		-6dB/oct	
Test time (min)		1		2	

7.3.3 Impact testing

The impact of rocket is mainly caused by the separation of fairing and the unlocking of initiating explosives device for the satellite-rocket separation (When the satellite is responsible for satellite-rocket separation, the impact environment of the separation of satellite-rocket separation is considered by the satellite itself.), the magnitude of test conditions as shown in table8. Three appraisal tests and one acceptance test were required.

7.3.4 Noise testing

The acceptance test of noise is shown in table 9. If there is no sound-sensitive structure or equipment on the satellite, only random vibration test is needed.

Table 8 Shock Conditions at Star-Arrow Interfaces

Position	Frequency range (Hz)	Shock Response Spectrum (g) (Q=20)
Rocket interface	100~1000	9dB/oct
	1000~8000	4000

Table 9 noise conditions in fairing

Octave center frequency (Hz)	Sound pressure level (dB)	
	Acceptance level	Appraisal level
31.5	109	113
63	121	125
125	124	128
250	130	134
500	135	139
1000	136	140
2000	131	135
4000	122	126
8000	118	122
Total sound pressure level	140	144
Test time(min)	1	2

8. Launch site operation

The Satellite team of Hyperbola-1 launch vehicle in the launch site is mainly take charge of satellite pre-loading alignment and testing, satellite-rocket docking, fairing closure, assembly transfer and hoisting docking, satellite pre-launch preparation and testing.

8.1 Pre-installation preparation and testing of satellites

The Satellite team is responsible for completing the test, fueling and pre-installation preparations for the satellite.

8.2 Satellite and rocket docking

The rocket team responsible for placing the four-stage cabin on the ground bracket, and installing the satellite bracket; After the satellite team lift up and move the satellite onto the four-stage satellite support, the rocket team to install the separation device as well as the electrical interface; both team confirm.

8.3 Fairing encapsulation

The rocket side is responsible for installing detonation bolts and other separating and unlocking mechanisms of the fairing.

8.4 Transportation and hoisting docking of assemblies

The rocket team is responsible for the integration of fairing and four stage interstage.

8.5 Pre-launch preparation and testing of satellites

Satellite can be connected to ground test equipment through satellite-rocket electrical interface and rocket umbilical cord cable. Before launching, satellite preparation and test can be carried out. However, the operation of satellite needs to consider the approach ability of rocket and the limitation of radio silence time.

9. Safety control of flight range

Hyperbola-1 launch vehicle is equipped with security control system equipment related to autonomous destruction, which can be self-destructed in case of abnormal flight conditions. The safety officer designated by the satellite launching center is responsible for the flight safety of the rocket. The specific responsibilities of the security officer include:

(1) According to the flight safety system design plan of the rocket design unit, the safety control criteria for launch vehicle are formulated jointly with the designer. The safety criteria include the safety boundaries (alarm lines and destruction lines) of flight trajectory permission.

(2) To get information about the distribution of population and important facilities in the area.

(3) Ensure the measuring equipment provides flight information required for Ground safety control, so as to effectively show the malfunction during the flight or to make sure that the rocket is flying within a predetermined range.

(4) If the rocket has irreparable faults that cannot complete the flight mission and may cause harm to the ground, the rocket flight will be terminated according to the requirements of the Guidelines for Safety Control of Launch Vehicles.

Interstellar Glory has a first-class management and R&D team

Industry cutting-edge technology strength

We are willing to share the achievements of industrial

development with investors and our clients!

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