

The China Space Science Satellites Technology



Li WANG

**Deep Space Exploration & Space Science Division
Research & Development Center
Chinese Academy of Space Technology(CAST)**

April 21, 2006



Outline

- 1. Introduction**
- 2. The History**
- 3. Space Science Satellites under Developing**
- 4. Prospects of China Space Science Satellites
Technology**
- 5. Cooperation Vision**



1. Introduction

Chinese Academy of Space Technology—CAST as the main spacecraft design, manufacture, operation and application corporation in China, had made all Chinese manned spaceship, communication, navigation, earth observation and space science satellites.



Introduction

While the “Double Stars program ” and “Chang’e Project ” were putting into force, the Chinese space exploration technology is rapidly expanding. CAST now attach importance to space science, and would apply the best space platform for scientists.



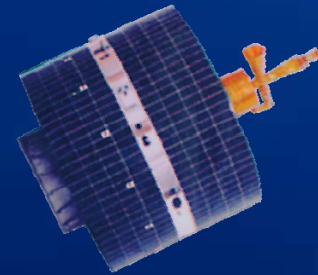
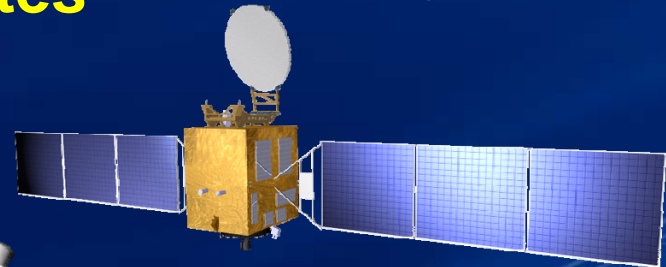
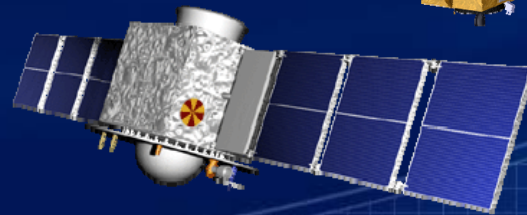
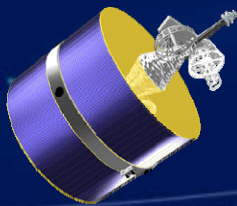
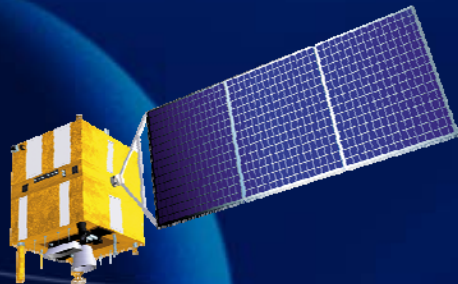
2. The History

In the past 30 years, although the government investment and the number of satellites are limited, the space science satellites technology has been greatly improved. Space exploration activity in China experienced the development of secondary payload of application satellite to dedicated satellite platform.

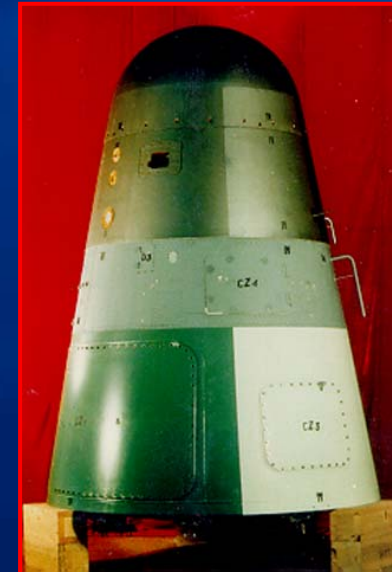
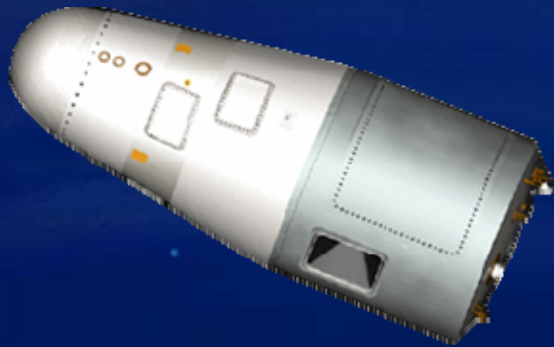


