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FUTURE POLAR ORBITING METEOROLOGICAL SATELLITE OF CHINA

Summary and purpose of paper

FY-1D, the fourth satellite of Chinese first generation polar orbiting Satellite will be launched in 2001. FY-3 is the second generation of Chinese polar orbiting meteorological satellite. This satellite series will be operated during 2004 to 2018 according to the plan. This paper describes the plan, instrumentation, progress and future consideration for FY-3 series.

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1. The plan for FY-1 D satellite

The fourth satellite of the first generation of Chinese polar orbiting satellite, FY-1D is scheduled to be launched in 2001. All the characteristics of FY-1D are the same as those of FY-1C, no any changes.

2. The plan for FY-3 satellite series

The plan for developing China's second generation of polar orbiting meteorological satellite FY-3 series was put on agenda a few years ago. Right now, the first two satellites of the series and on-board instruments are being designed and manufactured. According to current plan, the FY-3 series will take a two-phase strategy to develop.

Phase-I (2004-2008): Two satellites will be manufactured with limited sounding capabilities. These first two satellites (FY-3A&B) are defined as experimental satellites, mainly for test of new instruments.

3. Mission of development of FY-3 series

The main mission objectives of FY-3 include:

- To provide global sounding of 3-dimensional atmospheric thermal and moisture structures, cloud and precipitation parameters, in order to support global numerical weather prediction.
- To provide global imagery to monitor large-scale meteorological and/or hydrological disasters and biosphere and environment anomaly.
- To derive important geophysical parameters to support research on global and regional climate change.
- To collect and relay important data.

4. Payloads onboard FY-3A and FY-3B

To achieve above-mentioned objectives, a core meteorological payload with the following main instruments are considered:

4.1 The Imaging Mission Payloads:

- Visible and Infrared Radiometer (VIRR)

This is a copy of the Multi-channel Visible and Infrared Scanning Radiometer (MVISR with 10 channels) inherited from FY-1C/D satellites. For the sake of operational continuity and risk reduction, this instrument will remain the same as MVISR of FY-1 C and D.

- Moderate Resolution Visible and Infrared Imager (MODI).

With reference to MODIS on-board EOS satellite series, this instrument of the first two FY-3 experimental satellites will have 20 channels located mainly at VIS and NIR region and be complementary to instrument VIRR that has important IR channels.

- Microwave Radiation Imager (MWRI)

This is a conical scanning microwave imager at 6 frequency points with 12 channels. This sensor measures thermal microwave radiation from land and ocean surfaces, as well as being sensitive to various forms of water and moisture in the atmosphere, clouds and surfaces. For microwave band, the wavelengths are much longer on the electromagnetic spectrum compared with visible and infrared and at some channels the wavelengths can be longer than one millimeter. At these channels the radiation can penetrate clouds, and provides forecasters with an all weather measurement capability. At higher frequency channels, the scattering signatures from the cloud and precipitation are also good indicators for detecting rainfall.

4.2 The Sounding Mission Payloads

- Infrared Atmospheric Sounder (IRAS)

This is the primary sounder for FY-3A and FY-3B. It is a HIRS/3-like instrument. The main system characteristics are:

  - Optical FOV 0.97 degrees, which makes the ground IFOV of 14 km in diameter
  - There are 26 channels in total. The first 20 channels are almost the same as HIRS/3. The rest six channels will enable IRAS to have the capability of measuring aerosols, stratosphere temperature, carbon dioxide content and cirrus.

The major specifications of IRAS are shown in Table 1.

Table 1
Major specifications of IRAS

Channel	Central wavelength (μm)	Half-power Bandwidth (cm^{-1})	Main absorber	Max. scene temperature •K•	Contribution Peak(hpa)	NEDN Specification	Main Purpose
1	14.95	3	CO_2	280	30	3.0	T(p)
2	14.71	10	CO_2	265	60	0.67	T(p)
3	14.49	12	CO_2	240	100	0.50	T(p)
4	14.22	16	CO_2	250	400	0.31	T(p)
5	13.97	16	CO_2	265	600	0.21	T(p)
6	13.64	16	CO_2/H_2O	280	800	0.24	T(p)
7	13.35	16	CO_2/H_2O	290	900	0.20	T(p)
8	11.11	35	Window	330	surface	0.10	Surface
9	9.71	25	O_3	270	25	0.15	Total ozone
10	8.16	25	H_2O	290	900	0.15	Water vapor
11	7.33	40	H_2O	275	700	0.20	Water vapor
12	6.52	80	H_2O	265	500	0.20	Water vapor
13	4.57	23	N_2O	300	1000	0.006	T(p)
14	4.52	23	N_2O	290	950	0.003	T(p)
15	4.47	23	CO_2/N_2O	280	700	0.004	T(p)
16	4.40	23	CO_2/N_2O	265	400	0.004	T(p)
17	4.20	23	N_2O	280	15	0.002	T(p)
18	4.00	35	Window	340	surface	0.002	Surface T
19	3.76	100	Window	340	surface	0.001	Surface T
20	0.69	1000	Window	100%	surface	0.10%A	Cloud Detect
21	14.8	3	CO_2	280	5	3.00	High Level T
22	0.659	TBD	Window	VIS	surface	0.003	CO_2/
23	0.885	TBD	Window	NIR	surface	TBD	Aerosol
24	0.94	TBD	H_2O	NIR	surface	TBD	Cirrus
25	1.24	TBD	Window	NIR	surface	TBD	Cirrus
26	1.64	TBD	Window	NIR	surface	TBD	Cirrus

- Microwave Atmospheric Sounder (MWAS)

This is an 8-channel passive scanning microwave sounder with the purpose of temperature sounding in cloudy area. There are four channels around 50 GHz and another four channels located at 19.35, 23.9, 31.0 and 89.0 GHz. Table 2 shows the major specifications of MWAS.

Table 2
Major specifications of MWAS

Ch.	Frequency (GHz)	Absorber	Band width (MHz)	NEDT (K)	Calibration Accuracy (K)	Resolution (Nadir, km)
1	19.35	Window	220	0.3	1.5	100
2	23.90	H_2O	250	0.3	1.5	100
3	31.00	Window	600	0.25	1.5	100
4	50.31	Window	220	0.3	1.0	100
5	53.74	O_2	220	0.3	1.0	100
6	54.96	O_2	220	0.3	1.0	100
7	57.95	O_2	220	0.3	1.0	100
8	89.00	Window	6000	0.8	1.5	50

- Total Ozone Mapper and Ozone Profiler (TOM/OP)

These two instruments are new sensors to be developed for FY-3 to measure ozone in the earth’s atmosphere. TOM is mapped by a 6-channel spectrometer with the wavelength ranging from 308nm to 360nm, resolution of 50km at the nadir. The profiler is a 12-channel spectrograph with the wavelength extending from 252nm to 380nm. The spatial resolution of OP is around 200 km at Nadir.