CGMS-XXXIV
CMA-WP-04
Prepared by NSMC/CMA
Agenda Item: C.1

FY-3 POLAR-ORBITING PROGRAMME

Summary and purpose of paper

China is developing FY-3, a new series of polar-orbiting meteorological satellites. There will be 7 satellites in the series, starting from FY-3A and ending with FY-3G, and covering the period from 2007 to 2020. FY-3 will be operating in either morning or afternoon orbits. Main instruments include the Medium Resolution Spectral Imager(MERSI), THE Microwave Radiation Imager(MWRI), in addition to Visible and Infrared Scanning Radiometer(VISR). Sounding instruments include the Infrared Atmospheric Sounder (IRAS), the Microwave Temperature Sounder (MWTS), and Microwave Humidity Sounder(MWHS). Also, there will be a Total Ozone Unit and Solar Backscatter Ultraviolet Sounder(TOU/SBUS).

FY-3 Polar-Orbiting Programme

The ***FY-3*** polar-orbiting series is being developed and include 7 flight models. All satellites are 3-axis stabilised, in sun-synchronous orbit. The following table records the chronology of the FY-3 programme.

Chronology of the FY-3 programme

Satellite	Launch	End of service	Height	LST	Status (Sept 2006)	Instruments
FY-3A	2007	expected ≥ 2010	836 km	10.00	Being built	VIRR, MERSI, MWRI, IRAS, MWTS, MWHS, TOU/SBUS, SEM
FY-3B	2010	expected ≥ 2013	836 km	14.00	Planned	VIRR, MERSI, MWRI, IRAS, MWTS, MWHS, TOU/SBUS, SEM
FY-3C	2012	expected ≥ 2015	836 km	TBD	Planned	VIRR, MERSI, MWRI, IRAS, MWTS, MWHS, TOU/SBUS, SEM
FY-3D	2014	expected ≥ 2017	836 km	TBD	Planned	VIRR, MERSI, MWRI, IRAS, MWTS, MWHS, TOU/SBUS, SEM
FY-3E	2016	expected ≥ 2019	836 km	TBD	Planned	VIRR, MERSI, MWRI, IRAS, MWTS, MWHS, TOU/SBUS, SEM
FY-3F	2018	expected ≥ 2021	836 km	TBD	Planned	VIRR, MERSI, MWRI, IRAS, MWTS, MWHS, TOU/SBUS, SEM
FY-3G	2020	expected ≥ 2023	836 km	TBD	Planned	VIRR, MERSI, MWRI, IRAS, MWTS, MWHS, TOU/SBUS, SEM

Payload of FY-3

- ***VIRR (Visible and Infra Red Radiometer)***, 10-channel VIS/IR radiometer for multi-purpose imagery, resolution 1.1 km, swath 2800 km.
- ***MERSI (Medium Resolution Spectral Imager)***, 20-channel radiometer (19 in VIS/NIR/SWIR + one TIR at 10.0-12.5 μm) for ocean colour and vegetation indexes; resolution 250 m for 4 VIS/NIR and the TIR channel, 1 km for all other channels; swath 2800 km.
- ***MWRI (Micro-Wave Radiation Imager)***, 6-frequencies / 12 channels (all frequencies in double polarisation) for multi-purpose MW imagery. Conical-scanning radiometer, resolution 9.5 x 15 km at 90 GHz, 30 x 50 km at 19 GHz, swath 1400 km.
- ***IRAS (Infra Red Atmospheric Sounder)***, 26-channel IR radiometer (including one VIS) for temperature/humidity sounding, resolution 17 km, swath 2250 km.
- ***MWTS (Micro-Wave Temperature Sounder)***, 4-channel MW radiometer for nearly-all-weather temperature sounding, 54 GHz band, resolution 70 km, cross-track scanning, swath 2200 km.
- ***MWHS (Micro-Wave Humidity Sounder)***, 4-frequency / 5-channel (one frequency in double polarisation) MW radiometer for nearly-all-weather humidity sounding, 118 GHz band, resolution 15 km, cross-track scanning, swath 2700 km.

- ***TOU/SBUS (Total Ozone Unit and Solar Backscatter Ultraviolet Sounder)***, a suite of two UV spectro-radiometers, one (TOU) with 6 channels in the 308-360 nm range, resolution 50 km, swath 3000 km, for total ozone; the other one (SBUS) with 12 channels in the range 252-340 nm, resolution 200 km, nadir viewing, for ozone profile.
- ***SEM (Space Environment Monitoring)*** for *in situ* observation of charged particles in solar wind.

Data transmission from FY-3

The data rate of the MERSI instrument requires moving to X-band, both for global data recovery and for full information real-time transmission. Global data stored on board are transmitted as:

- ***Delayed Picture Transmission (DPT)***: frequency 8146 MHz, bandwidth 149 MHz, data rate 93 Mbps.

Direct read-out is provided according to two systems:

- ***MPT (Medium-resolution Picture Transmission)***, for full information in X-band. Main features:
  - frequency: 7775 MHz; bandwidth: 45 MHz; polarisation: right hand circular
  - antenna diameter ~ 3 m, G/T ~ 21.4 dB/K, data rate 18.7 Mbps;
- ***AHRPT (Advanced High Resolution Picture Transmission)*** for selected information in S-band. Main features:
  - frequency: in the range 1704.5 MHz; bandwidth: 6.8 MHz; polarisation: right hand circular
  - antenna diameter ~ 3 m, G/T ~ 6.8 dB/K, data rate 4.2 Mbps.

