

4 CAST programs

4.1 Scientific Satellites (SJ)

China's scientific satellite program began with the DFH-1 satellite launched in 1970 and continued with the Shi Jian satellite series, launched occasionally starting in 1971. The series remained a small part of the Chinese program compared to the FSW recoverable satellites and the DFH communications satellites.

- Dong Fang Hong Yi Hao (1970-34A)

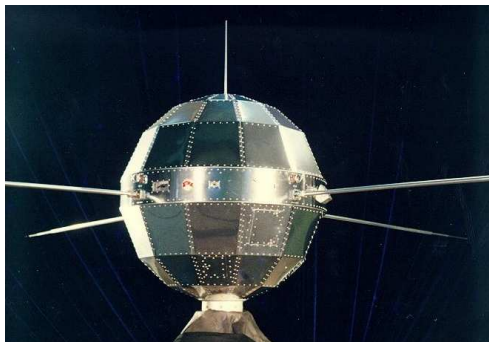


Figure 13: China's first satellite (via Sven Grahn)

The radio transmitter on China's first satellite played the anthem 'East is Red' (Dong Fang Hong), which became the name of the satellite - Dong Fang Hong Yi Hao or DFH-1. It was launched by a Chang Zheng 1 (Long March) rocket from the Jiuquan space center. Internally the project was designated Project 651. Western sources labelled the satellite PRC-1 or Mao-1. Mass of Dong Fang Hong 1 was 173 kg. The satellite operated for 28 days.

DFH1 was 1.0m polyhedron.

The third stage was 2050 kg full, 250 kg empty and delivered a Δv of around 4.13 km/s over a 38s burn.

Dong Fang Hong

Date	Time	Event	Orbit
1970 Apr 24	1335	Launch by Chang Zheng 1	Jiuquan
	1336	T+1:00 Stage 2 burn	
	1338	T+3:00? Stage 2 burnout	
	1339?	Stage 3 sep	
	1342?	Stage 3 burn	-5300? x 440 x 68.4
	1343?	Stage 3 burnout	
	1348	Stage 3 sep	114.1 441 x 2386 x 68.4
1970 May 22?		End of transmissions	

PAYLOAD

Radio Transmitter

- Shi Jian Yi Hao (1971-18A)

China's second satellite was Shi Jian Yi Hao (SJ 1, PRC 2). Shi Jian has been translated as 'Practice' or 'Test'. SJ 1 was similar in construction to DFH 1. It carried a magnetometer and solar cells, and cosmic



Figure 14: China's second satellite (via Sven Grahn)

ray detectors. SJ 1 transmitted until at least 1977, and possibly until reentry in 1979. Transmissions continued on 20.008MHz from the final stage rocket until Mar 11, after which 19.995 MHz transmissions from the payload began, and it appears that the rocket did not separate until then.

Satellite was a 1.0m dia sphere, spin-stabilized and covered with solar cells. Mass was 221 kg.

Shi Jian 1

Date	Time	Event	Orbit
1971 Mar 3	1215	Launch by CZ1	JQ
			106.2 268 x 1830 x 69.9
1971 Mar 11		Final stage separated	
1971 Mar 26		End of tx from stage 3	
1979 Jun 17		End of transmissions	
1979 Jun 17		Reentered over Lake Michigan	

PAYLOAD

GM counter e 0.8 MeV, p 16.4 MeV
Ionization chamber, Solar X-rays 1-8A.
Magnetometer

- Shi Jian A satellite simulator of 3100 kg mass was test launched by FB-1 on 1977 Sep 15 and on 1978 Apr 15.

- Shi Jian (1979-F02)

A Feng Bao 1 rocket launched on 1979 Jul 30 failed to reach orbit. It carried a trio of Shi Jian 2 satellites, mass 250 kg, 480 kg and 30 kg. The stage 2 vernier engines failed.

SJ

Date	Time	Event	Orbit
1979 Jul 30		Launch by FB1	JQ
		Stage 1 MECO	
		Stage 2 burn	
		Stage 2 MECO	
		Stage 2 verniers fail	
		Failed to orbit	

• Shi Jian Er Hao

(1981-93B)

The final FB-1 launch carried Shi Jian 2 (Shi Jian Er Hao, PRC 9) into orbit. The satellite was also referred to as Shiyan Kexuedi Weixing (Experimental Scientific Satellite) but the SJ-2 name has been consistently used since the late 1980s. Two small subsatellites were carried into orbit with SJ-2. SJ-2 was an octagonal cylinder with 4 solar panels, 1.1m long and 1.2m diameter (or 0.6m dia?). Mass was 257 kg. Span around 3.2m.



Figure 15: The SJ-2 satellites during checkout

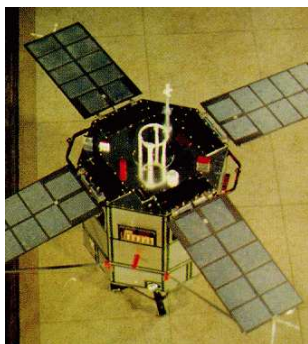


Figure 16: The SJ-2 satellite

SJ 2

Date	Time	Event	Orbit
1981 Sep 19	2128:40	Launch by Feng Bao 1	JQ
	2130:48	T+2:08 Stage 1 MECO	
	2130:48?	Stage 2 MES	
	2132:45?	T+4:05? Stage 2 MECO	
	2136:00	T+7:20? Stage 2 VECO	
	2136:00	T+7:20 SJ-2A sep	
	2136:00	T+7:20 SJ-2B sep	

SJ 2

Date	Time	Event	Orbit
	2137?	adapter sep from stage 2	
	2137?	SJ-2 sep from stage 2	
1982 Oct 6		Reentered	240 x 1610 x 59.5

PAYLOAD

Ionization gauge
Magnetometer
IR radiometer and UV radiation from upper atmosphere
Solar protons and electrons
Solar UV,X

• Shi Jian Er Hao Jia

(1981-93D)

The first subsatellite with the SJ-2 mission was named Shi Jian Er Hao Jia, loosely the equivalent of SJ-2A. The satellite was a tapered cone with 4 antennae which studied the magnetic field and the ionosphere. Mass was 483 kg. The satellite was in the upper part of the nosecone, and the SJ-2/SJ-2B pair were beneath and partly inside it.

SJ 2A

Date	Time	Event	Orbit
1981 Sep 19	2128:40	Launch by FB 1	JQ
			240 x 1610 x 59.5
1982 Aug 17		Reentered	

PAYLOAD

Ionospheric beacons 40.5 MHz, 162 MHz

• Shi Jian Er Hao Yi

(1981-93A)

The second subsatellite, Shi Jian Er Hao Yi, again approximately equivalent to Shi Jian 2B, was a 28 kg 0.45m dia metal sphere connected by a 600m silk cable to a passive 4m diameter balloon. It was a passive radar calibration test satellite (the balloon aided optical tracking but was also coated with aluminium) and was also used to study air density. It reentered after 6 days.

SJ 2B

Date	Time	Event	Orbit
1981 Sep 19	2132	Launch by FB1	JQ
			103.3 232 x 1598 x 59.5
1981 Sep 25		Reentered	



Figure 17: The SJ-2A satellite



Figure 18: The SJ-2B satellite

• **Da Qui Weixing 1** (1990-81B)

The DQ (Atmosphere) or QQW balloon satellites were launched by a Chang Zheng 4 from the T'ai Yuan (Wuzhai) site in Sep 1990. They consisted of 2 40-cm diameter containers, which ejected a 3-m balloon and a 2.5 m balloon.

Atmosphere 1			
Date	Time	Event	Orbit
1990 Sep 3	0053	Launch by CZ-4	

• **Da Qui Weixing 2** (1990-81C)

The DQ (Atmosphere) balloon satellites were launched by a Chang Zheng 4 from the T'ai Yuan (Wuzhai) site in Sep 1990. They consisted of 2 40-cm diameter containers, which ejected a 3-m balloon and a 2.5 m balloon. Total mass 8 kg for both balloons.

Atmosphere 2			
Date	Time	Event	Orbit
1990 Sep 3	0053	Launch by CZ-4	
1991 Jul 24		Reentered	

• **Shi Jian 4** (1994-10A)

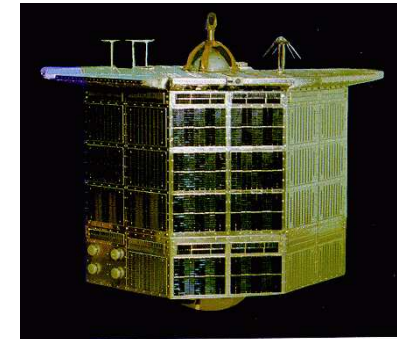


Figure 19: The SJ-4 satellite

SJ4, launched on the first Chang Zheng 3A test flight, carried a scientific payload from the Chinese Academy of Sciences [6]. The 400 kg satellite studied the radiation belts at synchronous altitudes, probably to support future comsat design. SJ4 was a 1.0m dia 2.0m long cylinder with a small boom.

SJ 4			
Date	Time	Event	Orbit
1994 Feb 8	0834	Launch by CZ-3A	XSC
1994 Feb 16			189 x 36152 x 28.7
1994 Apr 1			165 x 36114 x 28.5

PAYLOAD

Proton and electron detectors
 Radiation effects on electronics (SEU monitor)
 Electrostatic analyser.
 Charging monitor

● SJ-5 (1999-25B)

Shi Jian 5 was a secondary payload on the first CZ-4B launch in 1999 using a new SISE manufactured bus. Size is 1.2 x 1.0m box with two 5-m span solar panels. Mission design life is three months. It tested out attitude control, software, S-band telemetry, Al honeycomb structure, thermal control, and power supplies, as well as carrying a radiation dose and fluid physics payload. Mass is 298 kg. (or 350 kg, ISTS22-1295).

The CZ-4B carried two transition sections (A and B) and a conical adapter. The adapter was left in orbit and is 2.9m dia like the fairing and third stage.

SJ-5			
Date	Time	Event	Orbit
1999 May 10	0133	Launch by CZ-4B	TYSC
	0135	T+2:32 St 1 sep St 2 burn	
	0135	T+2:47 Fairing sep	
	0139	T+6:48 Stage 2 MECO	
	0139	T+6:49 St 2 sep Stage 3 burn	
	0145	T+12:29 FY-1C sep	
	0146	T+13:34 SJ5 sep	
1999 May 10			838 x 861 x 98.8
1999 Jun 14			844 x 868 x 98.8
2004 Jan 8			840 x 866 x 98.6

PAYLOAD

Particle precipitation
 SAA measurements
 SEU upset experiment
 Microgravity fluid physics

● Haiyang 1 (2002-24A)



Launched with FY-1D on 2002 May 15. HY-1 ("Marine No. 1") is the first Chinese marine survey satellite. Developed by China Space DFH Satellite Co. for the State Bureau of Oceanography. Uses SJ-5 bus. Box + 2 panels. 360 kg.

Satellite was cataloged as 27433/2002-024D until May 23; then 27430/2002-024A.