2.1 Cases for Secondary payload of applications satellites

- Recoverable satellites
- Communication satellites
- Meteorological satellites
- Earth resources satellites



2.2 Space science satellites in China(1)



Recoverable series satellites



2.2 Space science satellites in China(2)



SJ-5



SJ-4



SJ-1

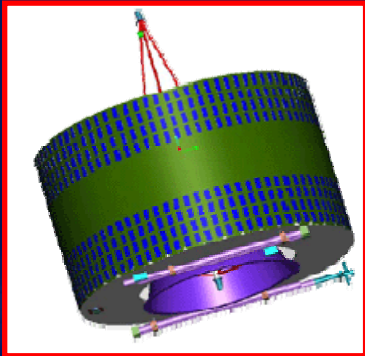


SJ-2

SJ series satellites

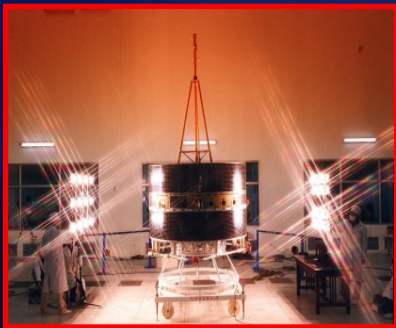


2.2 Space science satellites in China(3)



TC-1

- Launch Date : TC-1 2003.12.29,
TC-2 2004.7.25
- Spacecraft Platform: CAST968
- Payload Mass: 82.7kg, 86.2kg
- Satellites Status: in operation



TC-2

Double Stars Program (TC-1,TC-2)



2.3 Summary

Table 1 Schedule of Space Science Experimentation onboard the Recoverable Satellites

Launch Date	Mission
1987-08-05	Crystal growth of GaAs and TeCdHg, plant seeds, albuminoid crystal
1987-09-09	Crystal growth of GaAs, carrying out experiments for Mtl. Co. France
1988-08-05	Commercial payloads flying of Cosima-1 (30kg, Intospace Co. Germany)
1990-10-05	Crystal growth of GaAs, animal experiment, microgravity measuring
1992-08-09	albuminoid crystal growth, Crystal growth of TeCdHg
1992-10-06	Crystal growth of GaAs and TeCdHg, albuminoid crystal experiment, relating to the experiments of rice, wheat and seed.
1993-10-08	Crystal growth of GaAs
1994-07-03	albuminoid crystal growth, cell cultivation, microorganism (microbial) crystal growth, microgravity measuring
1996-10-20	Biology cultivation, real-time observation of crystal growth, Crystal growth of GaAs



Table 2 Schedule of China dedicated space science Satellites

Sspacecraft	launch Data	Mass (Kg)	Orbit parameter	Mission Design
SJ-1	1971-3-3	221	Perigee (Periapsis) : 266km. Apogee(Apoapsis) : 1826 km. Inclination:69.9°	Space physics exploration
SJ-2	1981-9-21	257	Perigee: 237km. Apogee: 1622 km. Inclination: 60°	Space physics exploration
DQ-1A/1B	1990-9-3	2.6	900km altitude, circular, inclination 99°	Upper atmospheric density exploration
SJ-4	1994-2-8	400	Perigee: 210km. Apogee: 36125 km. Inclination 28.6°	Space physics and effect exploration
SJ-5	1999-5-10	350	870km altitude, circular, inclination 98.8°	Space physics and effect exploration
TC-1	2003-12-30	330	Perigee :6900 km. Apogee: 85300 km. Inclination 28.5°	A cooperation mission with ESA, sun-earth space physics exploration
TC-2	2004-6-29	330	Perigee :700 km. Apogee: 39000km. Inclination 90°	A cooperation mission with ESA, sun-earth space physics exploration



