Progress of the China Seismo-Electromagnetic Satellite (CSES) mission

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Part I: CSES General Information

Scientific objectives

- To obtain world-wide data of space environment of the electromagnetic field, ionospheric plasma and charged particles,
- To monitor in real-time and study the ionospheric perturbations which may possibly associated with earthquake activity, especially with those destructive ones.
- To analyze the features of seismo-ionospheric perturbations, in order to test the possibility for short-term earthquake forecasting.
- To support the research on geophysics, space sciences as well as electrical wave sciences, and to provide the data sharing service for international cooperation and scientific community.
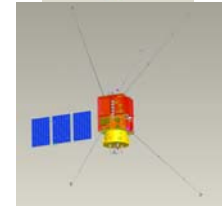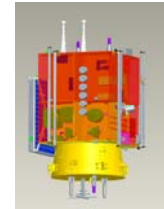
Mission contents and the main parameters

Detection content	Physical parameters	Specifications
Electromagnetic field and wave	Magnetic field	DC~20kHz
	Electric field	DC~3.5MHz
Ionosphere plasma	TEC and content profile	
	Ion density	10^2~10^7cm^{-3}
	Ion temperature	500~10000K
	Electron density	10^2~10^7cm^{-3}
	Electron temperature	500~10000K
Energetic particles	Proton flux	1.5MeV~200MeV
	Electron flux	≥100keV
	Pitch angle	

Satellite Segment

Scientific Payloads

Institutions on Duty	Payloads	Description
Beijing Univ. of Aerospace and Astronauts	Search-Coil Magnetometer	Measuring the magnetic field and electric field
Center for Space Science and Application, CAS together with Austria Space Institute	High Precision Magnetometer	
China Academy of Space Technology	Electric field detector	
Center for Space Science and Aplication Research, CAS	Plasma analyzer	Measuring the in-situ disturbance of plasma in ionosphere
Center for Space Science and Aplication Research, CAS	Langmuir probe	
China Academy of Space Technology	GNSS Occultation Receiver	Measuring the profile disturbance of plasma in ionosphere
Institute of Electrical Wave Propagation of China	Three frequency transmitter	
Italian National Institute of Neuclear Physics; Institute of High Energitical Physics, CAS	Energetic particle detector	Measuring the flux and spectrum of energetic particles

The Ground Segment

Data Flow
Instructions Flow

Data Receiving Stations(CAS)
Data Receiving Center(CASC)
Operational Center
Three Frequency Beacon receiving Array(CEA)
Scientific Mission and Application Center(CEA)
Ground-based verification field(CEA)
Internal and international Users
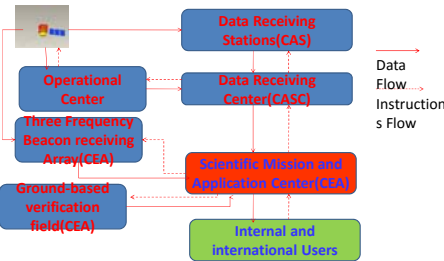
Orbit Parameters

Style of orbit	Sun synchronous orbit
Altitude (km)	507
Inclination (deg)	97.4°
Period (min)	94.6
Local time of descending node	14:00pm
Revisiting period (day)	5

Part 2: Some First Results of the Payload Subsystem in Phase C
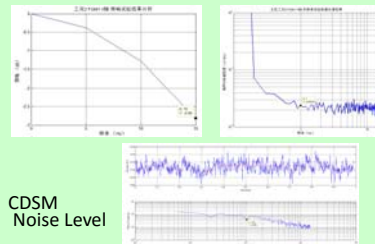
Stacer Boom

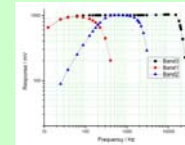- Used for EFD Sensor deployment.
- 4 identical booms.

High Precision Magnetometer

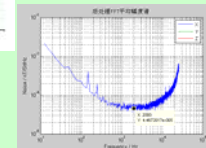f-Domain Response   f-Domain Sensitivity

CDSM Noise Level
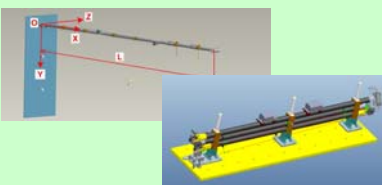
Search Coil Magnetometer

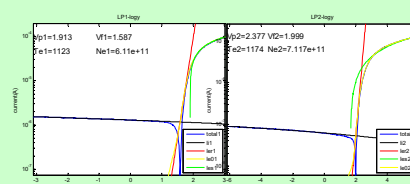f-Domain Response

System Noise Level

Hinged Boom

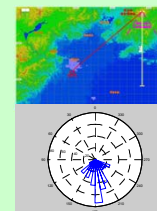- Used for HPM and SCM Sensor deployment.
- 2 identical booms.

Langmuir Probe

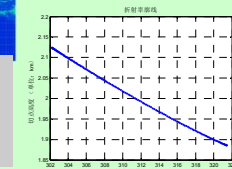Plasma Environment TEST Result (INAF, Italy)
Φ 50 Probe   Φ 10 Probe

Vp1=1.913 Vf1=1.587 Te1=1123 Ne1=6.11e+11
Vp2=2.377 Vf2=1.999 Te2=1174 Ne2=7.117e+11

GNSS Occultation Receiver

Mountain-Based GNSS-RO Test

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Part 3: Comments and Follow-on Plans

Point 1: Inter-Calibration and verification while the Sat. onboard

- Experiments on Space-ground joint observation
- Inter-calibration together with ESA SWARM constellation and ground based incoherent Scatter Radar network

Point 2: Focusing on 2nd CSES Sat.

- 2nd CSES sat is included in the China national strategic plan
- double sats. Are proposed to launch in 2019.

Point 3: the Integrate research for Data processing, information Distinguishing and the mechanisms related with precursors:

- Standard data processing
- Methodology developing and signals recognition related with earthquake
- Geomagnetism Field Model and Ionosphere Model Construction
- L-A-I coupling models and EQ precursors models developing

Point 4: Joint Experiments on Earthquake Monitoring in Seismic Areas

- Sharing CSES and related data in time;
- Encouraging to build the tre-frenquancy receiving array;
- Real time data analyzing and information managing;
- Multi-parameters RS Joint analysis and simulation techniques;
- Experiments on Earthquake Monitoring in test sites.