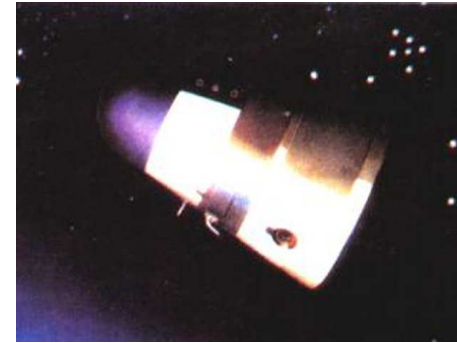
HY-1

Date	Time	Event	Orbit
2002 May 15	0150	Launch by CZ-4B	
	0152	T+2:32? St 1 sep	
	0152	St 2 burn	
	0152	T+2:47? Fairing sep	
	0156	T+6:48? Stage 2 MECO	
	0156	T+6:49? St 2 sep Stage 3 burn	
	0200?	Stage 3 MECO	
	0202	T+12:29? FY-1D sep	
	0203?	Adapter sep?	
	0203	T+13:34? HY-1 sep	
2002 May 15			(D) 102.14 850 x 869 x 98.81
2002 May 19			(D) 102.14 850 x 869 x 98.8
2002 May 20?		Lower orbit	
2002 May 23		Redesignated as 24A	
2002 May 23			101.20 807 x 823 x 98.8
2002 May 24			100.83 796 x 799 x 98.8
2002 May 28			100.72 792 x 792 x 98.81
2002 May 28		Adapter orbit:	(D) 102.18 850 x 873 x 98.8

PAYLOAD

10-band ocean color scanner
 4-band CCD camera
 IR radiometer

4.2 Recoverable Satellites (FSW)



The Project 911 Fanhui Shi Weixing (FSW), Experimental Recoverable Satellite, was the first spacecraft to be recovered from orbit by a country other than the US and the USSR. It has also been referred to as Fan Hui Shi Yao Gan Weixing. A description of its development was given by Clark [5].

The mass and size of the FSW satellites has grown over time. FSW-0 was 1800 kg, 2.2m dia 3.1m long. FSW-1 was 2100 kg. FSW-2 was 2590 kg for first mission, up to 3100 kg, 2.2dia 4.6l. Later missions were 2760 and 2970 kg.

An AAS history paper[1] describes a retro-motor that is probably the FSW-0 retro. It is a 0.901 0.68dia sphere-cone with a mass of 266 kg full 54 kg empty and delivering 583 kNs over 18.5s with an Isp of 280s. If the recoverable part of the spacecraft was 1000 kg, the Δv delivered would be 0.65 km/s which is enough to lower perigee to -1500 km or, if the burn was in the nadir direction as suggested, change orbit to -200 x 950 km. Retroburn direction is cited as 100-110 deg from velocity vector. This would give (-0.17,0.00,-0.63) km/s.

For later FSW satellites with reentry mass about (guess) 1200 kg and an orbit of 191 x 328 km with deorbit just before perigee, a similar motor would give 533m/s or (-0.138,0.0,-0.515) km/s and a -426 x 554 km reentry orbit giving a fast reentry reaching 60 km altitude in only 3 minutes and 10 degrees of latitude.

Mass of the equipment module for FSW-0 is probably around 1000 kg with 266 kg for the retro and around 500 kg for the rest of the RV.

The payload in the RV was 150 kg for FSW-0, growing to 260 kg for FSW-2.

	EM size	RM size	RV size	EM mass	RM mass	RV mass
FSW	2.2d 1.6l	-	1.7d 1.5l	1100?	266	434?
FSW-1	2.2d 1.6l	-	1.7d 1.5l	1300?	266	534?
FSW-2	2.2d 2.5l	0.65l 1.7d	1.7d 1.5l	1650?	350?	700?
JB-4	2.2d 2.8l?	0.65l 1.7d	1.7d 1.7l?	2000?	350?	850?

• Fanhui Shi Weixing

(1974-F07)

The first FSW was lost in a launch failure in Nov 1974. Guidance control was lost due to a broken wire in the rate gyro and the rocket began huge oscillations before destruction.

FSW			
Date	Time	Event	Orbit
1974 Nov 5		Launch by CZ-2 T+20s, out of control Failed to orbit	Jiuquan

Payload	Name	Launch Veh.	Site	Launch Date	Reentry Date	Dur	Orbit	Designation
DEH 1	Dong Peng Hong Yi Hao	CZ-1	IO	1970 Apr 24	1970 Jun 17	0	441 x 2386 x 68.4	1970-31A
SI 1	Shi Jian Yi Hao	CZ-1	IO	1971 Mar 3	1979 Jun 17		268 x 1830 x 69.9	1971-18A
SI 1	Shi Jian Yi Hao	FB-1	IO	1979 Jul 30				
SI 2	Shi Jian Er Hao	FB-1	IO	1981 Sep 19				1981-93B
SI 2A	Shi Jian Er Hao Jia	FB-1	IO	1981 Sep 19			240 x 1610 x 59.5	1981-93D
SI 2B	Shi Jian Er Hao Yi	FB-1	IO	1981 Sep 19			240 x 1610 x 59.5	1981-93A
DQ 1	Da Qui Weixing 1	CZ-4	T'ai Yuan	1990 Sep 3			232 x 1598 x 59.5	1990-81B
DQ 2	Da Qui Weixing 2	CZ-4	XSC	1990 Sep 3				1990-81C
SI 4	Shi Jian 4	CZ-3A	T'ai Yuan	1994 Feb 8				1994-10A
SI 5	Shi Jian 5	CZ-4B	T'ai Yuan	1999 May			1999-25B	

Table 26: Experimental Chinese satellites

• **Fanhui Shi Weixing**

(1975-111A)

The second FSW became the fourth Chinese satellite (PRC 4 in the West). The 1790 kg satellite ejected a recovery capsule after 6 days. The satellite was somewhat damaged on reentry due to a parachute failure and landed off course.

FSW			
Date	Time	Event	Orbit
1975 Nov 26	0329	Launch by CZ-2C	JQ
	0331	T+2:10 MECO	
	0331	Stage 2 burn	
	0333	T+4:02? Stage 2 MECO	
	0334	T+5:06? Stage 2 VECO	
			91.1 179 x 479 x 63.0
1975 Dec 2		Capsule sep	
		Capsule deorbit	-200 x 900?
	0218	Capsule landed in China	
1975 Dec 29		FSW reentered	

• **Fanhui Shi Weixing**

(1976-117A)

FSW No. 3 (PRC 7) recovered its capsule after 3 days in space. Mass was 1790 kg. The mission suffered from attitude control problems.

FSW			
Date	Time	Event	Orbit
1976 Dec 7	0436	Launch by CZ2	JQ
			91.0 172 x 479 x 59.5
1976 Dec 9		Capsule sep	90.9 174 x 469 x 59.5
1976 Dec 9	0357	Capsule recovered after 3d	
1977 Jan 2		Reentered	

• **Fanhui Shi Weixing**

(1978-11A)

FSW No. 4 (PRC 8) was launched in Jan 1978. Mass was around 1810 kg.

FSW			
Date	Time	Event	Orbit
1978 Jan 26	0457	Launch by CZ2	JQ
			90.9 161 x 479 x 57.0
1978 Jan 30		Capsule sep	
	0431	Capsule landed	
1978 Feb 7		Reentered after 12d	

• **Fanhui Shi Weixing**

(1982-90A)

FSW No. 5 (PRC 10) was launched in Sep 1982 on a 5 day mission. Mass was 1780 kg. The new spacecraft had a CCD camera as well as the standard film camera. The apogee was reduced by 80 km relative to earlier flights.

FSW

Date	Time	Event	Orbit
1982 Sep 9	0718	Launch by CZ2	JQ
			90.20 180 x 390 x 63.0
1982 Sep 14		Capsule sep	89.74 170 x 355 x 63.0
	0604	Capsule landed in China, 5d	
1982 Sep 21		Reentered	87.3 127 x 156 x 63.0

• **Fanhui Shi Weixing**

(1983-86A)



Figure 20: FSW satellite ready for launch on CZ-2C, 1983

FSW No. 6 (PRC 11) was launched in Aug 1983 and carried out a 5 day flight. Mass was 1840 kg.

FSW

Date	Time	Event	Orbit
1983 Aug 19	0600	Launch by CZ2	JQ
			90.1 173 x 389 x 63.3
1983 Aug 24	0443	Capsule landed	
1983 Sep 3		Reentered	

• **Fanhui Shi Weixing**

(1984-98A)

FSW No. 7 was launched in Sep 1984. Mass was 1810 kg.

FSW

Date	Time	Event	Orbit
1984 Sep 12	0543	Launch by CZ2	JQ
			171 x 389 x 68
1984 Sep 17	0439	Capsule landed in China	
1984 Sep 29		Reentered	

• **Fanhui Shi Weixing** (1985-96A)

FSW No. 8 flew a standard 5 day mission in Oct 1985. Mass was 1810 kg.

FSW			
Date	Time	Event	Orbit
1985 Oct 21	0504	Launch by CZ2	JQ 172 x 395 x 63.0
1985 Oct 26	0351	Capsule landed in China	
1985 Oct 29			170 x 342 x 63.0
1985 Nov 7		Reentered	

• **Fanhui Shi Weixing** (1986-76A)

FSW No. 9 flew a 5 day mission on 6-11 Oct 1986. Mass was 1770 kg. The final rocket stage remained in orbit until Oct 20. The recovery capsule landed in a lake.

FSW			
Date	Time	Event	Orbit
1986 Oct 6	0540	Launch by CZ-2	JQ 173 x 385 x 56.96
1986 Oct 9			172 x 378 x 57.0
1986 Oct 11	1200		174 x 366 x 57.0
1986 Oct 11		D,E sep	165 x 406 x 57.0 (D)
1986 Oct 11	0420	Capsule landed in China	
1986 Oct 16			170 x 318 x 56.9
1986 Oct 21	1400		155 x 226 x 56.9
1986 Oct 23	0200		125 x 142 x 56.9
1986 Oct 23		Reentered	

• **Fanhui Shi Weixing** (1987-67A)

FSW No. 10 was launched in Aug 1987. The capsule was recovered in central Sichuan province five days after launch. Mass was 1810 kg.

FSW			
Date	Time	Event	Orbit
1987 Aug 5	0637	Launch by CZ2	JQ 90.24 173 x 400 x 62.96
1987 Aug 5	2241		90.16 171 x 393 x 63.0
1987 Aug 6			90.12 172 x 389 x 63.0
1987 Aug 6	1200	Orbit trim?	90.19 171 x 396 x 63.0
1987 Aug 10	0530	Capsule landed in Sichuan	
1987 Aug 11	1700		89.92 172 x 370 x 63.0
1987 Aug 22			88.04 148 x 207 x 62.9
1987 Aug 23		Reentered	

PAYLOAD Recoverable capsule
Camera?
Materials processing experiment
MATRA microgravity experiment, with biological specimens

• **Fanhui Shi Weixing 1**

(1987-75A)

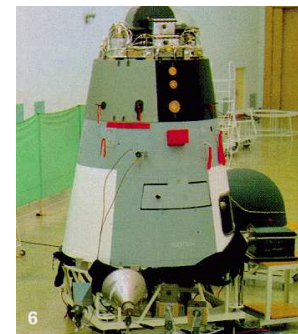


Figure 21: The FSW-1 satellite in checkout

A month after the 9th FSW flight, a new Chinese recoverable satellite was launched. This was the first FSW-1 model. Mass was 2070 kg. The recoverable capsule was about 1000 kg, 350 kg of retro solid fuel and 750 kg for the instrument module. The FSW-1 had improved avionics and attitude control as well as new payloads. Orbital altitude was lower; the mission lasted 8 days and was recovered on Sep 17.



