Another step towards MTG

Meteosat Third Generation (MTG) took another step towards full approval with a EUMETSAT special Council on 26 March 2010.

The special Council unanimously approved the MTG End-User Requirements Document, which defines not only the deliverables to the users, but also the duration of the operational service - at least 20 years for the imagery mission and at least 15 and a half years for the sounding mission - the number of satellites, and the satellites in-orbit lifetime. The special Council also voted in favour of the MTG Programme Proposal and Programme Resolution, with two out of the 24 EUMETSAT Member States reserving their votes. These two countries are now expected to indicate their position in the coming months. The EUMETSAT Director-General, Dr. Lars Prahm, said, “During the special Council, Member States expressed support for the MTG Programme Resolution and Programme Proposal and I now look forward to all EUMETSAT Member States agreeing to them.” Once they have, the process of committing the required funds at national level will start for EUMETSAT Member States, which is expected to last until later this year. This approval will set the stage for MTG system development and operations. The launch of the first MTG satellite is currently planned at the end of 2016.

MTG Phase B (preliminary design) activities at EUMETSAT, covered under the MTG Preparatory Programme and aimed at defining the baseline MTG system for detailed design and production, have been underway since the end of 2008 and are expected to be completed in late 2010. The space segment includes four MTG-I imaging and two MTG-S sounding satellites. MTG-I will carry a Flexible Combined Imager and a Lightening Imager and MTG-S an Infrared Sounder and Ultraviolet Visible Near-infrared Sounder provided by the European Space Agency (ESA) under the Global Monitoring for Environment and Security (GMES) Sentinel-4 programme.

The EUMETSAT MTG programme includes overall system activities, development of the ground segment, procurement of the four recurrent satellites - three MTG-Is and one additional MTG-S - as well as the six launches of the satellites and in-orbit operations. The first MTG-I and MTG-S prototypes will be developed by ESA as part of its MTG programme. The EUMETSAT programme also includes the Satellite Application Facility network and the EUMETSAT financial contribution to the ESA programme.
Ensuring global sea level rise monitoring

With the approval by 19 Member States of the transatlantic Jason-3 ocean altimetry satellite programme on 1 February, the programme entered into force and industrial activities have begun.

**Artists impression of Jason-2**

The EUMETSAT Council meeting in Rome on 21-22 June is expected to approve the memorandum of understanding for signing by EUMETSAT, CNES, and the US National Oceanic and Atmospheric Administration (NOAA) and National Aeronautics and Space Administration (NASA). On 12 February, the Centre National d’Etudes Spatiales (CNES), the French space agency, which is coordinating the programme at the technical level, signed the main contract with Thales Alenia Space, which will build the Jason-3 satellite and altimeter.

MTG and Jason-3 would not be possible without EUMETSAT’s European and transatlantic partners. The European Space Agency (ESA) will supervise the development of the first two MTG satellites and Jason-3 is a continuation of the successful cooperation with the Centre National d’Etudes Spatiales (CNES), the French space agency, and the US National Oceanic and Atmospheric Administration (NOAA) on Jason-2 and the Ocean Surface Topography Mission.

MTG will be only one vehicle for EUMETSAT’s cooperation with the European Union on Global Monitoring for Environment and Security (GMES), carrying the GMES Sentinel-4 instrument. In addition, EUMETSAT will operate GMES Sentinel-3 on behalf of ESA and the next generation EUMETSAT Polar System will carry Sentinel-5. With these missions, EUMETSAT will be responsible for the operations of the marine and atmospheric composition-related GMES missions.

In addition to its European and transatlantic partnerships, EUMETSAT is developing important cooperation with its Chinese, Indian and Japanese partners focusing on sharing satellite data. I will further develop this cooperation during my visit to the Shanghai Expo this month and later this year at the Group on Earth Observations ministerial in Beijing and finally the Coordination Group for Meteorological Satellites in New Delhi.

EUMETSAT looks forward to continuing its fruitful global cooperation over the coming years and decades.