3. Space Science satellites under Developing

3.1 (SEUS)Space Environment utilization satellite

(Recoverable satellite)



- **Science Objectives:**

 - microgravity scientific experiments

- **Orbit Altitude:** ~300--500km

- **Microgravity:** $10^{-4} \sim 10^{-5} \text{ g}$

- **Payload Capacities:**

 - In Orbit Module: $\leq 0.9\text{m}^3$, $\sim 300\text{kg}$

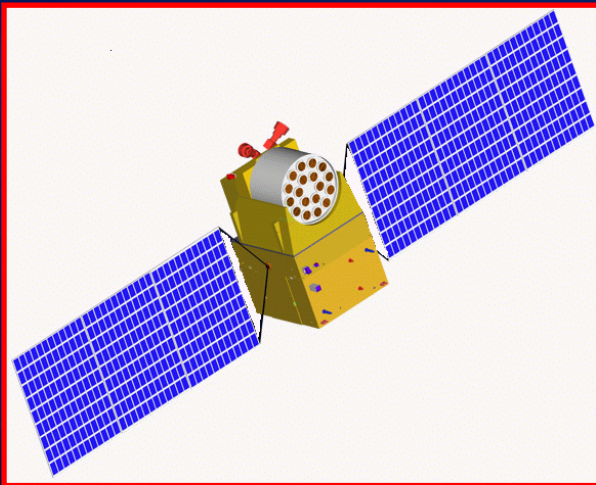
 - Recoverable module: $\leq 0.45\text{m}^3$, $\sim 280\text{kg}$

- **Lifetime:** Recoverable Payload: 30 days (max)

 - Non-recoverable Payload: 90-180 days



3.2 Hard X-ray Modulation Telescope (HXMT)



- **Science Objectives:**

Performing hard-X all-sky survey with high-sensitivity and high-resolution , deep scanning of selected regions and pointing observation.

- **Science payload:** HXMT

- **Payload mass:** $\geq 1000\text{Kg}$;

- **Pointing accuracy :** $< 0.3^\circ (3\sigma)$

- **Attitude measurement accuracy** $< 0.03^\circ (3\sigma)$

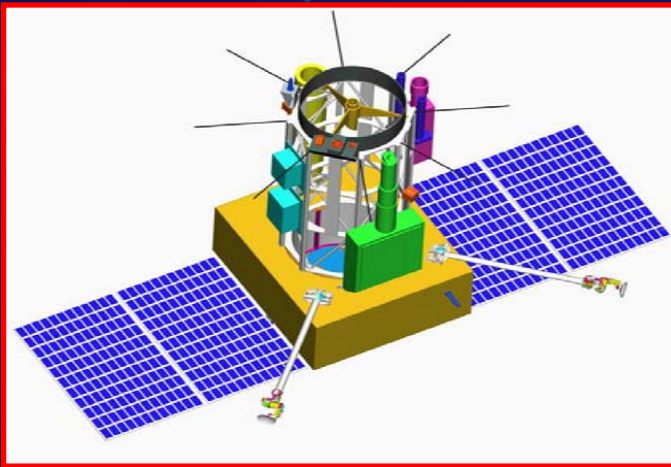
- **Power(W):** 2388(BOL), 2121(EOL)



3.3 Space Solar Telescope (SST)

- **Science Objectives:**

Engaging in observation of the transient and steady solar hydrodynamic and magneto-hydrodynamic processes and their continuous evolution.