Figure 22: The recovery vehicle after landing

FSW-1			
Date	Time	Event	Orbit
1987 Sep 9	0715	Launch by CZ2	JQ 89.7 206 x 310 x 63.0
1987 Sep 17	0501	Capsule landed in China, 8 d	
1987 Sep 18		75C,D cataloged	
1987 Sep 22		End of transmissions	
1987 Oct 4		Reentered	

PAYLOAD

Materials processing experiments

● **Fanhui Shi Weixing 1** (1988-67E)

The second FSW-1 flight was in Aug 1988. After capsule separation, the main body was cataloged as 1988-67E, with the recovered capsule as 67A. Mass was 2130 kg.

FSW 1

Date	Time	Event	Orbit
1988 Aug 5	0728:35	Launch by CZ2	JQ 89.70 206 x 313 x 63.0
1988 Aug 7			89.61 205 x 306 x 63.0
1988 Aug 13	0509	Capsule landed after 8d	
1988 Aug 27		Main satellite reentered	

PAYLOAD

Recoverable capsule
Earth resources film unit
COSIMA 1, DLR/Intospace protein crystal growth experiment

● **Fanhui Shi Weixing 1** (1990-89A)

FSW-1 No. 3 was launched in Oct 1990. Mass was 2080 kg. This flight carried guinea pigs and as far as is known was the first flight by the Chinese which carried animals.

FSW 1

Date	Time	Event	Orbit
1990 Oct 5		Launch by CZ2	JQ 89.72 208 x 312 x 57.0
1990 Oct 13	0404?	Capsule recovered	89.47 203 x 293 x 57.0 89.46 199 x 295 x 57.0 89.15 193 x 271 x 57.0
1990 Oct 16	1400		
1990 Oct 20		End of transmissions (RAE)	
1990 Oct 22	1400		87.68 148 x 171 x 57.0
		Reentered	

PAYLOAD

Recoverable capsule
Biological experiment capsule with guinea pigs and plants.

● **Fanhui Shi Weixing 1** (1992-64B)

The FSW-1 No. 4 flight carried the Swedish Freja satellite into orbit as a secondary payload. Mass was 2060 kg.

FSW 1

Date	Time	Event	Orbit
1992 Oct 6		Launch by CZ2	JQ
		FSW sep from upper adapter	
		Upper adapter sep from stage 2	
		Freja sep from stage 2	
1992 Oct 7			213 x 311 x 63.0
1992 Oct 13		Capsule recovered	215 x 299 x 63.0
1992 Oct 15			212 x 289 x 63.0

FSW 1

Date	Time	Event	Orbit
1992 Oct 30			169 x 193 x 63.0
1992 Oct 31		Reentered	

● **Fanhui Shi Weixing 1** (1993-63A)

The FSW-1 No. 5 flight was announced as Jian Bing 93 (Progress or Pathfinder). Mass was 2100 kg.

FSW 1

Date	Time	Event	Orbit
1993 Oct 8	0800	Launch by CZ-2C	JQ
1993 Oct 10			89.54 207 x 295 x 56.9
1993 Oct 16	0520	Equipment module sep	
1993 Oct 16		Capsule sep, wrong direction	
1993 Oct 20	1900		88.96 195 x 250 x 56.9
1993 Oct 28		Reentered over Pacific	

● **Jian Bing 93 Capsule** (1993-63H)

The FSW-1 No. 5 capsule was separated from the main spacecraft on 1993 Oct 16, but the motor fired in the wrong direction. It finally reentered over the Atlantic in Mar 1996.

The delta-V was 650m/s.

Jian Bing 93 Capsule

Date	Time	Event	Orbit
1993 Oct 8	0800	Launch by CZ2C	JQ
1993 Oct 16	0521	Equipment module sep	
	0521	Retro module burn	
		Retro sep?	
1993 Oct 21			118.23 187 x 3015 x 56.59 118.24 181 x 3022 x 56.53
1996 Mar 12	0405	Reentered over S Atlantic 23S 20W	

● **Fanhui Shi Weixing 2** (1992-51A)

The first FSW-2 engineering test flight was orbited in Aug 1992. Mass was 2590 kg. The FSW-2 used the standard FSW recovery capsule attached to a retrograde module and an equipment module [5]. The equipment module carried a monopropellant orbit adjust system.

FSW 2

Date	Time	Event	Orbit
1992 Aug 9	0800	Launch by CZ2D	JQ
			175 x 330 x 63
1992 Aug 12			89.44 170 x 323 x 63.1 89.70 171 x 347 x 63.1 89.64 170 x 343 x 63.1
1992 Aug 15		Orbit raise	
1992 Aug		Maneuver engine failed	
1992 Aug 20			169 x 335 x 63.1

FSW 2

Date	Time	Event	Orbit
1992 Aug 25	0310?	EM sep	
	0310?	Deorbit	
	0311?	Retrograde module sep	
	0320	Capsule recovered	
1992 Aug 25			89.23 170 x 302 x 63.0
1992 Sep 1			87.27 129 x 149 x 63.0
1992 Sep 1		Reentered	

PAYLOAD

Recoverable capsule
Retrograde module
Equipment module, service section
Equipment module, pressurized section

● Fanhui Shi Weixing 2

(1994-37A)

Mass was 2760 kg. On this flight the equipment module ended up in a higher orbit after capsule recovery. Phillip Clark speculated that following the 1993 failure, the EM remained attached until the moment of the deorbit burn, with the burn plume separating the vehicles and pushing the EM into a higher orbit. A debris object (37D) cataloged and decayed on Jul 18 was probably spurious, but might have been the retrograde module.

FSW-2 No 2

Date	Time	Event	Orbit
1994 Jul 3	0800	Launch by CZ-2D	JQ
1994 Jul 4			174 x 353 x 63.0
1994 Jul 8			173 x 329 x 63.0
		apogee raise	173 x 337 x 63.0
1994 Jul 11			173 x 330 x 63.0
		apogee raise	174 x 338 x 63.0
1994 Jul 14			172 x 333 x 63.0
		apogee raise	172 x 340 x 63.0
1994 Jul 18			171 x 324 x 63.0
1994 Jul 18		EM sep	
		Deorbit burn	
		Retro module sep	
	0335	Landed in Sichuan province	
		EM orbit	90.33 208 x 372 x 63.0
		Debris (37D)	91.41 131 x 557 x 62.8

PAYLOAD

Recoverable capsule
Biological specimens (including rats?)
Retrograde module
Equipment module, service section
Equipment module, pressurized section

● Fanhui Shi Weixing 2

(1996-59A)

The third FSW-2 satellite was launched in 1996 and successfully recovered after a 15 day flight. Mass was 2970 kg.

FSW-2 No. 3

Date	Time	Event	Orbit
1996 Oct 20	0720	Launch by CZ-2D	JQ
		Stage 2 burn	

FSW-2 No. 3

Date	Time	Event	Orbit
		Stage 2 sep	
			172 x 338 x 63.0
1996 Oct 26			89.49 170 x 328 x 63.0
1996 Oct 27		Raise	89.62 170 x 340 x 63.0
1996 Oct 28			89.57 171 x 335 x 63.0
1996 Oct 29		Raise	89.62 171 x 340 x 63.0
1996 Oct 31			89.54 170 x 332 x 63.0
1996 Nov 1			89.59 170 x 338 x 63.0
1996 Nov 4		RV deorbit	
1996 Nov 4	1058LT?	RV landed	
1996 Nov 11			89.10 166 x 292 x 63.0
			89.61 211 x 298 x 63.0
1996 Dec 3			87.03 121 x 133 x 63.0

● JB-4

(2003-51A)

A new generation FSW/JB satellite was launched by a CZ-2D with a stretched second stage in late 2003, shortly after the first piloted Shenzhou flight. It was reportedly designated Jianbing-4.

I speculate a slightly larger mass of 3200 kg for the JB-4, with a recoverable section mass of 1200 kg.

FSW-3

Date	Time	Event	Orbit
2003 Nov 3	0720	Launch by CZ-2D	
	0730?	Stage 2 MECO	
2003 Nov 3			89.69 193 x 324 x 62.99
2003 Nov 4			89.78 193 x 333 x 62.99
2003 Nov 8	2154	89.75 192 x 331 x 62.99	
		Apogee raise 4 km	
2003 Nov 9			89.79 192 x 335 x 62.99
2003 Nov 14			89.76 192 x 332 x 62.99
		Apogee raise 5 km	
2003 Nov 15			89.81 192 x 337 x 62.99
2003 Nov 20			89.70 191 x 328 x 62.99
2003 Nov 21	0142	Deorbit command over 54N 80E	
		RV separation	
		Landed in Sichuan province	-430? x 550? x 63.0
2003 Nov 21	0204		
2003 Nov 22		Apogee raise 29km	
			90.01 192 x 357 x 62.99
2003 Nov 28			89.82 190 x 340 x 62.98

Table 46: FSW

Payload	Name	Launch Veh.	Site	Launch Date	Reentry Date	Dur	Orbit	Designation
FSW 1	FSW	CZ-2A	JQ	1974 Nov 5	1974 Nov 5	0	-	-
FSW 2	FSW	CZ-2	JQ	1975 Nov 26	1975 Dec 2	6d	179 x 479 x 63.0	1975-111A
FSW 3	FSW	CZ-2	JQ	1976 Dec 7	1976 Dec 9	3d	174 x 469 x 59.5	1976-117A
FSW 4	FSW	CZ-2	JQ	1978 Jan 26	1978 Jan 30	4d	161 x 479 x 57.0	1978-11A
FSW 5	FSW	CZ-2	JQ	1982 Sep 9	1982 Sep 14	5d	170 x 355 x 63.0	1982-90A
FSW 6	FSW	CZ-2	JQ	1983 Aug 19	1983 Aug 24	5d	173 x 389 x 63.3	1983-86A
FSW 7	FSW	CZ-2	JQ	1984 Sep 12	1984 Sep 17	5d	171 x 389 x 68	1984-98A
FSW 8	FSW	CZ-2	JQ	1985 Oct 21	1985 Oct 26	5d	170 x 342 x 63.0	1985-96A
FSW 9	FSW	CZ-2	JQ	1986 Oct 6	1986 Oct 11	5d	172 x 378 x 57.0	1986-76A
FSW 10	FSW	CZ-2	JQ	1987 Aug 5	1987 Aug 10	5d	171 x 396 x 63.0	1987-67A
FSW-1 1	FSW-1	CZ-2C	JQ	1987 Sep 9	1987 Sep 17	8d	206 x 310 x 63.0	1987-75A
FSW-1 2	FSW-1	CZ-2C	JQ	1988 Aug 5	1988 Aug 13	8d	205 x 306 x 63.0	1988-67E
FSW-1 3	FSW-1	CZ-2C	JQ	1990 Oct 5	1990 Oct 13	8d	208 x 312 x 57.0	1990-89A
FSW-1 4	FSW-1	CZ-2C	JQ	1992 Oct 6	1992 Oct 13	7d	213 x 311 x 63.0	1992-64B
FSW-1 5	FSW-1	CZ-2C	JQ	1993 Oct 8	1993 Oct 16	8d	207 x 295 x 56.9	1993-63A
FSW-2 1	FSW-2	CZ-2D	JQ	1992 Aug 9	1992 Aug 25	16d	175 x 330 x 63.0	1992-51A
FSW-2 2	FSW-2	CZ-2D	JQ	1994 Jul 3	1994 Jul 18	15d	173 x 329 x 63.0	1994-37A
FSW-2 3	FSW-2	CZ-2D	JQ	1996 Oct 20	1996 Nov 4	15d	170 x 340 x 63.0	1996-59A
JB-4	JB-4	CZ-2D	JQ	2003 Nov 3	2003 Nov 21	18d	193 x 324 x 63.0	2003-51A