Dr. Lars Prahm
Director-General of EUMETSAT

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**Cooperation is the basis for EUMETSAT’s activities, both among its Member and Cooperating States and with its international partners. Approval of the Jason-3 programme at the end of January was a show of solidarity among Member States which I hope to see repeated when they give the final go-ahead to the Meteosat Third Generation (MTG) programme by the end of this year.**

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The EUMETSAT Director-General, Dr. Lars Prahm, said, “With Jason-3, EUMETSAT will reinforce its role in meteorology, operational oceanography and the continuation of global sea level rise monitoring.” He thanked EUMETSAT Member States for the solidarity they showed by agreeing to contribute a total of €63.6 million (at 2009 economic conditions) to the €252-million programme cost of Jason-3.

Jason-2 already supplies the much-needed data continuity essential for measuring the sea level trend. Jason-3 will continue this mission, ensuring the measurement of rising sea levels carried out by Jason-2, Jason-1 and TOPEX/Poseidon over the last 18 years. These high-accuracy measurements show a global sea level rise over the last 15 years averaging 3.3 millimetres per year, a key indicator of climate change (see feature in this issue on this and other ways EUMETSAT contributes to climate monitoring).

The Jason-3 programme is led by EUMETSAT and NOAA as operational agencies. NOAA has secured funding for Jason-3 and has given the programme top priority. In addition, CNES is making a significant in-kind contribution to the programme, including making available the Jason-3 Proteus satellite platform, CNES facilities and associated human resources.

On 12 February, the Centre National d’Etudes Spatiales (CNES), the French space agency, which is coordinating the programme at the technical level, signed the main contract with Thales Alenia Space, which will build the Jason-3 satellite and altimeter.

NASA, in conjunction with the three other partners, will support science team activities. The US contribution to Jason-3 includes the satellite launch, planned for 2013, in addition to providing instruments and support to operations.

In addition to Jason-3, EUMETSAT is discussing involvement in other ocean altimetry programmes. Under the Global Monitoring for Environment and Security (GMES) programme, the organisation will operate the Sentinel-3 mission, serving the marine user community with near-real-time and off-line products. EUMETSAT’s contribution to the Indian Space Research Organisation (ISRO) and CNES Satellite with ARGos and ALtimeter in Ka-band (SARAL) programme will focus mainly on near-real-time processing of SARAL data and the dissemination of these processed data to end users.

Cooperation with China’s State Oceanic Administration (SOA) could include exchanging data and scientific cooperation on calibration/validation and processing of scatterometer data. EUMETSAT is interested in the scatterometer and altimetry data of China’s future HY-2 and -3 satellites.
AMESD improves African data access

As part of EUMETSAT’s strategy to support National Meteorological Services in developing countries, particularly in Africa, to make better use of satellite services, data and products, EUMETCast stations are being upgraded in sub-Saharan African countries. At the beginning of the year, the African Monitoring of the Environment for Sustainable Development (AMESD) project initiated the replacement of the Preparation for the Use of Meteosat Second Generation (MSG) in Africa (PUMA) stations first installed in 2002.

This activity, which was launched at the African Union Commission premises in Addis Ababa, Ethiopia, in January, will ensure the sustainable and long-term access to EUMETSAT data by the meteorological community in Africa, allowing it to fully benefit from the extensive coverage of Africa by EUMETSAT satellites. Africa takes up some 28 per cent of any full disk image produced by MSG, compared to only 4.5 per cent by Europe (oceans and seas account for 62 per cent and Asia and South America for the remaining 5.5 per cent).

All PUMA PCs are being replaced and software packages for the visualisation and interpretation of the data are also being upgraded. New training sessions for both station operators and station administrators are being provided this year and next, in close coordination with EUMETSAT’s general training activities in Africa. The upgrade of the 52 previously deployed PUMA stations at National Meteorological Services in sub-Saharan Africa and regional institutions will then secure operational access to EUMETSAT data and improve data processing for various meteorological applications.

In addition, 47 new EUMETCast stations called AMESD stations are being installed in the environment, agriculture or water management ministry of each sub-Saharan African country, providing them with effective access to environmental data and products, including from AMESD, relevant to their activities related to the management of the environment. Over 100 stations will be deployed through the AMESD project.

EUMETCast is the GEONETCast component for Europe and Africa, so all sub-Saharan African countries will now have two operational stations to access various environmental data in real time from various data providers all over the world. These stations will provide users with key information on the state of the environment for sustainable development in the African continent.