Annex: CMA Update for Table 4:

Table 4: Future Polar-Orbiting Satellites Coordinated Within CGMS
(as of 01 October 2006)

Orbit type (equatorial crossing times)	Future additional Satellites	Operator	Planned launch date	Other information
Sun-synchr. "Morning" (6:00 – 12:00) (18:00 – 24:00)	METOP-2	EUMETSAT	10-12/2005	(827 km) (9:30) AHRPT
	METOP-1	EUMETSAT	2010	(827 km) (9:30) AHRPT
	METOP-3	EUMETSAT	2015	(827 km) (9:30) AHRPT
	FY-3A	China/CMA	2007	(836 km) (10:00) AHRPT/MPT
	FY-3B	China/CMA	2009	(836 km) (14:00) AHRPT/MPT
	METEOR 3M-N1	Russia	2005	(10:20) AHRPT
	METEOR 3M-N2	Russia	2008	(10:20) or (16:30) AHRPT
	DMSP S-16	USA/NOAA	09/2003	(19:54 A) (SSMI/S)
	DMSP S-18	USA/NOAA	10/2006	(SSMI/S)
	NPP – NPOESS Preparatory Project	USA/NOAA/ NASA	10/2006	(833 km) (10:30 D) (VIIRS, CrIS, ATMS, OMPS) HRD
	NPOESS-1	USA/NOAA	11/2009	(833 km) (9:30 D) LRD (AHRPT) HRD
	NPOESS-4	USA/NOAA	11/2015	(833 km) (9:30 D) LRD (AHRPT) HRD
Sun-synchr. "Afternoon" (12:00 – 16:00) (00:00 – 04:00)	NOAA-N	USA/NOAA	12/2004	(14:00)
	NOAA-N'	USA/NOAA	2008 (TBC)	(14:00)
	NPOESS-2	USA/NOAA	06/2011	(833 km) (13:30 A) LRD (AHRPT)
	NPOESS-5	USA/NOAA	01/2018	(833 km) (13:30 A) LRD (AHRPT) HRD
Sun-synchr. "Early morning" (4:00 - 6:00) (16:00 – 18:00)	DMSP-S17	USA/NOAA	10/2004	(SSMI/S)
	DMSP-S19	USA/NOAA	10/2008	(SSMI/S)
	DMSP-S20	USA/NOAA	10/2010	(SSMI/S)
	NPOESS-3	USA/NOAA	03/2013	(833 km) (5:30 D) LRD (AHRPT) HRD
	NPOESS-6	USA/NOAA	~2019	(833 km) (5:30 D) LRD (AHRPT) HRD

Annex-2: CMA Update for Table 7

Table 7: Polar-orbiting satellite equator crossing times
(as of 01 October 2006)

Satellite	Service	Start	EOL	Eq. Cross-time	Freq(MHz)	BW MHz	Data rate (Mb/s)
:	:	:	:	:	:	:	:
:	:	:	:	;	:	:	:
NOAA-N’	GAC/LAC	2008	2012	1400	1698/1702.5/1707	5.32	2.66
FY-1D	CHRPT	2002	2004	0650	1704.5	6.8	4.2
FY-3A	AHRPT	2007	2010	1000-1020	1704.5	6.8	4.2
FY-3B	AHRPT	2009	2012	1340-1400	1704.5	6.8	4.2
FY-3C	AHRPT	2011	2014	TBD	1704.5	6.8	4.2
FY-3D	AHRPT	2011	2014	TBD	1704.5	6.8	4.2
FY-3E	AHRPT	2014	2017	TBD	1704.5	6.8	4.2
FY-3F	AHRPT	2014	2017	TBD	1704.5	6.8	4.2
FY-3G	AHRPT	2017	2020	TBD	1704.5	6.8	4.2
FY-3H	AHRPT	2017	2020	TBD	1704.5	6.8	4.2
FY-3A	MPT	2007	2010	1010	7775	45	18.7
FY-3B	MPT	2009	2012	1340-1400	7775	45	18.7
FY-3C	MPT	2011	2014	TBD	7775	45	18.7
FY-3D	MPT	2011	2014	TBD	7775	45	18.7
FY-3E	MPT	2014	2017	TBD	7775	45	18.7
FY-3F	MPT	2014	2017	TBD	7775	45	18.7
FY-3G	MPT	2017	2020	TBD	7775	45	18.7
FY-3H	MPT	2017	2020	TBD	7775	45	18.7
FY-3A	DPT	2007	2010	1000-1020	8145	149	93
FY-3B	DPT	2009	2012	1340-1400	8145	149	93
FY-3C	DPT	2011	2014	TBD	8145	149	93
FY-3D	DPT	2011	2014	TBD	8145	149	93
FY-3E	DPT	2014	2017	TBD	8145	149	93
FY-3F	DPT	2014	2017	TBD	8145	149	93
FY-3G	DPT	2017	2020	TBD	8145	149	93
FY-3H	DPT	2017	2020	TBD	8145	149	93
Meteor 3M	Raw	2001	2004	0915	466.5	3	0.080
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:	:	:	:	:	:	:	;