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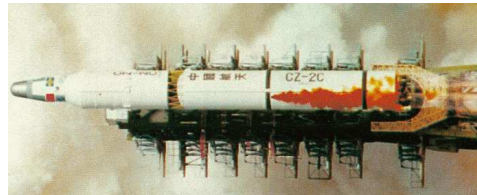


Figure 23: Launch of FSW-1-4 and Freja

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4.3 Communications Satellites (STTW, DFH)

The DFH-2 satellite was 2.1m dia and 3.1m high. Mass is 915 kg launch, 420 kg BOL. The DFH-2A is 1024 kg launch, 441 kg BOL, 363 kg dry. Size is 2.1m dia 3.7m high.

The first Zhongxing 6 failed so the name was reassigned.

Table 47: Zhongxing (Chinastar) satellites

Name	Type	Launch date	Desig	Notes
Zhongxing?	DFH-2	1984 Apr 8	1986-10A	
Zhongxing?	DFH-2	1986 Feb 1	1986-10A	
Zhongxing 1	DFH-2A	1988 Mar 7	1988-14A	
Zhongxing 2	DFH-2A	1988 Dec 22	1988-111A	
Zhongxing 3	DFH-2A	1990 Feb 4	1990-11A	
Zhongxing 4	DFH-2A	1991 Dec 28	1991-88A	
Zhongxing 5	AS3000	1993 Jun 26	1984-49A	Previously Spacenet 1
(Zhongxing 6)	DFH-3	1994 Nov 29	1994-80A	
Zhongxing 7	HS-376	1996 Aug 18	1996-48A	
Zhongxing 6	DFH-3	1997 May 21	1997-21A	
Zhongxing 22	DFH-3	2000 Jan 25	2000-03A	
Zhongxing 20	DFH-3	2003 Nov 14	2003-52A	

• Shiyao Weixing (1984-08A)

The first Chinese experimental comsat was launched in Jan 1984. The third stage of the Chang Zheng 3 rocket failed to restart, leaving the satellite in a low orbit, but a successful test of the apogee motor and stationkeeping propulsion system was carried out. The satellite was referred to as Shiyao Weixing (Experimental Satellite) compared to the later STTW name, implying that this satellite may not have carried an actual communications payload.

The third stage failure was due to an error in the gas generator mixture ratio; the turbine overheated and failed.

The apogee motor was a Shanxi FG-15, with a mass of 525 kg.

SW

Date	Time	Event	Orbit
1984 Jan 29	1225	Launch by CZ-3	XSC
		Stage 1 sep	
		Stage 2 burn	
		Stage 2 MECO	
		Stage 2 sep	
		Stage 3 MES-1	
		Stage 3 MECO-1	92.0 347 x 408 x 31.0
	1240	Stage 3 MES-2	
	1240	Stage 3 cutoff after 3s, T+903s	
1984 Jan 30		AKM burn	160.7 360 x 6474 x 36.0
1984 Jan 31			160.80 358 x 6475 x 36.0
1984 Feb 8			160.74 355 x 6473 x 36.0
1984 Feb		Hydrazine RCS burns	
1984 Feb 10			160.78 356 x 6475 x 36.1
1984 Feb 11			161.28 378 x 6495 x 36.1
1984 Feb 12			161.51 379 x 6511 x 36.1
1984 Feb 14			162.27 394 x 6559 x 36.1
1984 Feb 15			162.64 401 x 6581 x 36.1
1984 Mar 11			162.63 402 x 6579 x 36.1
1984 Mar 12		Raise peri	163.17 446 x 6579 x 36.1

SW

Date	Time	Event	Orbit
1984 Mar 29			163.20 446 x 6581 x 36.2
1984 Mar 30		Raise peri	163.60 480 x 6580 x 36.1
1984 Apr 16			163.55 475 x 6581 x 36.2
1984 May 12		Lower peri	163.44 469 x 6578 x 36.2
1984 Jul 7			163.33 462 x 6577 x 36.2
1984 Sep 19		Last mv	163.37 461 x 6580 x 36.1

• Shiyao Tongbu Tongxin Weixing (1984-35A)

The STTW satellite (Experimental Synchronous Communications Satellite) had a mass of 900 kg at launch, 420 kg on orbit. It was China's first geostationary satellite. The satellite remained at 124E until 1988 when its orbit was raised.



Figure 24: STTW (DFH-2) satellite

The satellite was a DFH-2 class satellite 2.1m dia 1.6m high with a mass of 920 kg. DFH-2 was spin-stabilized with a despun horn antenna.

STTW

Date	Time	Event	Orbit
1984 Apr 8	1120	Launch by CZ3	XSC
		Stage 2 burn	
		Stage 3 burn	
		Stage 3 MECO	
1984 Apr 9			633.21 401 x 35694 x 31.0
1984 Apr 10	0041	Apogee burn	1431.94 35683 x 35727 x 0.9 GEO 142.4E+1.0E
1984 Apr 10			GEO 142E dr
1984 Apr 12			1444.55 35520 x 36383 x 0.7 GEO 137.3E+2.1W
1984 Apr 16		On station 125E	
1984 Apr 26			1436.13 35782 x 35791 x 0.6 GEO 125.1E
1984 May			GEO 125E
1985 Jun 21			1435.92 35772 x 35794 x 1.5 GEO 125.1E
1986 Oct			GEO 125E
1987 Mar 19			1436.36 35788 x 35796 x 1.6 GEO 124.1E

STTW

Date	Time	Event	Orbit
1988 Jan 21			1436.38 35788 x 35795 x 1.6 GEO 124.1E
1988 Jun 26			1436.49 35769 x 35819 x 1.9 GEO 124.1E
1988 Jun 28		mv out	1436.88 35784 x 35818 x 1.3 GEO 123.7E+0.2W
1988 Jul 16			1437.02 35785 x 35824 x 1.3 GEO 119.9E+0.2W
1999 Apr 7			1435.85 35746 x 35817 x 9.3

PAYLOAD

C-band transponders (2)

• Shiyong Tongbu Tongxin Weixing

(1986-10A)



Figure 25: STTW (DFH2) satellite

The Feb 1986 launch carried the Shiyong Tongbu Tongxin Weixing (Operational Synchronous Communications Satellite), the second DFH-2 satellite. (DFH is an abbreviation for Dong Fang Hong, the East Is Red). Launch mass 920 kg. BOL mass was 433 kg.

STTW 1

Date	Time	Event	Orbit
1986 Feb 1	1237	Launch by CZ-3	XSC
		Stage 2 burn	
		Stage 3 burn	
	1255?	Stage 3 MECO	
			633.89 420 x 35711 x 31.0
1986 Feb 3	0200?	Apogee burn	
1986 Feb 3			1403.55 34411 x 35882 x 0.1 GEO 142.5E+8.3E
1986 Feb 4			1450.09 35895 x 36224 x 0.2 GEO 148.9E+3.5W
1986 Feb 18		mv in	1436.02 35779 x 35790 x 0.1 GEO 102.9E
1986 Feb 20		On station 103E	
1987 Mar 12			1435.99 35782 x 35786 x 0.1 GEO 103.0E
1988 Oct 10			1435.93 35781 x 35785 x 0.1 GEO 103.2E
1989 Sep 20			1436.35 35783 x 35799 x 1.0 GEO 103.3E
1990 Apr 18		Last mv	
1990 Jun 11			1436.16 35782 x 35793 x 1.7 GEO 104.0E
1991 Feb 16			1436.97 35793 x 35813 x 2.3 GEO 82.7E+0.2W
1995 Nov 26			1436.64 35769 x 35825 x 6.1 GEO 52.8E+0.1W

PAYLOAD

Antenna, 0.7m dia

• Shiyong Tongbu Tongxin Weixing 2

(1988-14A)

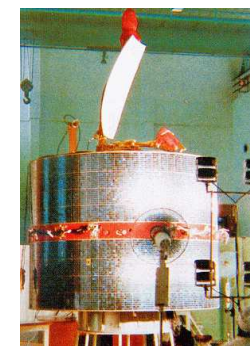


Figure 26: The DFH-2A class ZX-1 satellite

The STTW 2 (Zhongxing 1) satellite was launched on 1988 Mar 7 by Chang Zheng 3 from Xichang. It was the first DFH-2A class satellite and went to the 87.5E Chinasat 1 position. Launch mass was 1040 kg; 530 kg on orbit. The satellite was replaced by Zhongwei 1.

The DFH-2A apogee motor was 1.49 long 0.90dia with a mass of 580 kg full 70 kg dry, and an impulse of 1432 kNs over 40s. in very good agreement with the required 1.89 km/s dV.

Chinasat 1 (STTW 2)

Date	Time	Event	Orbit
1988 Mar 7	1241	Launch by CZ3	XSC
		stage 2 burn	
		Stage 3 burn	
		Stage 3 sep	
			630.26 179 x 35765 x 31.2
1988 Mar 9	0148	AKM burn	1455.0 35715 x 36597 x 0.5 GEO 124E-5/d
1988 Mar 10			1457.16 35784 x 36611 x 0.5 GEO 141.5E+5.2W
1988 Mar 22		mv in	1436.10 35782 x 35791 x 0.2 GEO 87.3E
1988 Mar 23			GEO 88E
1988 Apr 3		On station	GEO 87.5E
1988 Apr 7			1436.07 35767 x 35805 x 0.0 GEO 87.6E
1989 Jun 24			1436.19 35783 x 35793 x 0.1 GEO 87.2E
1991 May 19			1436.13 35779 x 35795 x 0.0 GEO 87.5E
1993 Feb 20			1436.09 35781 x 35791 x 0.0 GEO 87.5E
1995 Jan 27			1436.06 35776 x 35795 x 1.5 GEO 87.5E
1996 Apr 9			1436.13 35782 x 35792 x 2.4 GEO 87.9E
1997 Mar 5		mv	
1997 Apr 17		mv	
1997 Jul 14		last mv	
1997 Jul		End of ops	
1997 Nov			GEO 87.5E drift
1997 Dec 23			1436.47 35752 x 35835 x 3.6 GEO 82.9E+0.1W
1999 Jun 15			1435.74 35757 x 35801 x 4.6 GEO 84.5E+0.1E

PAYLOAD

C-band transponders (8)

• Shiyong Tongbu Tongxin Weixing 3

(1988-111A)

STTW-3 (Chinasat 2, Zhongxing 2?) was launched in Dec 1988. The DFH-2A class satellite was stationed at 110.5E (Chinasat 2). The third stage has not been cataloged.