- **Main science payloads:**

- MOT (main optical telescope)
- EUVT (extreme UV telescope)

- **Payload mass:** $\geq 800\text{Kg}$;

- **Pointing accuracy:** $< 0.3^\circ (3\sigma)$

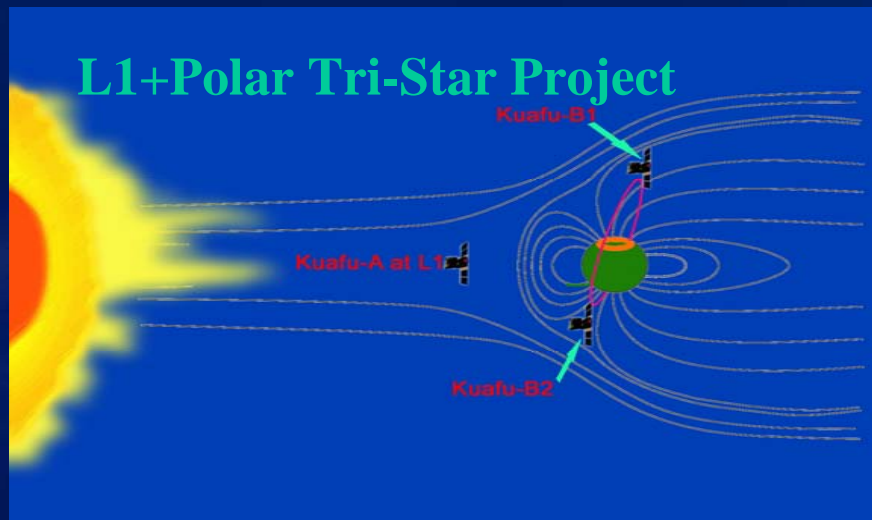
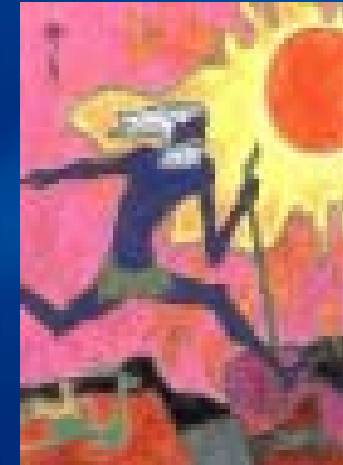
- **Attitude measurement accuracy:** $< 0.03^\circ (3\sigma)$

- **Power:** payload power 1300W

- **Downlink data rate:** 2X150~300Mbps



3.4 KuaFu program



- Solar Flares, CMEs
- Interplanetary Clouds,
- shock Waves
- Their geo-effectiveness

•Science objectives:

To observe the complete chain of Disturbance from the Solar atmosphere to the geo-space.

•Satellite platform (planned):

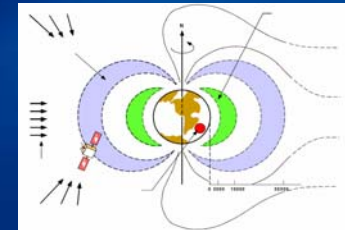
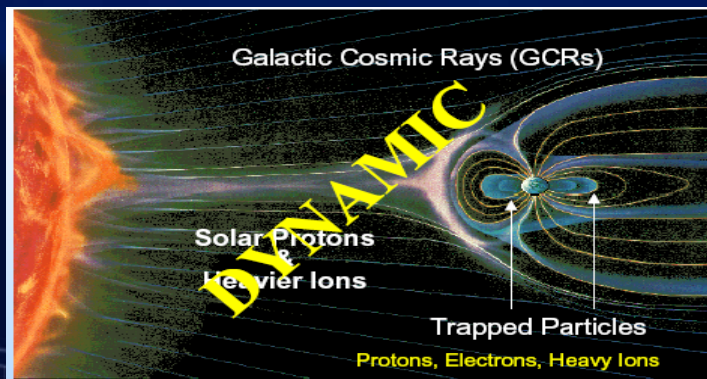
CAST 968 Platform



3.5 SEEMS(Space Environment &Effects Monitor Satellite)



CAST 968 Platform



- **Objectives:**

Monitor dynamic space environment & space environment effect and validate model/tools/ground test protocol.