AMESD is funded by the European Union under the European Development Fund programme. It is being implemented by the African Union Commission in Addis Ababa, Ethiopia. EUMETSAT has provided technical support to the African Union Commission for the implementation of AMESD.

Reader survey

The IMAGE team is researching the possibility of publishing the newsletter as an online e-zine rather than continuing its current printed/PDF format. Not only will this make the content more accessible, it will also allow EUMETSAT to publish articles and features on a more regular basis. The input of readers of IMAGE is most valuable in making a decision on the future of the publication; your help is therefore greatly appreciated.

The survey can be found at: http://bit.ly/btxpKp
Climate monitoring applications

EUMETSAT contributes to the operational monitoring of the climate and the detection of global climatic changes. Data collected by instruments on board the organisation’s satellites are processed and archived in support of monitoring and research activities related to climate change.

Dr. Lars Prahm, the EUMETSAT Director-General, explains, “Satellites are ideal for monitoring climate because they provide constant, continuous observations over the long term which are needed for monitoring climate trends; global coverage for observing global climate change; and repeated observations of the globe with the same suite of instruments for measurement consistency.”

In addition, next-generation instruments provide data compatible with those collected by earlier generation instruments, thus providing continuity in measurements, he said.

Instruments on board EUMETSAT’s Meteosat geostationary satellites support climate monitoring and research activities. This will also be the case with the organisation’s Metop polar-orbiting satellite when they have been in service long enough to provide climate-relevant long-term data sets. Specifically, satellite instruments measure temperature, moisture, clouds, aerosol, winds, vegetation cover, atmospheric chemistry and the ozone layer, as well as a variety of other phenomena related to climate and environmental monitoring.

Meteosat satellites have been delivering climate-relevant parameters like sea surface temperatures and surface albedo since 1977. The second generation Meteosat-8 and -9 satellites over the meridian have much higher capabilities with temporal repeat cycles and twelve spectral bands, compared to only three spectral bands for the first
EUMETSAT’s ability to monitor climate. These new programmes take into account the specific requirements of climate monitoring with respect to calibration, characterization, continuity, consistency and sustainability set out by the Global Climate Observing System (GCOS) climate principles.

MTG will make even better geostationary measurements than its predecessors and their high temporal frequency will provide the capability to observe subsynoptic atmospheric and surface events, particularly precipitating cloud systems and to characterize the diurnal cycles of the atmospheric-surface system. Characterization of the annual as well as diurnal cycles is crucial to understanding the physical processes determining the status of the climate system and its potential changes.

Under the European Global Monitoring for Environment and Security (GMES) programme, EUMETSAT will operate the Sentinel-3 series of oceanographic satellites. The Sentinel-4 instruments on MTG and Sentinel-5 on Post-EPS which will monitor atmospheric composition constituents from geostationary and polar-orbiting platforms are planned to be included on related follow-on EUMETSAT missions. The Sentinel-4 sounding mission conducted by the Ultraviolet Visible Near-infrared instrument on board the MTG-S sounding satellites will cover Europe every hour taking measurements in three spectral bands between 305 and 775 nm with a resolution of around eight kilometres. Its primary data products will be ozone, nitrogen dioxide, sulphur dioxide, methane and aerosol optical depth. In addition, the MTG-S infrared sounder will provide information on ozone and carbon monoxide.

But as EUMETSAT’s Director of Operations, Mikael Rattenborg, points out, “It’s not enough to have a satellite in space” for climate monitoring. EUMETSAT’s Application Ground Segment, which includes the organisation’s Central Application Facilities in Darmstadt and its network of Satellite Application Facilities (SAFs) located in its Member States, continuously generates, on an operational basis, products of climate-relevant parameters which are stored by EUMETSAT’s Data Centre, the organisation’s archive services. These data products also include homogeneous long-term climate data sets - for example winds, radiation, clouds and precipitation from satellites generated through the reproprocessing activities of the Meteosat first and second generation satellites since 1989.