In 1997 the longitude of the spacecraft was allowed to vary in a slightly wider band, presumably indicating that fuel reserves were low. It finally drifted off station in Sep 1999, having been replaced by Sinosat 1.

Chinasat 2 (STTW 3)

Date	Time	Event	Orbit
1988 Dec 22	1240	Launch by Chang Zheng 3	XSC
1988 Dec 23	0700		1471.03 35756 x 37179 x 0.5 GEO 152E-9/d
1988 Dec 29	0930	On station	1436.05 35783 x 35788 x 0.6 GEO 110.3E
1989 Feb 10			1436.10 35785 x 35788 x 0.4 GEO 110.7E
1989 Nov 25			1436.24 35779 x 35799 x 0.1 GEO 110.9E
1991 Jan 11			1436.02 35781 x 35788 x 0.1 GEO 110.8E
1992 May 22			1436.13 35782 x 35792 x 0.0 GEO 110.6E
1994 Jun 15			1436.21 35786 x 35790 x 0.0 GEO 110.4E
1996 Apr 7			1436.03 35775 x 35794 x 0.8 GEO 110.5E
1997 Feb		Stationkeep band widened	
1997 Jul 7			1435.86 35771 x 35792 x 1.7 GEO 110.3E
1999 Jun 15			1436.32 35781 x 35800 x 3.1 GEO 110.6E
1999 Sep		Drifting	
2003 Sep 1			1435.05 35737 x 35794 x 6.4

PAYLOAD

C-band transponders (8)

• Shiyong Tongbu Tongxin Weixing 4

(1990-11A)



Figure 27: DFH-2A satellite

STTW-4 (Chinasat 3, Zhongxing 3?) was launched in Feb 1990 and was the third and last DFH-2A satellite. It was stationed at the 98E Chinasat 3 position. Mass was 1040 kg.

The satellite ended operations in mid 1998, and was apparently replaced by Feng Huo 1.

Chinasat 3

Date	Time	Event	Orbit
1990 Feb 4	1228?	Launch by CZ-3	XSC

Chinasat 3

Date	Time	Event	Orbit
1990 Feb 5		Stage 3 burn	
1990 Feb 6		Stage 3 MECO	
1990 Feb 6	0230?	AKM	720.85 4732 x 35773 x 12.3
1990 Feb 12			1470.64 35721 x 37199 x 0.5 GEO 146.0E+8.5W
1990 Feb 18		mv in	1436.40 35782 x 35802 x 0.1 GEO 97.9E+0.1W
1990 Feb 27			1436.01 35779 x 35790 x 0.1 GEO 97.9E
1991 Jul 7			1436.06 35784 x 35787 x 0.1 GEO 98.1E
1992 Mar 12			1436.06 35778 x 35792 x 0.1 GEO 98.2E
1993 Jun 13			1436.14 35783 x 35791 x 0.1 GEO 98.1E
1994 Apr 22			1436.18 35777 x 35798 x 0.0 GEO 98.0E
1995 May 19			1436.00 35782 x 35787 x 0.1 GEO 97.9E
1998 Jul 2		Last mv	1436.15 35780 x 35794 x 0.1 GEO 98.2E
1998 Aug 12			1436.07 35777 x 35794 x 2.3 GEO 98.5E
1999 Jun 15			1436.31 35781 x 35800 x 2.3 GEO 97.5E+0.06W
			1436.44 35779 x 35807 x 3.0 GEO 54.3E+0.1W

PAYLOAD

C-band transponders (8?)

• Shiyong Tongbu Tongxin Weixing 5

(1991-88A)

STTW-5 was launched on 1991 Dec 28 but the second burn of the third stage failed after 58 seconds. A plumbing leak in the helium pressurization system was the culprit. The apogee motor was fired to place the spacecraft in GTO, and the fuel was depleted in early 1992 to raise perigee to 2100 km.

STTW 5

Date	Time	Event	Orbit
1991 Dec 28	1202	Launch by CZ-3	XSC
	1204	Stage 1 sep	
	1206	T+4:15 St 2 MECO	
	1206	T+4:19 Fairing	
	1206	T+4:22 St 2 VECO	
	1206	T+4:23 Stage 2 sep	
	1206	T+4:23 Stage 3 burn 1	
	1213	T+11:28 Stage 3 cutoff, parking orbit	
	1217	T+15:35 Stage 3 restart	
	1219	Stage 3 failed after 58s	
	1219	T+17:50 Engine thrust terminated at 135s	
	1223	T+21:32? Payload and stage 3 sep	219 x 2451 x 31.1
1991 Dec 29	0043	AKM fired	
1992 Jan 9			617.49 208 x 35076 x 31.62
1992 Feb 17			609.20 185 x 34668 x 31.5
1992 Feb?		Raise orbit	
1993 Mar 28			632.72 2131 x 33939 x 31.5
1999 Aug 31			632.58 2012 x 34051 x 31.8

• Kua Fu 1

(1994-10B)

The first test flight of the uprated CZ-3A launch vehicle carried a dummy version of the DFH-3 satellite.

It was named KF 1 (Kua Fu), after a mythical character. Mass was 1342 kg. Shape was 2.5dia 2.2l cylinder + cone.

DFH-3 Mockup

Date	Time	Event	Orbit
1994 Feb 8	0830	Launch by CZ-3A Stage 2 sep Stage 3 burn 1 Stage 3 cutoff, parking orbit Stage 3 restart Stage 3 MECO	XSC
1994 Feb 8		Stage 3 sep	637.09 208 x 36086 x 28.6
1999 Sep 4			322.70 158 x 18254 x 28.4

• DFH-3 (1994-80A)

A DFH-3 satellite was launched on 1994 Nov 29. The satellite failed to stabilize its orbit, due to a fuel leak. The satellite was a 2.2 x 1.7 x 2.0 m box with a 2m dish and two panels. Span 18.1m, deployed height 5.7m. Mass 2230 kg launch 1145 kg BOL. The satellite has an FY-25 apogee motor with a thrust of 490N.

The intended location was 125E.

DFH-3

Date	Time	Event	Orbit
1994 Nov 29	1702	Launch by CZ-3A Stage 2 burn Stage 3 burn Stage 3 MECO	XSC LC2
1994 Nov 29			635.35 180 x 36026 x 28.5
1994 Dec		LAM	
1994 Dec 13			760.79 6391 x 36064 x 12.4
1994 Dec 17			760.75 6389 x 36064 x 12.4
1994 Dec 18?		LAM	
1994 Dec 29			1425.91 35181 x 35992 x 0.3 GEO 126.8E+2.5E
1995 Jan 8			1426.30 35225 x 35964 x 0.2 GEO 152.0E+2.5E
1999 Oct 16			1426.26 35205 x 35982 x 3.3 GEO 171.3W+2.5E

PAYLOAD

C-band transponders (24)

• DFH-3 (1997-21A)

A DFH-3 (Dongfanghong 3) satellite was launched on 1997 May 11. The DFH-3-A2 satellite was also referred to as Zhongxing No. 6. Launch mass was 2260 kg. It was stationed at 125E.

DFH-3

Date	Time	Event	Orbit
1997 May 11	1617	Launch by CZ-3A T+2:25 Stage 1 MECO T+2:27 Stage 2 MES, Stage 1 sep T+3:52 Fairing T+4:15 St 2 MECO T+4:20 St 2 VECO T+4:21 St 2 sep, St 3 MES	XSC LC2

DFH-3

Date	Time	Event	Orbit
		T+10:19 St 3 MECO-1 T+20:00 St 3 MES-2 T+22:00 St 3 MECO-2 T+23:40 Stage 3 sep	
1997 May 11			633.12 203 x 35888 x 28.5
1997 May 12	0830?	LAM1	
1997 May 12			765.87 6782 x 35919 x 12.1
1997 May 13	0959?	LAM2	
1997 May 14	0830?	LAM3	
1997 May 14			1410.05 34613 x 35936 x 0.1 GEO 105.5E+6.6E
1997 May 17			1434.72 35661 x 35857 x 0.3 GEO 124.5E+0.3E
1997 May 20			1435.40 35758 x 35787 x 0.3 GEO 125.0E+0.1E
1997 May 30			1436.12 35784 x 35789 x 0.3 GEO 125.1E
1999 Oct 17			1436.13 35773 x 35800 x 0.2 GEO 125.1E

PAYLOAD

C-band transponders (24)

• Zhongxing-22 (2000-03A)



2300 kg CAST-built DFH-3 comsat launched Jan 2000. Known as Zhongxing-22 (the ITU registered location) and as Feng Huo 1. Phillip Clark has suggested that Feng Huo 1 is used for military communications. Feng Hou was a message system (beacon fires?) used by the ancient Chinese along the Great Wall. Control from Xi'an SCC.

(Ascent times based on 1997 launch).

Zhongxing-22

Date	Time	Event	Orbit
2000 Jan 25	1645	Launch by CZ-3A T+2:25 Stage 1 MECO T+2:27 Stage 2 MES, Stage 1 sep T+3:52 Fairing T+4:15 St 2 MECO T+4:20 St 2 VECO T+4:21 St 2 sep, St 3 MES	XSC
	1655	T+10:19 St 3 MECO-1	

Table 60: DFH

Payload	Name	Launch Veh.	Site	Launch Date	Reentry Date	Dur	Orbit	Designation
DFH-2	Shiyan Weixing	CZ-3	XSC	1984 Jan 29	1984 Sep?	0.7yr	476 x 6583 x 36	1984-08A
DFH-2	Shiyan Tongbu Tongxin Weixing	CZ-3	XSC	1984 Apr 8	1988 Jun 28	4.2 yr	35782 x 35791 x 0.6 GEO 125E	1984-35A
DFH-2	Shiyong Tongbu Tongxin Weixing	CZ-3	XSC	1986 Feb 1	1990 May?	4.3yr	35782 x 35786 x 0.1 GEO 103E	1986-10A
DFH-2A	Zhongxing 1	CZ-3	XSC	1988 Mar 7	1997 Jul	9.3yr	35783 x 35793 x 0.1 GEO 87E	1988-14A
DFH-2A	Zhongxing 2	CZ-3	XSC	1988 Dec 22	1998 Dec	10.0yr	35785 x 35788 x 0.4 GEO 110E	1988-111A
DFH-2A	Zhongxing 3	CZ-3	XSC	1990 Feb 4	1998 Jul	8.4yr	35784 x 35787 x 0.1 GEO 98E	1990-11A
DFH-2A?	Zhongxing 4	CZ-3	XSC	1991 Dec 28	1992 Mar?	0.3yr	2131 x 33939 x 31.5	1991-88A
DFH-3 Mockup	Kua Fu 1	CZ-3A	XSC	1994 Feb 8	1994 Feb 8	0.0yr	208 x 36086 x 28.6	1994-10B
DFH-3	Dong Fang Hong 3	CZ-3A	XSC	1994 Nov 29	1994 Dec	0.1yr	35225 x 35964 x 0.2	1994-80A
DFH-3	Zhongxing 6	CZ-3A	XSC	1997 May 11			35784 x 35789 x 0.3 GEO 125E	1997-21A
DFH-3	Feng Huo 1 (Zhongxing-22)	CZ-3A	XSC	2000 Jan 25				2000-03A
DFH-3	Feng Huo 2? (Zhongxing-20)	CZ-3A	XSC	2003 Nov 14				2003-52A

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Zhongxing-22

Date	Time	Event	Orbit
		T+20:00 St 3 MES-2	
		T+22:00 St 3 MECO-2	
	1708	T+23:40 Stage 3 sep	767.08 493 x 42266 x 24.9 756.24 347 x 41887 x 24.3
2000 Jan 26		LAM burn?	
2000 Jan 30		On station 98E	
2000 Feb 6			1436.00 35781 x 35787 x 0.8 GEO 97.9E
2000 Feb 7			1436.21 35777 x 35800 x 0.5 GEO 97.9E
2000 May 27			

• Zhongxing-20

(2003-52A)

CAST/CASTC DFH-3.