- **Description:**

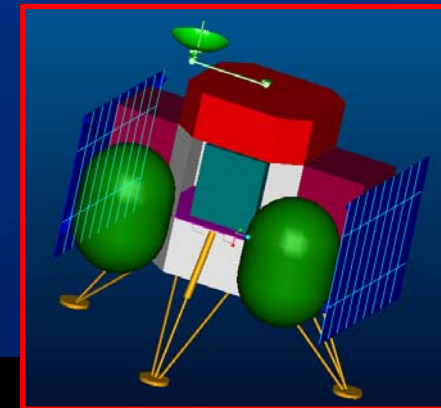
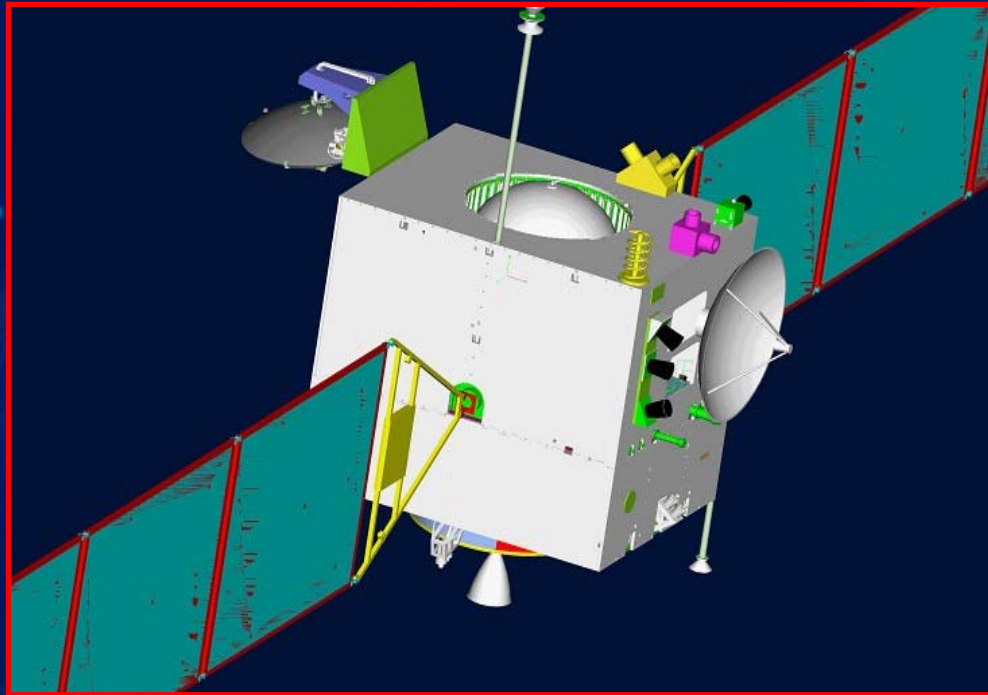
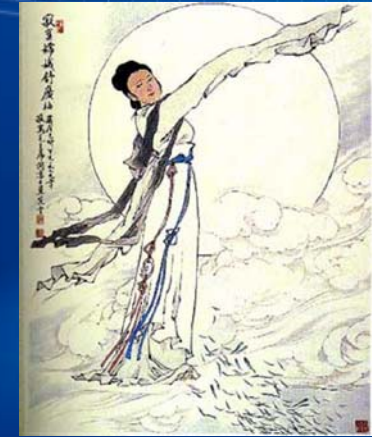
- one satellite in Low orbit and the other one in high orbit.
- The Low altitude orbit satellite is expect to launch in 2011-2012.

