

# China Country Report to WGCV#20

CSIRO Marine Research, CSIRO Earth Observation Centre &  
Antarctic Cooperative Research Centre, Tasmania, Australia

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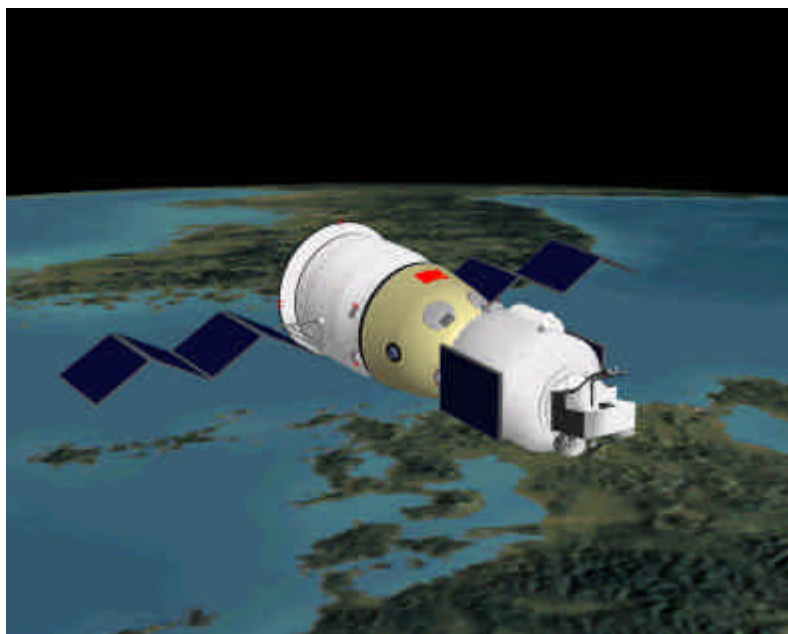
Center for Space Science & Applied Research,

Chinese Academy of Sciences

## **1. The multi-mode microwave remote sensor (M<sup>3</sup>RS) of Shenzhou    unmanned spacecraft**

China has successfully launched its Shenzhou    ("Shenzhou    ", in English, "Divine Vessel    ",) unmanned spacecraft at 00:40 AM local time on 30 December 2002. The spacecraft was launched from the Jiuquan Satellite Launching Center located in Gansu Province.

The Shenzhou    spacecraft is circling the earth once every 90 minutes. In each case, the Shenzhou left an orbital module in orbit which continued on an autonomous mission for a number of months after the reentry module returned to Earth. This orbital module has its own propulsion, guidance, navigation, and communications systems. It also has its own solar panels for power generation.



The orbital module will continue circling the earth and conducting space science and application experiments, according to scientists at the Beijing center.

Scientists also carried out experiments in earth observation, space material and life, space astronomy, space environment exploration, audio and video transmission while the spacecraft was in orbit. The science investigation covers four main areas: microwave earth observation, space environment monitoring, micro-gravity fluid physics, and biological technology research. The main payload of Shenzhou spacecraft is multi-mode microwave remote sensor (M<sup>3</sup>RS). M<sup>3</sup>RS is China's first spaceborne microwave remote sensor. M<sup>3</sup>RS consists of three main instruments: a Ku-band radar altimeter, a Ku-band radar scatterometer and a five-channel microwave radiometer.



Table 1 is show the designed application specifications of M<sup>3</sup>RS.

Table 2 is the key system parameters of M<sup>3</sup>RS.

M<sup>3</sup>RS of Shenzhou spacecraft is test system. These equipments will be used to FY-3 (Chinese meteorological satellites) and HY-2 (Chinese oceanic satellites).

User of FY-3 is National Satellite Meteorological Center, China Meteorological Administration.

User of HY-2 is Satellite Ocean Application Center, State Oceanic Administration.

## 2. Calibration and validation activities of M<sup>3</sup>RS

We will provide reports at the next meeting.

## 3. WGCV-21 meeting

The Chinese CEOS agrees that the WGCV-21 meeting will be held in China this year. The meeting will be hosted by Center for Space Science and Applied Research (CSSAR), Chinese Academy of Sciences, Beijing China.

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**Table 1 Application parameters of M<sup>3</sup>RS**

Instrument	Measurement Parameter	Designed Value
ALT	Accuracy of average sea surface height	10cm (after atmosphere and orbit calibration) 4.5cm (instrument error)
	Precision of backscatter coefficient	1dB
	Range of SWH	1~20m
	Accuracy of SWH	The greater of 0.5m and 10% SWH
	Center frequency	13.9GHz
SCAT	Range of wind speed	4~24m/s
	Accuracy of wind speed	The greater of 2m/s and 10% wind speed
	Range of wind direction	0~360deg
	Accuracy of wind direction	Less than 20 degree
	Precision of backscatter coefficient	1dB
	Range of backscatter coefficient	-40~+20dB
	Swath width	350km
	Spatial resolution	50km
	Polarization	VV, HH
	Center frequency	13.9GHz
	Incident angle	37deg
RAD	Radiometric precision	1K
	Range of brightness temperature	100~330K
	Integration time	100ms
	Incident angle	40deg
	A/D bit	12bit

**Table 2 Key System Parameters of M<sup>3</sup>RS**

Instrument	System Parameter	Designed Value				
ALT	Peak transmit power	58W				
	Transmit pulse width	24μs				
	Transmit pulse bandwidth	333MHz				
	Compressed pulse width	3ns				
	T/R antenna gain	69dBi (two-way)				
	Antenna 3dB beamwidth	2.6deg				
	PRF	1.23kHz				
	Receiver noise figure	5.5dB				
	Type of tracker	Quasi-maximum likelihood and gravity center				
	Type of pulse compressor	Full-deramp				
	Range processor	FFT spectrum analyzer				
	Output of filter	64				
	Base bandwidth	1.35MHz				
	Bandwidth of filter output	42kHz				
	Sampling rate	2.7MHz				
SCAT	Peak transmit power	100W				
	Antenna gain	69dBi(two-way)				
	Antenna 3dB beamwidth	2.6deg				
	Transmit pulse length	0.65ms				
	PRF	128Hz				
	Receiver noise temperature	420K				
	Incident angle	37deg				
	Scanning mode	Conically scan				
	Polarization	Dual antenna, VV, HH				
	Signal bandwidth	50kHz				
	Precision and range of Doppler tracking	1kHz@-429kHz~+429kHz				
RAD	Center frequency (GHz)	6.6	19.35	23.8	37	13.9
	RF bandwidth (MHz)	400	800	800	800	400
	IF bandwidth (MHz)	200	400	400	400	200
	Integration time (ms)	100				
	Range of brightness temperature	100~330K				
	Receiver sensitivity	0.26K	0.29K	0.42K	0.43K	0.18K
	Antenna beamwidth (deg)	5.3	1.81	1.57	0.94	2.6
	Antenna gain (dBi)	29.3	>30	>30	>30	>37
	Type of antenna	Offset-feed parabolic reflector				C/o SCAT