CMA report on the current and future satellite systems

Presented to CGMS-43 plenary session, agenda item [D.1]

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Overview - Planning of CMA satellite systems by year 2020

- 2010FY-3B (R&D)
- 2012FY-2F(Op)
- 2013FY-3C(Op)
- 2014FY-2G(Op)
- 2015FY-3D(Op)
- 2016FY-2H(Op)
- 2016FY-4A (R&D)
- 2017 FY-3E(Op)
- 2018FY-4B (Op)
- 2019FY-3F(Op)
- 2020FY-4C(Op)
- 2020FY-RM(Op)
- 2021 FY-3G(Op)
Overview - Planning of CMA satellite systems by year 2020

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- 2019FY-3F(Op)
- 2020FY-4C(Op)
- 2020FY-RM(Op)
- 2021 FY-3G(Op)

Coordination Group for Meteorological Satellites - CGMS

CGMS-43, May 18-22, Boulder, Colorado • USA
CURRENT CMA GEO SATELLITES

For CMA GEO satellite system. 105E is primary position and 86.5E secondary.
CURRENT CMA GEO SATELLITES

For CMA GEO satellite system. 105E is primary position and 86.5E secondary.

- **FY-2D**: Operational
- **FY-2E**: Operational
- **FY-2F**: Orbit storage or partially Operational
- **FY-2G**: Orbit storage or partially Operational

Position:
- 86.5E
- 99.5E
- 105E
- 112.5E
- 123.5E
CURRENT CMA GEO SATELLITES

For CMA GEO satellite system. 105E is primary position and 86.5E secondary.

- 86.5E FY-2E
- 99.5E
- 105E FY-2G
- 112.5E FY-2F
- 123.5E FY-2D

Legend:
- Green: Operational
- Red: Orbit storage or partially Operational
- Gray: Long-term observation records
Coordination Group for Meteorological Satellites

FY-2E  FY-2G  FY-2F  FY-2D
<table>
<thead>
<tr>
<th>NEΔT</th>
<th>FY-2G</th>
<th>FY-2F</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>IR1(10.8μm)</td>
<td>0.10K@300K</td>
<td>0.11K@300K</td>
</tr>
<tr>
<td>IR2(12.0μm)</td>
<td>0.12K@300K</td>
<td>0.13K@300K</td>
</tr>
<tr>
<td>IR3(6.95μm)</td>
<td>0.12K@260K</td>
<td>0.11K@260K</td>
</tr>
<tr>
<td>IR4(3.75μm)</td>
<td>0.26K@300K</td>
<td>0.26K@300K</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Channel</th>
<th>FY-2G Stray light level energy (compare with FY-2F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IR1</td>
<td>decrease 50%~60%</td>
</tr>
<tr>
<td>IR2</td>
<td>decrease 60%~70%</td>
</tr>
<tr>
<td>IR3</td>
<td>decrease 50%~60%</td>
</tr>
<tr>
<td>IR4</td>
<td>decrease 50%</td>
</tr>
</tbody>
</table>
Post Lunch test: using GISCS Verify the FY-2G Radiometric Performance Cross check of MTSAT/FengYun shows the calibration improvements

DCC region, dB<T<-1.0K@200K
FY-2G Products Validation

Systematic bias 1.2W/m²
FY-2G Regional Rapid Scan

2015.4.27 16:00-17:57  3 minute interval
FUTURE CMA GEO SATELLITES: FY-4

Spacecraft:

1. Launch Weight: approx 5300kg
2. Stabilization: Three-axis
3. Attitude accuracy: 3"
4. Bus: 1553B+Spacewire
5. Raw data transmission: X band
6. Output power: >= 3200W
7. Design life: over 7 years

**GIIRS**: Geo. Interferometric Infrared Sounder
**AGRI**: Advanced Geosynchronous Radiation Imager
**LMI**: Lightning Mapping Imager
**SEP**: Space Environment Package
FY-4 Ground System Developing Schedule

PrePhase:
End user requirement analysis  2006-2009
Instrument requirement  2006-2009

Phase A: Science(Algorithm Development)
Product requirement analysis & tradeoff study  2008-2011
Algorithm Development  2009-2013

Phase B:
R&D system design  2011-2013
R&D system integration & test  2012-2014

Phase C: Engineering (System Integration)
Operational system Design  2013-2015
Operational system integration & test  2014-2015
Satellite Launch: On orbit test  2016
### CURRENT CMA LEO SATELLITES