- **Satellite platform (planned) :**

CAST 968 Platform



3.6 Lunar Exploration (Chang'e Project)



**Chang'e-1 would be
launched in 2007**



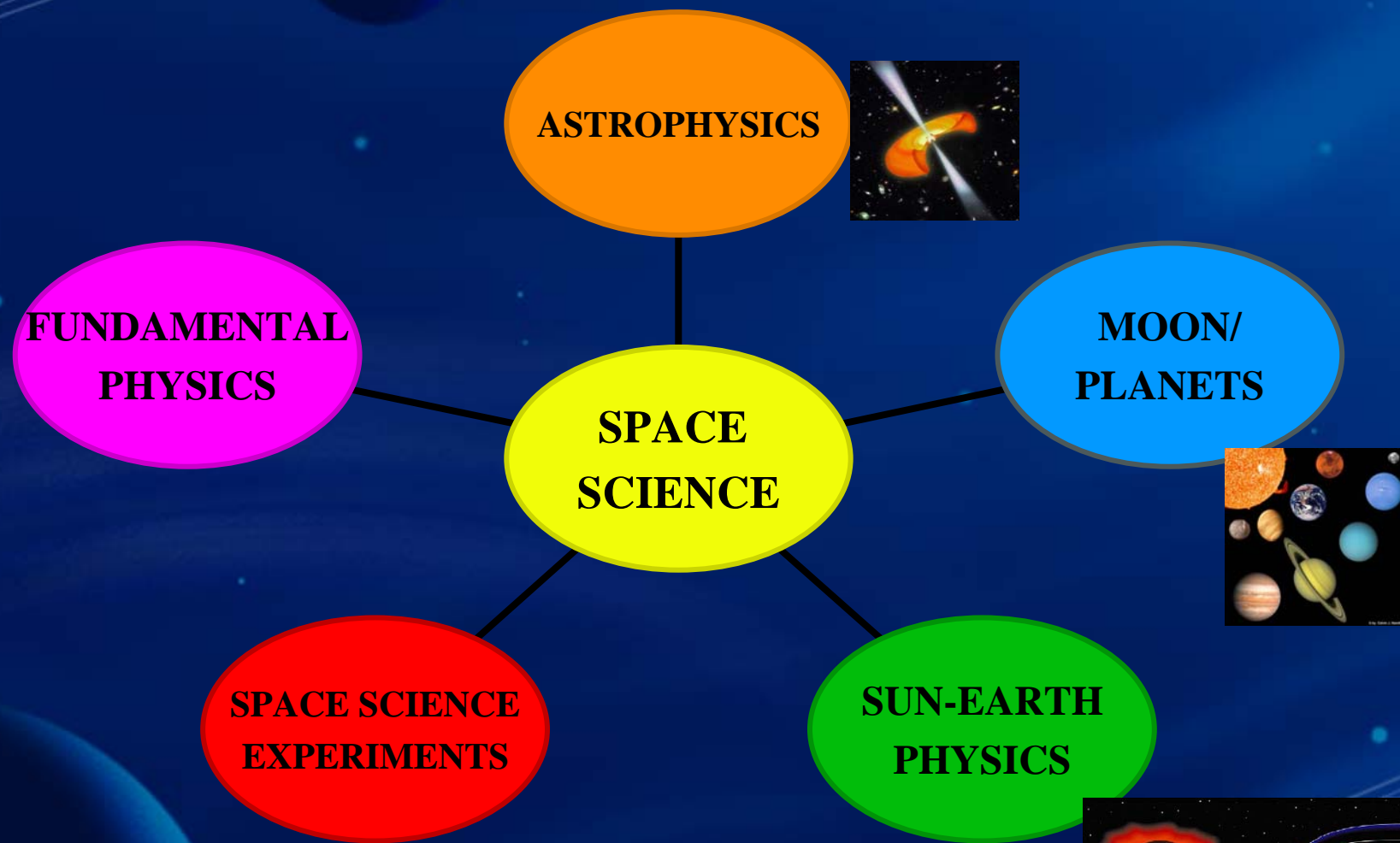
4. THE PROSPECTS

Driving by the government support and better space science projects, the China space science satellites technology would be develop rapidly .

Particle and fundamental physics in space is a new field for CAST, we will work hard with scientists to overcome the new technology challenges .



SPACE SCIENCE IN CAST



5. COOPERATION VISION

The 21st century is a new age of exploring and using outer space. international cooperation in space science will strengthen the capability to explore and understand the universe.

CAST would like to join the space science projects proposed by scientists.



Potential cooperation items such as:

- ◆ **Space environment utilization**

 - Microgravity physics, materials, medical,...

- ◆ **Payload**

 - second payload, test, calibration,.....

- ◆ **Space science satellites technology**

 - drag-free, data handling, Accurate thermal control, ...



Thanks!

Address: <http://www.cast.cn>

