



CGMS-37, CMA-WP-03
Prepared by CMA
Agenda Item: B.2
Discussed in Plenary

Status of CMA Operational Geostationary Satellite

Summary of the Working Paper.

CMA-WP-03 reports the status of current FY-2 geostationary programme. The programme has produced 4 satellites FY-2A/B/C/D that provide GEO imagery observation. Currently FY-2C/D are operationally active. **FY-2D** was launched on November 15, 2006. It was positioned at 86.5E. **FY-2C** was launched on 19 October 2004 and it is positioned at 105E. **FY-2E**, launched on 23 December 2008, is located at 123.5E.

FY-2C and FY-2D alternatively observe to transmit S-VISSR image every 15 minutes during rainy season from June-September, and every 30 minutes from October-May.

As FY-2C is older than the designed life time and the remaining propellant onboard is insufficient to maintain FY-2C stationed long, FY-2E and FY-2C will swap their position. According plan, FY-2E shall use one month time to move to 105E and take over the work of FY-2C; then FY-2C be drifted to 123.5E. This process shall begin on October 22, 2009.

FY-2 Programme shall continue with FY-2F/G/H.

Status of FY-2 Geostationary Satellite Programme (as of October 4, 2009)

I Introduction

The Chinese geostationary meteorological satellites FY-2 are spin stabilized spacecraft. The current primary satellite FY-2C is stationed at 105E. The FY-2D, with identical capability of the FY-2C is stationed at 86.5E. The two satellites back up each other and alternatively make observations to acquire full disc imagery every 30 minutes (every 15 minutes during rainy season in June-September). FY-2C is expected to work till October 2009 according to the remaining fuel. It shall be substituted by FY-2E, which was launched on 23 December 2008 and is located at 123.5E.

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 carries Space Environmental Monitor (SEM) 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 as of Oct. 2008)

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	23 Dec. 2008	expected ≥ 2014	123.5°E	Orbital storage	S-VISSR (improved), DCS, SEM
FY-2F	2011	expected ≥ 2014	86.5°E	Approved	S-VISSR (improved), DCS, SEM
FY-2G	2013	expected ≥ 2016	105E	Approved	S-VISSR (improved), DCS, SEM
FY-2H	2015	Expected ≥ 2018	123.5E	approved	S-VISSR (improved), DCS, SEM

FY-2E

FY-2E was launched on 23 December 2009 as the substitute for FY-2C and currently located at 123.5E as of September 20, 2009.

FY-2D

FY-2D, with identical capability of FY-2C, was launched on November 15, 2006. It was positioned at 86.5E as on-orbit storage. FY-2D observation was switched on in June 2007. Together with the FY-2C at 105E, they form a dual satellite constellation. Alternatively the two satellites observe to acquire an image every 15 minutes during rainy season from June-September, and every 30 minutes from October-May.

FY-2C was launched on 19 October 2004 and stationed at 105E. It is the primary operational satellite carrying S-VISSR of 5 channels (see table. 2). The satellite, which is designed with 3 years life time, currently is active. As the remaining propellant onboard is not enough for station keeping operationally, FY-2C and FY-2E shall swap position, and this process is scheduled to begin on 22 October 2009.

FY-2B

FY-2B was launched on 25 June 2000 and stationed at 105E. It started S-VISSR transmission and WEFAX on January 1, 2001. FY-2B has similar instrument of FY-2A.

On February 28, 2001, the transponder ceased working due to problem with the amplifier of the up-converter. Later it was found the amplifier had got sensitive to the variation of temperature. The transmission resumed on June 18, 2001 by carefully controlling the temperature, however, the EIRP (Effective Isotropic Radiated Power) was 8dBW below the normal level because of the problem.

The temperature controlling imposed extra pressure upon energy supply for the satellite operation. During the eclipse period of the satellite when energy was less supplied, S-VISSR data transmission had to be switched off to ensure sufficient energy for the safety management of the satellite.

After June 8, 2003, the VISSR was making observation only for the northern hemisphere. In September 2004, FY-2B was demissioned and moved to 123.5E. On August 31, 2006, FY-2B was de-orbited.

FY-2A

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

3 FY-2 Payloads

- **S-VISSR (Stretched Visible and Infrared Spin Scan Radiometer)** – The version for 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 100bps, 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
IFOV (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, 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 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



CGMS 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, 50°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.

6 Future Fengyun Geostationary Meteorological Satellite

FY-2F/G/H plan have been approved. Capability of FY-2F/G/H is identical with FY-2C/D. Launch of FY-2F is expected for 2011. The designed lifetime of FY-2F/G/H is 3 years.