<table>
<thead>
<tr>
<th>Year</th>
<th>Satellite</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>88</td>
<td>FY-1A</td>
<td>R &amp; D Experimental</td>
</tr>
<tr>
<td>89</td>
<td>FY-1B</td>
<td>Partially Operational</td>
</tr>
<tr>
<td>90</td>
<td>FY-1C</td>
<td>Operational</td>
</tr>
<tr>
<td>91</td>
<td>FY-1D</td>
<td>Extended service</td>
</tr>
<tr>
<td>99</td>
<td>FY-3A</td>
<td>Operational</td>
</tr>
<tr>
<td>100</td>
<td>FY-3B</td>
<td>Operational</td>
</tr>
<tr>
<td>101</td>
<td>FY-3C</td>
<td>Operational</td>
</tr>
<tr>
<td>102</td>
<td>FY-3D</td>
<td>Operational</td>
</tr>
</tbody>
</table>
ECMWF starts using Chinese satellite data

29 September 2014

On 24 September 2014, ECMWF actively used Chinese satellite data for the first time in the operational forecasting system. This marks a milestone in ECMWF’s fruitful cooperation with the Chinese Meteorological Administration (CMA) and the Chinese Institute of Atmospheric Physics (IAP) in the area of characterisation and use of Chinese satellite data. China is expected to play a leading role in providing meteorological satellite data in the near future, alongside Europe and the US, currently the main providers of satellite sounding data used operationally. Activating the first Chinese satellite data in the ECMWF system is therefore an important step towards a much greater use of Chinese satellite data in the future.

The new data originates from the Microwave Humidity Sounder (MWHS) on-board the Fengyun-3B (FY-3B) satellite. It contributes to an improved analysis of mid- to upper-tropospheric humidity, and adds robustness to the satellite observing system. Although FY-3B is an experimental satellite, the data has been found to be of sufficient quality to further improve ECMWF’s atmospheric analysis. Keyi Chen, visiting scientist from IAP, explains: “Our work has shown the data is of reliable quality, and it has an impact comparable to similar European or US satellite instruments that have been used operationally for a long time.”

The development is the result of a very constructive partnership with CMA and IAP to characterise Chinese satellite data. During regular visits to ECMWF, Qifeng Lu from CMA has significantly advanced our understanding of the performance of the instruments on the experimental FY-3A and B satellites. This work continues with the analysis of data from the latest Chinese satellite, FY-3C, performed together with CMA, ECMWF, and the UK Met Office. FY-3C is China’s first operational meteorological polar-orbiting satellite, and it carries much improved instruments compared to the earlier FY-3A and B satellites. It was launched in September last year and Qifeng Lu is currently visiting ECMWF again. He notes: “The cooperation between CMA, ECMWF and the Met Office is very important to help us evaluate the data and improve its performance. This is also of benefit to the wider community. We very much hope that more Chinese data will be actively assimilated at ECMWF and elsewhere in the future.”
FY-3 Ready European Direct Broadcast stations
FY-3 IPPS SOFTWARE PACKAGE

- Version update for MWHS support
- Support L0 X-Band processing

Before Update 2015

After Update 2015
FY-3 GNOS status

Validation

Exhibiting good agreement with ECMWF in terms of bias
Reconfirming the characteristic of non-bias of radio occultation
The most excellent sounding height of GNOS is from 5 to 30 kilometers, standard deviation is within 1%

Forecast Impact Experiment

GNOS data has an neutral and positive impacts on GRAPES analysis and forecast skill.

Courtesy of Dr. Liao mi\&Liu yan CMA
FY-3 02 batch to 03 batch Transition

3 yrs  5 yrs  8 yrs  Designing lifetime

FY-3(1st batch)
- FY-3A
- FY-3B
- FY-3C

FY-3(2nd batch)
- FY-3D
- FY-3E
- FY-3F
- FY-3G

FY-3(3rd batch)
- FY-3R

Years:
- FY-1C/1D: 2008
- FY-3A: 2010
- FY-3B: 2012
- FY-3C: 2014
- FY-3D: 2016
- FY-3E: 2018
- FY-3F: 2020
- FY-3G: 2022
- FY-3R: 2024

Color Coding:
- AM: Green
- PM: Blue
- EM: Yellow
- Rainfall: Purple
Outlook of Future CMA LEO Constellation

Sun-Synchronous Polar-orbiting
- FY-3E EM 2018
- FY-3F AM 2019
- FY-3G PM 2021

Non-Sun-Synchronous
- FY-3 RM 2020
Thank you for your attention