Mass 2300 kg. To go to 103E.

ZX-20

Date	Time	Event	Orbit
2003 Nov 14	1601	Launch by CZ-3A	XSC
		T+2:25 Stage 1 MECO	
		T+2:27 Stage 2 MES, Stage 1 sep	
		T+3:52 Fairing	
		T+4:15 St 2 MECO	
		T+4:20 St 2 MECO	
		T+4:21 St 2 sep, St 3 MES	
	1611?	T+10:19 St 3 MECO-1	200 x 200 x 28.5?
	1621?	T+20:00 St 3 MES-2	
	1623?	T+22:00 St 3 MECO-2	
	1625?	Stage 3 sep	
2003 Nov 14			212 x 41981 x 734.15 198 x 41934 x 24.98
2003 Nov 20			1435.96 35770 x 35796 x 0.31 GEO 103.0E
2003 Nov 26			1436.00 35775 x 35793 x 0.29 GEO 103.0E

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4.4 Test payloads

- Aussat B Mockup (1990-59)



Figure 28: EPKM motor being loaded on the first CZ-2E

The 7300 kg payload of the first CZ-2E launch, on 1990 Jul 16, was a dummy mass model of the Aussat B satellite to be used on the first operational launch, together with a Chinese built EPKM kick motor. Although it is believed to have been in the form of an HS-601 satellite, the mockup was probably built by China and not by Hughes. The second stage of the CZ-2E rocket entered a 204 x 990 km orbit and remained in space until 1990 Oct 9. The Aussat mockup/EPKM combination reportedly reentered on the day of launch; it is possible that the EPKM fired in the wrong direction. Alternatively, the CALT web page suggests that the PKM was only a mockup, in which case it may have remained attached to the second stage.

Aussat B Mockup

Date	Time	Event	Orbit
1990 Jul 16	0040	Launch by CZ2E	XSC LC2
1990 Jul 16		Orbit insertion	96.63 204 x 990 x 28.5
		Failed to orient	
		Payload ejection failed	
1990 Oct 9		Reentered	

PAYLOAD

Dummy Aussat B, 2700 kg
EPKM, 4650 kg

4.5 ZY (CBERS)

• Zi Yuan 1

(1999-57A)



Figure 29: ZY-1

The 1540 kg China-Brasil Earth Resources Satellite 1, ZY-1 ("Resource") is built by CAST. CBERS 2, launched three years later, was built by INPE. Size is 1.8 x 2.0 x 2.0 m, 9.8m span box +1 panel.

Xian control center, China; CRC/INPE, San Jose dos Campos.

From late October to early November the satellite's on board engine raised the orbit to sun-synchronous altitude [4]. Since then, very small orbital tweaks have maintained the altitude. A slightly larger burn on 2003 Aug 13 may have marked the satellite's retirement, according to analyst Phillip Clark.

The upper stage broke up into more than 125 pieces.

ZY-1

Date	Time	Event	Orbit
1999 Oct 14	0316	Launch by CZ-4B	TY
		T+2:33 Stage 1 MECO	
		T+2:34 Stage 1 sep	
		T+2:54 Fairing	
		T+4:37 St 2 MECO	
		T+4:47 St 2 VECO	
		T+4:48 St 2 sep	
		T+4:48 St 3 burn	
	0327	T+11:18 St 3 MECO	
	0328	T+12:28 ZY 1 sep	
	0330?	T+12:55 SACI-1 sep	
1999 Oct 20		Cal burn	99.54 727 x 746 x 98.6
			99.59 733 x 745 x 98.6
1999 Nov 3		Orbit raise	99.63 734 x 748 x 98.6
1999 Nov 5		Orbit raise	99.92 747 x 763 x 98.6
1999 Nov 6		Orbit raise	100.06 753 x 770 x 98.6
1999 Nov 8		Orbit raise	100.27 770 x 772 x 98.6
1999 Nov 9		Orbit raise	100.32 773 x 774 x 98.6
1999 Dec 17		Orbit trim	100.32 773 x 775 x 98.6
2000 Feb 28		Orbit trim	
2000 Mar 29		Orbit trim	
2000 Apr 22		Orbit trim	

ZY-1

Date	Time	Event	Orbit
2000 Jun 23		Orbit trim	
2000 Aug 16		Orbit trim	
2000 Nov 10		Orbit trim	
2000 Dec 21		Orbit trim	
2001 Feb 12		Orbit trim	
2001 Apr 12		Orbit trim	
2001 Jul 6		Orbit trim	
2001 Oct 10		Orbit trim	
2001 Nov 1		Orbit trim	
2001 Dec 6			100.31 772 x 775 x 98.5
2001 Dec 6		Orbit trim	100.32 773 x 774 x 98.5
2000 Mar 11	1304	Stage 4 breakup	
2000 Jun		WFI failed	
2003 Aug 13			100.32 773 x 774 x 98.4
		mv	100.41 774 x 782 x 98.4

PAYLOAD

Wide Field Imager, 860 km FOV with 260m res
Hi Res CCD Camera, 20m res
IR Multispectral Scanner, 80m res
Data Collection System
2 x 20 N hydrazine system

• ZY-2

(2000-50A)

ZY-2 was a domestic remote sensing satellite developed by CAST. The satellite was flown into a 474 x 493 km orbit, much lower than ZY-1. In 2001, Bill Gertz of the Washington Times reported that the civilian ZY-2 name was a cover for the Jianbing-3 imaging military reconnaissance satellite.

The ZY-2 adjusted its orbit on a regular basis, keeping it within a few km of its operational altitude.

ZY-2

Date	Time	Event	Orbit
2000 Sep 1	0325	Launch by CZ-4B	Taiyuan
		T+2:33 Stage 1 MECO	
		T+2:34 Stage 1 sep	
		T+2:54 Fairing	
		T+4:37 St 2 MECO	
		T+4:47 St 2 VECO	
		T+4:48 St 2 sep	
		T+4:48 St 3 burn	
	0336	T+11:18 St 3 MECO	
	0337	T+12:28 ZY 2 sep	94.28 474 x 493 x 97.4
2000 Sep 8		Orbit raise	94.40 483 x 496 x 97.4
2000 Sep 10		Orbit raise	94.44 484 x 499 x 97.4
2000 Sep 28			94.42 482 x 499 x 97.4
2000 Sep 28		Orbit trim	94.45 485 x 499 x 97.41
2000 Oct 10		Orbit trim	94.45 486 x 498 x 97.4
2000 Oct 25		Orbit trim	
2000 Nov 6		Orbit trim	
2000 Nov 24		Orbit trim	
2000 Dec 3		Orbit trim	
2000 Dec 22		Orbit trim	
2001 Jan 12		Orbit trim	
2001 Feb 6		Orbit trim	
2001 Mar 2		Orbit trim	

ZY-2

Date	Time	Event	Orbit
2001 Mar 24		Orbit trim	
2001 Apr 3		Orbit trim	
2001 Apr 26		Orbit trim	
2001 May 17		Orbit trim	
2001 Jun 18		Orbit trim	
2001 Jul 17		Orbit trim	
2001 Sep 2		Orbit trim	
2001 Sep 20		Orbit trim	
2001 Oct 3			94.41 488 x 492 x 97.4
2001 Oct 3		Orbit trim	94.46 489 x 495 x 97.4
2001 Oct 19		Orbit trim	
2001 Oct 30		Orbit trim	
2001 Nov 13		Orbit trim	

• CBERS-2

(2003-49A)

The second China-Brazil Earth Resources Satellite, CBERS-2 was built at INPE in Brazil. It was launched from China in Oct 2003 on a CZ-4B and called ZY-1 No. 2 by the Chinese. Mass was 1550 kg.

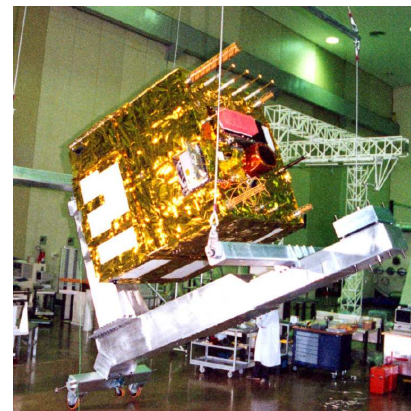


Figure 30: CBERS 2 before launch



Figure 31: Illustration of CBERS 2 on orbit

ZY-1 No 2/CBERS-2

Date	Time	Event	Orbit
2003 Oct 21	0316	Launch by CZ-4B T+2:33 Stage 1 MECO T+2:34 Stage 1 sep	

Table 66: ZY

Payload	Name	Launch Veh.	Site	Launch Date	Reentry Date	Dur	Orbit	Designation
ZY-1/CBERS-1	Zi Yuan 1	CZ-4B	TY	1999 Oct 14	2003 Aug?		773 x 774 x 98.6	1999-57A
ZY-1/CBERS-2	Zi Yuan 1	CZ-4B	TY	2003 Oct 21			772 x 774 x 98.5	2003-49A
ZY-2	Zi Yuan 2	CZ-4B	TY	2000 Sep 1			474 x 493 x 97.4	2000-50A
ZY-2	Zi Yuan 2	CZ-4B	TY	2002 Oct 27			470 x 483 x 97.4	2002-49A

ZY-1 No 2/CBERS-2

Date	Time	Event	Orbit
	T+2:54	Fairing	
	T+4:37	St 2 MECO	
	T+4:47	St 2 VEEO	
	T+4:48	St 2 sep	
	T+4:48	St 3 burn	
	T+11:18	St 3 MECO	
	T+12:28	ZY 1 sep	99.62 730 x 750 x 98.54
	T+12:55	CX sep	99.98 751 x 763 x 98.5
2003 Oct 22		Orbit raise	100.27 770 x 771 x 98.5
2003 Oct 24		Orbit raise	772 x 774 x 98.5
2003 Oct 27			
2004 Jan 14			

4.6 Beidou

• Beidou (2000-69A)

The Beidou ('Northern Dipper', or 'Ursa Major') navigation technology satellite for the People's Liberation Army was launched by CZ-3A in late 2000. It was built by CAST/Beijing. Also referred to as Beidou Daohang Jishu Weixing, 'Ursa Major Navigation Technology Satellite', and Chinasat-32 (in the UN registration).

