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Prepared by CMA
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Summary of the Working Paper.

CMA reports on the status of the FY-2 geostationary satellite program. The program has produced 4 satellites. The FY-2A at 86.5E, FY-2B at 123.5E were de-orbited. FY-2C at 105E is the primary satellite for operational use. FY-2D was launched on 15 November 2006 and stationed at 86.5E now. The capability of FY-2C/D is identical, both carrying VISSR and SEM. In June 2007, FY-2D joined FY-2C in flood season observation. The ground station receives images alternatively from FY-2C and FY-2D's interlaced scanning every 15 minutes in flood season from June-September, every 30 minutes off the flood season.

FY-2 Programme shall continue with FY-2E/F. The FY-2E is planned to be launched in 2008, the designed life time 3 years. FY-2 Programme is to cover the duration till 2015.

Status of FY-2 Geostationary Satellite Programme

I Introduction

The Chinese geostationary meteorological satellites FY-2 are spin stabilized spacecraft. The current primary satellite FY-2C is stationed at 105E. FY-2D has identical capability with FY-2C and provide hot standby at 86.5E. FY-2B at 123.5E was de-orbited on 31 August 2006. FY-2A, previously at 86.5E, was de-orbited in May 2006.

The primary instrument payload for the current series of FY-2 spacecraft is VISSR, a multi-channel instrument designed to sense radiant and solar reflected energy. It provides data for upper level wind predictions.

The FY-2 spacecraft also has Space Environmental Monitor (SEM) systems to detect the space Environment in proximity of the satellite, the solar activities and relevant space phenomenon.

2 Chronology

Table 1 records the chronology of the FY-2 programme.

Table 1 - Chronology of the FY-2 GEO Programme (in bold the satellites active currently)

Satellite	Launch	End of service	Position	Status (Sept 2007)	Instruments
FY-2A	10 Jun 1997	08 April 1998	86.5E	Deorbited	S-VISSR, DCS, SEM
FY-2B	25 Jun 2000	Sept. 2004	123.5°E	Deorbited	S-VISSR, DCS, SEM
FY-2C	19 Oct 2004	expected ≥ 2009	105°E	Operational	S-VISSR (improved), DCS, SEM
FY-2D	15 Nov.2006	expected ≥ 2011	86.5°E	Operational	S-VISSR (improved), DCS, SEM
FY-2E	2008	expected ≥ 2014		Planned	S-VISSR (improved), DCS, SEM
FY-2F	2011	expected ≥ 2015		Planned	S-VISSR (improved), DCS, SEM

FY-2D

FY-2D, with identical capability of FY-2C, was successfully launched on November 15, 2006. It was positioned at 86.5E as orbital storage. FY-2D observation was switched on in June 2007 and to form a duel satellite constellation together with FY-2C at 105E. User stations within this constellation can get access to data transmission alternatively from the two satellites every 15 minutes in the season from June-September, every 30 minutes in the season from October-May.

FY-2C

FY-2C was launched on 19 October 2000 and it is positioned at 105E. It is the primary FY-2 satellite with instrument S-VISSR of 5 channels (see table. 2). Currently is active.

FY-2B

FY-2B was launched 25 June 2000 and to start transmit S-VISSR and WEFAX on January 1, 2001 at 105E, identical in capability with FY-2A.

On February 28, 2001, the transponder ceased working due to the local oscillator of the up-converter was found sensitive to temperature.

Through careful temperature control, the transponder worked again. On June 18, 2001, image transmission recovered. However, the EIRP (Effective Isotropic Radiated Power) was 8dBW below the normal level.

It pressured much upon energy supply in order to control temperature properly. So during the eclipse period when energy is less supplied, FY-2B has to stop image transmission completely to ensure enough energy for the management of satellite.

On June 8, 2003, retrace of VISSR scan mirror stuck due to insufficient lubrication. To prevent it from becoming deteriorated, VISSR only scanned the north hemisphere since then. In September 2004, FY-2B was moved to 123.5E.

On August 31, 2006, the FY-2B was de-orbited.

FY-2A

FY-2A is the first Chinese geostationary meteorological satellite. The launch date was 10 June 1997. It was positioned at the 105°E and was moved to 86.5°E in July 2000 due to failure of de-spun system. It was de-orbited in 2006.

3 FY-2 Payloads

- **S-VISSR (Stretched Visible and Infrared Spin Scan Radiometer)** – The version of FY-2A/B had three VIS/IR channels (0.5-1.05 μm, 6.3-7.6 μm and 10.5-12.5 μm) the improved version for FY-2 C/D/E/F splits the IR channel in two and adds a 3.5-4.0 μm channel (see table. 2) The resolution also is slightly improved: from 5.76 km (IR) and 1.44 km (VIS), to 5.0 km (IR) and 1.25 km (VIS). The image cycle is 30 min.
- **Data Collection Service (DCS)** - Main features:
 - uplink: two bands, frequencies 402.0-402.1 MHz for international DCPs (33 channels of bandwidth 3 kHz), 401.1-401.4 MHz for regional DCPs (100 channels of bandwidth 3 kHz); data rate 100 kbps, polarisation right-hand circular.
- **SEM (Space Environment Monitor)** – A space particle monitor and an x-ray monitor are mounted on FY-2C to detect the space environment in proximity of the satellite, the solar activities and relevant space phenomenon. The SEM measurement is transmitted via telemetry to the ground system.

