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DEVELOPMENT OF FY-3A METEOROLOGICAL SATELLITE

Summary and purpose of paper

FY-3s are the second generation of China's polar orbiting meteorological satellites. This satellite series will be operated during 2004 - 2018. This paper describes the mission and the status of development of FY-3A, the first satellite of the series.

DEVELOPMENT OF FY-3A METEOROLOGICAL SATELLITE

1. FY-3 Satellite Series

FY-3 is the second generation of Chinese polar orbiting meteorological satellite. It is a series including 7 satellites to be operated 2004-2018. The first two satellites FY-3A and FY-3B and the on-board instruments are being designed and manufactured.

2. Mission of FY-3 Series

The main mission objectives of FY-3 include:

- To provide global 3-dimensional atmospheric thermal and moisture structures, cloud and precipitation parameters, in order to support global numerical weather prediction.
- To provide global imagery for monitoring large-scale meteorological and hydrological disasters and biosphere and environment anomaly.
- To derive geophysical parameters to support research activities in study global and regional climate change.
- To collect and relay observation data.

3. Payloads onboard FY-3A

The following primary instruments are considered as core meteorological payload:

3.1 The Imaging Mission Payload:

1) 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 basically remain the same as MVISR of FY-1 C and D.

2) Moderate Resolution Visible and Infrared Imager (MODI).

With reference to MODIS on-board EOS satellite series, this instrument on the FY-3A will have 20 channels located mainly at VIS and near IR spectral region and be complementary to VIRR's IR channels.

3) 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.

3.2 The Sounding Mission Payload

1) Infrared Atmospheric Sounder (IRAS)

This is the primary sounder for FY-3A. The main 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 similar to HIRS/3 of NOAA. The rest six channels are aimed to measure aerosol, carbon dioxide content and cirrus, etc..

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 (specified)	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

2) Microwave Atmospheric Sounder (MWAS)

This is an 8-channel passive scanning microwave sounder for improving temperature sounding in cloud-covered 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

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

TOM is a 6-channel spectrometer whose wavelength ranges from 308nm to 360nm, resolution 50km at the nadir. The profiler is a 12-channel spectrograph with the wavelength locating from 252nm to 380nm. The spatial resolution of OP is around 200 km at Nadir.

4. The Current Status of FY-3A Development

Design schemes for all subsystems of FY-3A, including fabric subsystem, attitude control subsystem, TT&C subsystem, OBDH, energy subsystem, thermal control subsystem, data transmission subsystem

and payload have passed examination and evaluation phase. Prototypes in phase B are being designed and manufactured to prove the design schemes, and to prepare for the electrical interface matching experiments among all subsystems at the same time.

The mock-up of FY-3A has been completed on the whole.

The dynamic load satellite of FY-3A is being manufactured, relevant experiments will be completed at the end of 2001.

The electrical interface experiments among all subsystems of FY-3A will be achieved this year.