On Nov 6, the apogee motor was fired to place the satellite at GEO 140E, the Chinasat-32 position. Phillip Clark speculates that further Beidou satellites will be launched to Chinasat-31 and -33, at 80E and 110.5E.

The Beidou uses the DFH-3 bus.

Mass probably around 2500? kg.

Beidou			
Date	Time	Event	Orbit
2000 Oct 30	1602	Launch by CZ-3A T+2:25? Stage 1 MECO T+2:27? Stage 2 MES, Stage 1 sep T+3:52? Fairing T+4:15? St 2 MECO T+4:20? St 2 VECO T+4:21? St 2 sep, St 3 MES	XSC LC2
	1612	T+10:19? St 3 MECO-1 T+20:00? St 3 MES-2 T+22:00? St 3 MECO-2	
	1625?	T+23:40? Stage 3 sep	
2000 Oct 30			753.14 194 x 41890 x 25.0
2000 Nov 6	0530?	AKM burn	
2000 Nov 7		(?)	753.77 192 x 41922 x 25.0
2000 Nov 9			1436.12 35772 x 35801 x 0.2 GEO 140.0E
2000 Dec 1			1436.05 35773 x 35798 x 0.1 GEO 140.0E

• Beidou 2 (2000-82A)

The second Beidou entered orbit at 80E and was registered with the UN as Chinasat-31.

Beidou 1B			
Date	Time	Event	Orbit
2000 Dec 20	1620	Launch	
	1630	MECO-1	
2000 Dec 20	1642?	MECO-2	
2000 Dec 20			750.51 196 x 41760 x 25.0
2000 Dec 25			752.64 190 x 41870 x 25.0
2000 Dec 30?		AKM	
2000 Dec 30			1436.07 35776 x 35796 x 0.1 GEO 80.0E
2001 Jan 13			1436.09 35776 x 35796 x 0.1 GEO 80.1E

• Beidou 3 (2003-21A)

The constellation was augmented with a third satellite in May 2003. An element set suggesting a perigee raise burn on May 26 may be in error, or may indicate a test of the RCS system; the AKM is probably liquid-fuelled, and made its main burn later on May 26.

Beidou 3			
Date	Time	Event	Orbit
2003 May 24	1634	Launch T+2:25? Stage 1 MECO T+2:27? Stage 2 MES, Stage 1 sep T+3:52? Fairing T+4:15? St 2 MECO T+4:20? St 2 VECO	
	1638?	T+4:21? St 2 sep, St 3 MES-1	
	1644?	MECO-1	
	1650?	MES-2?	
	1652?	MECO-2	
	1654	Stage 3 sep	749.29 196 x 41701 x 25.0 790.82 1917 x 41981 x 38.8
2003 May 26	1413?	AKM	
2003 May 26			1438.91 35716 x 35966 x 0.0 GEO 38.8E-0.7W
2003 Jun 2			1436.67 35760 x 35835 x 0.3 GEO 110.5E-0.15W
2003 Jun 9			1436.12 35752 x 35821 x 0.3 GEO 110.5E

4.7 TC

• Tan Ce 1

(2003-61A)



Figure 32: Launch of TC-1



Figure 33: The TC-1 satellite

Tan Ce (Explorer) 1, or Double Star DSP-E, Chinese/ESA magnetospheric satellites, to supplement the Cluster system and using backup European Cluster instruments. Equatorial DSP-E 550 x 66970 x 28.5 planned orbit. Launch Dec 2003 and Apr 2004 by CZ-2C/SM (or CTS). CTS top stage derived from SD. Places 1400 kg in SSO. Has FG-47 solid motor.

Spin-stabilized satellites, 350 kg built by CATC's Space Tech Inst. Spacecraft is a 2.1m dia 1.4m high spin stabilized (15 rpm) cylinder, with overall size 4.0m high 8.3m span. Used a direct ascent orbit with all three stages burning without coast phase, giving perigee around 23 deg N.

With Isp of 288s, and stage mass of 160 kg prop, guessing 350 kg empty 510 kg full), we would get a delta-V of 580 m/s. From a 555 km circular orbit would need 2.7 km/s, corresponding to m1/m2 = 2.6. If 160 kg is truly the prop, this is not possible. Actual FG-47 prop is only 125 kg.

Assuming Isp of 290s, and insertion orbit of -2000 x 590 km, delta-V required is 10.3 - 6.64 km/s = 3.66 km/s which corresponds to a mass factor of 3.62, so a prop of 1050-1200 kg is required.

TC-1

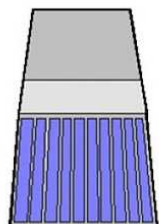
Date	Time	Event	Orbit
2003 Dec 29	1906:18	Launch by CZ-2C/CTS	Xichang
	1916?	Stage 2 burn	
	1916?	Stage 2 sep	
	1916?	SM burn	
	1916?	SM burnout	555 x 78051 x 28-5
	1918?	SM sep	

PAYLOAD		
ASPOC		Active spacecraft potential control
FGM		Fluxgate magnetometer
PEACE		Plasma electron and current expt
HIA		Hot ion analyser
STAFF/DWP		Spatio-temporal analysis of field fluctuations
HEED		High energy electron detector
HEPD		High energy proton detector
HID		Heavy ion detector

5 SISE/SAST programs

5.1 JSSW Satellites

A 1972 test flight carried a dummy JSSW of mass 1050 kg on a suborbital mission. Two more suborbital missions with dummy 3100 kg payloads flew in Sep 1977 and Apr 1978.



Sketch of CK-1 satellite
(launched by FB-1)

Figure 34: Sven Grahn's sketch of CK

• Ji Shu Shiyan Weixing (1973-F07)

The first Project 701 Test Experimental Satellite (JSSW) was reportedly launched in 1973 but the FB-1 rocket failed to reach orbit. The JSSW satellites are believed to have carried meteorological and military imaging systems with television radio readout. JSSW may also be called CK, according to Sven Grahn. It is believed to be a truncated cone about 2.5m long 1.7m dia. Mass was 1138 kg. Design lifetime is about 10 days.

JSSW 1

Date	Time	Event	Orbit
1973 Sep 18		Launch by Feng Bao 1 Failed to orbit	JQ

• Ji Shu Shiyan Weixing (1974-F05)

After the Jul 1974 launch failure the FB-1 engines were replaced by engines from the CZ-1. The second launch still failed to orbit. Payload mass was 1108 kg.

JSSW 2

Date	Time	Event	Orbit
1974 Jul 14		Launch by FB1 Failed to orbit	JQ

• Ji Shu Shiyan Weixing (1975-70A)

Mass of the JSSW was around 1107 kg.

JSSW 3

Date	Time	Event	Orbit
1975 Jul 26	1328	Launch by FB1	JQ 91.0 184 x 461 x 69.0
1975 Sep 14		Reentered SW of Tasmania	

PAYLOAD

Visible and IR meteo sensors
Radio transmission imaging recon camera

• Ji Shu Shiyan Weixing (1975-119A)

The second Feng Bao 1 launch to reach orbit carried another JSSW satellite, PRC 5. Mass was 1109 kg.

JSSW 4

Date	Time	Event	Orbit
1975 Dec 16	0919	Launch by Feng Bao 1	JQ 90.3 186 x 387 x 69.0
1976 Jan 27		Reentered	

• Ji Shu Shiyan Weixing (1976-87A)

The final successful JSSW launch (PRC 6) went into an orbit with a much higher apogee; however mass was similar at 1108 kg.

JSSW 5

Date	Time	Event	Orbit
1976 Aug 30	1153	Launch by Feng Bao 1	JQ 108.8 195 x 2145 x 69.2

• Ji Shu Shiyan Weixing (1976-F03)

The last FB-1 launch failed to reach orbit on 10 Nov 1976. It probably carried another JSSW satellite. Mass was 1208 kg.

Table 76. JSSW

Payload	Name	Launch Veh.	Site	Launch Date	Reentry Date	Dur	Orbit	Designation
JSSW 1	Ji Shu Shiyuan Weixing	Peng Bao 1	JQ	1973 Sep 18	1973 Sep 18	0	-	-
JSSW 2	Ji Shu Shiyuan Weixing	Peng Bao 1	JQ	1974 Jul 14	1974 Jul 14	0	-	1975-70A
JSSW 3	Ji Shu Shiyuan Weixing	Peng Bao 1	JQ	1975 Jul 26	1975 Sep 14	0	184 x 461 x 69.0	1975-19A
JSSW 4	Ji Shu Shiyuan Weixing	Peng Bao 1	JQ	1975 Dec 6	1976 Jan 27	0	186 x 387 x 69.0	-
JSSW 5	Ji Shu Shiyuan Weixing	Peng Bao 1	JQ	1976 Aug 30	-	0	195 x 2145 x 69.2	-
JSSW 6	Ji Shu Shiyuan Weixing	Peng Bao 1	JQ	1976 Nov 10	1976 Nov 10	0	-	1976-87A

5.2 Weather satellites (FY)

• Feng Yun 1 (1988-80A)

The first FY-1 (Wind and Cloud) satellite carried radiometers to return Earth weather imagery. The 757 kg satellite failed after one month when its attitude control was lost. The FY satellites are built by SISE (Shanghai Inst of Satellite Engineering), part of CAST until 1993 and then part of SBA.

The China Meteorological Administration operates the National Satellite Meteorological Center in Beijing, which controls the satellites via ground stations in Beijing, Guangzhou and Urumqi.

Size was 1.4 x 1.4 x 1.2m box, 1.76m deployed, 8.6m span with 2 solar panels.

Feng Yun 1			
Date	Time	Event	Orbit
1988 Sep 6	2030	Launch by CZ-4	T'ai Yuan
	2032	T+2:31 St 1 MECO	
	2032	T+2:32 St 1 sep	
	2032	T+2:47 Fairing	
	2036	T+6:38 St 2 MECO	
	2036	T+6:48 St 2 VECO	
	2036	T+6:49 St 2 sep	
	2036	St 3 burn?	
	2040	St 3 burn 303s?	
	2041	T+10:10 St 3 MECO	102.8 881 x 904 x 99.1
1988 Oct 15		T+11:05 St 3 sep	
		End of operations	

PAYLOAD		
VIRR	5-channel Vis/IR Radiometer	
HRPT	Hi Res picture transmission system (NOAA compatible)	
DRPT	Delayed picture transmission	
	AOCS 12 kg N2 gas	

• Feng Yun 1B (1990-81A)

The second FY satellite was launched in Sep 1990. Mass was 881 kg.

FY-1B temporarily lost attitude control in 1991 because of radiation damage, but control was regained in two months, although lost again later.