Table 2. The spectral channels of VISSR

Channel	Wavelength(μm)
IR1	10.3~11.3
IR2	11.5~12.5
IR3	6.3~7.6
IR4	3.5~4.0
VIS	0.55~0.99

Table 3. The characteristics of VIS channels of VISSR

Channel	VIS
Wavelength (μm)	0.55~0.99
IFOV(μr)	35
Space resolution (km)	1.25
Dynamic range	0~98%
S/N	1.5 @ 0.5% albedo 50 @ 95%
Number of detectors	4 (primary) + 4 (backup)
Quantization level	64
Calibration	Solar calibration

Table 4. The characteristics of IR channels of VISSR

Channel	IR1	IR2	IR3	IR4
Wavelength(μm)	10.3~11.3	11.5~12.5	6.3~7.6	3.5~4.0
I FOV (μr)	140	140	140	140
Space resolution(km)	5	5	5	5
Dynamic range	180~330K		190~300K	180~340K
Temperature resolution	0.4~0.2K	0.4~0.2k	0.5~0.3 K	0.6~0.5 K
Number of detectors	1(primary)+1 (backup)	1(primary)+1 (backup)	1(primary)+1 (backup)	1(primary)+1 (backup)
Quantization level	1024	1024	1024	256
Calibration	Blackbody calibration			

4 Data transmission from FY-2

FY-2 data are transmitted in real time to be:

- **Command and Data Acquisition Station (CDAS)** Main transmission characteristics: frequency 1681.6 MHz, bandwidth 14 MHz, linear polarisation, data rate 14 Mbps.
- **S-VISSR Data Transmission**, compatible with MDUS acquisition stations. Main features:
 - frequency: 1687.5 MHz; bandwidth: 2.0 MHz; polarisation: linear
 - antenna diameter ~ 3 m, G/T ~ 12 dB/K, data rate 660 kbps.
- **WEFAX** from FY-2 A/B, **LRIT (Low Rate Information Transmission)** from FY-2 C/D/E, similar to MSG, GOES, MTSAT and GOMS-N2. Main features of LRIT:
 - frequency: 1691.0 MHz; bandwidth: 260 kHz; polarisation: linear
 - antenna diameter ~ 1 m, G/T ~ 3 dB/K, data rate 150 kbps.

5 Future FY-2 on the Way

FY-2E/F plan have been proved. Capacity of FY-2E/F is identical with FY-2C/D. Launch of FY-2E is planned for 2008. The designed life time 3 years.

6 Currently Disseminated FY-2 Data Products

1. Image Products

Product	Coverage	Time/day
S-VISSR full disc earth image	Actual observation coverage to be centered at the satellite sub-point	28
Nominal image	Nominal full disc earth image to be centered at 105°E, 0°N	24
S-VISSR hemispheric image	Half disc earth image of the northern hemisphere	20
Nominal hemispheric	Nominal half disc earth image of the northern hemisphere	20
Quadrant image	Four quadrant images with extension of 10 degree longitude and latitude from 105°E, 0°N	24
China area image	China area and proximity	24
Lambert projection	70° -140°E, 5°-55°N	24
Mercator projection	45°-165°E, 45°N-45°S	24
Sea area image	105°-150°E, 0°-45°N	24

Note: 28 times/day – observation starts at each hour, and at the half-hour dedicated for the AMV detection.

24 times/day – observation starts at each hour.

20 times/day – observation starts at each half-hour exclusive of those on the 28 times/day category.

2. Quantitative Products

Product	Coverage	Times/day
AMV	50°N-50°S, 55°E-155°E	4
SST	50°N-50°S, 55°E-155°E	8
UTH	50°N-50°S, 55°E-155°E	8
ISCCP Dataset, Precipitation index	50°N-50°S, 55°E-155°E	8
Rainfall estimate	70°E-140°E, 5°N-55° N	4
Cloud detection	50°N-50°S, 55°E-155°E	8
Cloud parameters(cloud top temperature, top height, cloud amount)	50°N-50°S, 55°E-155°E	8
Humidity profile by cloud analysis	50°N-50°S, 55°E-155°E	8
Outgoing long-wave radiation	50°N-50°S, 55°E-155°E	8
Downward solar radiation	50°N-50°S, 55°E-155°E	1
Snow coverage	Whole disc	1
Sea ice	Whole disc	1
Flood monitoring	China area	1
Drought monitoring	China area	1
Fire monitoring	China area	24
Tropical cyclone positioning	West pacific to 150°E, the Indian Ocean	24
Dust storm monitoring	China area	8
Fog monitoring product	China area	24
Brightness temperature	50°N-50°S, 55°E-155°E	8

Note: 4 times/day – observation starts at 00, 06, 12, 18 (UTC)
 8 times/day- observation starts at 00, 03, 06, 09, 12, 15, 18 ,21 (UTC)
 1 time/day-average of all the image data received a day.