Feng Yun 1B			
Date	Time	Event	Orbit
1990 Sep 3	0053	Launch by CZ-4	T'ai Yuan
1991 Feb		Attitude control lost	
1991 Apr		Control regained	
1991?		End of ops	
1994 Jan		Operable inactive	

• Feng Yun 2 (1997-29A)

The FY-2 weather satellite was launched in Jun 1997 after a long delay caused by the explosion of the first flight model during testing.

The spin-stabilized FY-2 was built by the Shanghai Aerospace Technology Research Institute and had a mass of 1380 kg. It will be stationed at 105E and controlled from the Xi'an control center. The satellite is a 2.1m dia 4.5m high cylinder with antenna deployed and AKM attached. The main bus is 2.1 dia 1.6m high, with

antenna but without AKM it is 3.0m high. The FG-36 AKM is a cylinder-cone 1.5m high 1.0m dia and 729 kg full, leaving a BOL mass for FY-2 of 651 kg.

FY-2 spins at 100 rpm. Resolution is 1.3km visible and 5 km in the IR. A despin system malfunctioned in Mar 2000 and FY-2 was relocated in Apr 2000 to a storage location at 85E.

FY2

Date	Time	Event	Orbit
1997 Jun 10	1201	Launch by CZ-3 T+2:06 St 1 MECO T+2:07 St 2 burn T+4:15 St 2 MECO T+4:19 Fairing T+4:22 St 2 VECO T+4:23 Stage 3 burn T+11:08 MECO-1 T+15:35 MES-1 T+20:53 Stage 3 MECO-2 T+21:32 Stage 3 sep	XSC
1997 Jun 10			635.12 206 x 35987 x 28.5
1997 Jun 11	0420?	AKM burn	
1997 Jun 11		AKM separated	1399.72 34099 x 36044 x 0.3
1997 Jun 11			1396.45 34015 x 35998 x 1.3
1997 Jun 11			1403.34 34069 x 36216 x 1.3 GEO 114.9E+8.4E
1997 Jun 17			1436.08 35780 x 35792 x 1.2 GEO 105.0E
1997 Jul 10			1436.01 35781 x 35788 x 1.1 GEO 104.1E
1999 Oct 13			1436.09 35784 x 35788 x 0.7 GEO 104.8E
2000 Apr 23		Moved out	1548.33 35773 x 36278 x 0.1 GEO 104E dr
2000 May 10		mv in	GEO 85.5E
2000 Jun 11			1436.15 35767 x 35807 x 0.3 GEO 85.6E

PAYLOAD VISSR Scanning Radiometer 0.55-1.05 mu (4 channels), 10.5-12.5 mu channel, H2O 6.3-7.6mu channel, Cloud cover monitor, Data collection relay: WEFAX, S-FAX, Space environment monitor

• FY-1C

(1999-25A)



The first operational FY-1, FY-1C, was launched in 1999. The number of channels in the radiometer was increased, as well as on board data storage capacity. The resolution is 1.1 km. Vehicle is a 1.4m cube with two solar panels of 8.6m span. Mass is 958 kg. According to AvWeek, FY-1C was built by CAST/Beijing for the National Satellite Meteorological Center [2] but most sources say the FY-1 series were built in Shanghai.

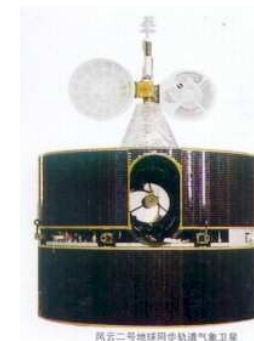
FY-1C

Date	Time	Event	Orbit
1999 May 10	0133	Launch by CZ-4B	TYSC
	0135	T+2:32 St 1 sep St 2 burn	
	0135	T+2:47 Fairing sep	
	0139	T+6:48 Stage 2 MECO	
	0139	T+6:49 St 2 sep Stage 3 burn	
	0145	T+12:29 FY-1C sep	
	0146	T+13:34 SJ5 sep	
2001 May		Still operating	

PAYLOAD Vis and IR radiometer, 0.5-3.9 mu, 11mu; 10 channels

• Feng Yun 2

(2000-32A)



FY-2B was developed by SARTI/Shanghai for CASC. It carries a 1.2km resolution radiometer. Launch mass is 1380 kg.

In the table below, velocities (supplied by CALT) are Earth-fixed.

FY-2C/D/E will have 5 radiometer channels but are otherwise similar.

FY-2

Date	Time	Event	Orbit
2000 Jun 25	1150	Launch by CZ-3	XSC
		T+2:00 St 1 sep 55 km, 2.274 km/s	
		T+4:13 Fairing 178 km, 5.224 km/s	
		T+4:17 St 2 sep 181 km, 5.226 km/s	
	1201	T+11:43 St 3 MECO-1 299 km, 7.089 km/s	-400? x 300 x 27.4
		T+17:48 St 3 MES-2 243 km, 7.189 km/s	
	1213	T+23:00 St 3 MECO-2 207 km, 9.804 km/s	
	1213	T+23:44 St 3 sep, 223 km, 9.797 km/s	233 x 35820 x 27.4
2000 Jun 26	0400?	AKM burn	
		AKM sep	
2000 Jul 2			1438.22 35796 x 35859 x 1.1
2000 Jul 6		First image	

FY-2

Date	Time	Event	Orbit
2000 Jul 8			1436.00 35776 x 35793 x 1.1 GEO 104.4E
2001 Jun 9			1435.72 35766 x 35792 x 0.3 GEO 103.1E
2004 Jan 16			1436.11 35781 x 35791 x 0.3 GEO 104.7E

PAYLOAD

Scanning Radiometer
 IR Cloud cover monitor (H2O vapor)
 Data collection relay
 Space environment monitor

● FY-1D

(2002-24B)

950 kg satellite launched by CZ-4B from TYSC.
 Advertised as supporting the 2008 Olympic Games. FY-1C still operating in May 2002.

FY-1D

Date	Time	Event	Orbit
2002 May 15	0150	Launch by CZ-4B	
	0152	T+2:32? St 1 sep	
	0152	St 2 burn	
	0152	T+2:47? Fairing sep	
	0156	T+6:48? Stage 2 MECO	
	0156	T+6:49? St 2 sep	
		Stage 3 burn	
	0200?	Stage 3 MECO	
	0202	T+12:29? FY-1D sep	
	0203?	Adapter sep?	
	0203	T+13:34? HY-1 sep	
2002 May 17			102.19 851 x 873 x 98.8

PAYLOAD

10-channel scanning radiometer

Table 83: FY

Payload	Name	Launch Veh.	Site	Launch Date	Reentry Date	Dur.	Orbit	Designation
FY-1	Peng Yun 1	CZ-4	T'ai Yuan	1988 Sep 6	1988 Oct 15		881 x 904 x 99.1	1988-80A
FY-1B	Peng Yun 1B	CZ-4	T'ai Yuan	1990 Sep 3				1990-81A
FY-1C	Peng Yun 1C	CZ-4B	T'ai Yuan	1999 May 10				1999-25A
FY-2	Peng Yun 2	CZ-3	Xidang	1997 Jun 10			35781 x 35788 x 1.1 GEO 105E	1997-29A

5.3 CX

• Chuangxin 1 (2003-49B)

Chuanxin or Chuang Xing is 'innovation'. CX-1 is a SAST store-relay comsat developed by Chinese Academy of Sciences. Piggyback on CZ with CBERS-2. Mass is under 100 kg.

ZY-1 No 2/CBERS-2

Date	Time	Event	Orbit
2003 Oct 21	0316	Launch by CZ-4B	
2003 Oct 22			99.24 685 x 759 x 98.5

6 Tsinghua and HSTSL

• HSTSL-1 (2002-F01)

50 kg Tsinghua microsat planned for 300 x 300 x 91 orbit. (Max White, private comm) for Tsinghua spinoff.

The Kai Tuozhe-1 rocket is based on the DF-31 missile. Solid fuel mobile launch vehicle from CAMEC (China Aerospace Machinery and Electronics Corp).

KT-1

Date	Time	Event	Orbit
2002 Sep 15	1030	Launch by KT1	TYSC
	1032?	Failed second stage	

• KT-1 Test (2003)

A suborbital test of the KT-1 was carried out on Sep 16.

From Chen Lan,

- It is confirmed that payload of this KT-1 launch is the 40-kg PS2 = microsat. The target orbit is 300kmx300km polar orbit.
- The PS2 launch service contract was signed on July 29 between = Aerospace Solid Launch Vehicle Corp.(ASLVC) and Harbin Fenghua-Aerospace = Hi-Tech CO.LTD, a Shenzhen listed company (stock code 0901). Beijing = Launch System Technologies, a subsidiary of Harbin Fenghua, provided = KT-1 launch service at RMB48.5 million (USD 5.8 million). ASLVC is the = customer of this R&D launch but is also the developer of the launch = vehicle, while the latter acts as the launch service provider. China = Aerospace Science and Industry Corp.(CASIC) are major shareholder of = both companies. ASLV has also shares in Harbin Fenghua.
- KT-1 is developed purely by CASIC funding, without any government = investment. Last year's failure has already put the project in difficult = situation.

7 Bibliography

References

- [1] AAS History Series Vol. 25, p 143.
- [2] Aviation Week, 1999 May 17, p 28.
- [3] Aviation Week, 2000 Oct 9, p 126.
- [4] JBIS 55, 236.
- [5] Quest, 6, 2, p 36.
- [6] Jane's Spaceflight Directory 1994, ed. A. Wilson.
- [7] Phillip S. Clark, personal communication.

8 Some things I don't know about China's space program

- 1. Organizations:
 - 1.1 What are the exact organizational relationships between CNSA, CASC, CGWIC?
 - 1.2 Some sources say FY-2 was built by SARTI (Shanghai Aerospace Research Tech. Inst.) - is this group distinct from SISE?
 - 1.3 What are the transliterated Chinese names for all the organizations?
- 2. Launch vehicles
 - 2.1 Trajectory details of the FB-1 launch failures (apogee, velocity..)
 - 2.2 Trajectory details of the suborbital FB-1 tests of 1972, 1977 and 1978.
 - 2.3 Details of alleged KT-1 launch failures in 2002 and 2003.
- 3. Spacecraft masses.
 - 3.1 What are the separate masses for the Shenzhou orbital module, descent module and propulsion module, for each mission?
 - 3.2 Separate masses for FSW/FSW-1/FSW-2 reentry vehicle, reentry motor and equipment section.
 - 3.3 What is the mass of the ZY-2 satellite?
 - 3.4 What is the mass of the JB-4 satellite launched 2003 Nov 3?
- 4. Spacecraft names.
 - 4.1 Confirm match of Zhongxing 1-4 designations to DFH-2A satellites launched 1988-1991; designations for 1984 and 1986 GEO satellites and *especially* 1994 Nov 29 launch (the one that failed) - ZX-6?
- 5. Spacecraft propulsion
 - 5.1 What is the delta-V in km/s of the FSW retrofire burn?
 - 5.2 Details (propellant, thrust, size) of the CTS used for the Tan Ce 1 launch.