Dedicated activities of the SAF on Climate Monitoring (CM SAF) and climate products generated by other SAFs complement the data generation and processing at the Central Application Facilities. The CM SAF’s products focus on key aspects of the Earth’s atmospheric water and energy cycle, including cloud, radiation budget and atmospheric humidity budgets. Examples of climate products generated by other SAFs include sea ice concentration in the SAF on Ocean and Sea Ice, ozone observations at the SAF on Ozone and Atmospheric Chemistry Monitoring, and climate maps by the SAF on Global Navigation Satellite System (GNSS) Radio-occultation Atmospheric Sounder (GRAS) Meteorology.

Climate product generation through reproprocessing of archived data by EUMETSAT’s central facility and SAF network are the organisation’s main contribution to the implementation of the Global Network of Sustained Coordinated Processing of Environmental Satellite Data for Climate Monitoring (SCOPE-CM) initiated in the framework of the World Meteorological Organization. The main objective of the SCOPE-CM network is to provide high-quality long-term data sets of Essential Climate Variables using observations from space in coordination and through cooperation between the world’s leading operators of meteorological satellites.

The highest quality of satellite-based data records suitable for observing climate trends and changes requires dedicated and careful data analysis which usually involves several cycles of reproprocessing. It must be ensured that the observed trends are caused by the observed climate phenomena and not by the observation system, for example sensor ageing or drifting satellites. Data sets of direct satellite measurements like radiance and brightness temperatures that reach this type of quality after the best possible calibration and correction activities are considered Fundamental Climate Data Records (FCDRs), from which Thematic Climate Data Records (TCDRs) - geophysical parameters like temperature, humidity, ozone and vegetation - can be derived. EUMETSAT considers the generation of these FCDRs and TCDRs its main priority in support of climate monitoring.
Last winter was so cold in Central Europe that the Ijsselmeer almost completely froze over, a rare occurrence. The Koninklijk Nederlands Meteorologisch Instituut (KNMI), the Dutch weather service, reported that not only the eastern part of the IJsselmeer was covered with ice, but also the shallower south-western part, known the Markermeer. EUMETSAT’s Metop-A polar-orbiting satellite caught a glimpse through the clouds with its Advanced Very High Resolution Radiometer (AVHRR) on 15 February. The magenta colour in this RGB composite of AVHRR channels 01, 03 and 04 from the Swedish Meteorological and Hydrological Institute (SMHI) represents snow/ice.

User Platform

Satellite Archive rebranded EUMETSAT Data Centre

To better reflect the service it provides to the user community, EUMETSAT’s Satellite Archive has been rebranded the EUMETSAT Data Centre. An integral part of EUMETSAT’s operational infrastructure, the Data Centre is not only a secure store for all of the organisation’s satellite data and derived products, it also provides a full service infrastructure for accessing and retrieving the archived data.

The EUMETSAT Data Centre supports the data requirements of external users such as the National Meteorological Services, research organisations, universities and commercial companies. It also supports internal use such as scientific and reprocessing activities. Data retrieval is carried out in parallel to safely ingest the constant satellite data flow. In 2009, over 1 Petabyte was retrieved from the Data Centre in response to user ordering. The amount of data retrieved is now more than 10 times the amount of all the satellite data and products archived in the same time-span, a fact which clearly demonstrates that the Data Centre is more than a safe data store. To cope with the growing demand and new data streams from satellite missions planned in the future, the systems in the Data Centre are continually upgraded. The evolution of the Data Centre infrastructure is also of key importance for EUMETSAT as an agency supporting climate monitoring. The near future will see the integration of Data Centre Search and Ordering into the EO Portal, a project planned to be completed in 2010.

Meteosat-6 breaks in-orbit record

On 5 January 2010, Meteosat-6 set a new record for the duration of the operational life of a Meteosat satellite, exceeding the previous record set by Meteosat-5, which was re-orbited in 2007. Launched over 16 years ago, on 20 November 1993, Meteosat-6 continues to provide an important operational service, the retransmission of Data Collection Platform messages, and is also part of the Tsunami Warning System for the Indian Ocean area. Originally designed for a five-year lifetime duration, Meteosat-6 is now running low on fuel and will have to be re-orbited between the end of 2010 and the beginning of 2011. After that, all services for the Indian Ocean area will rely solely on Meteosat-7.

EO Portal launched

January saw the launch of the EUMETSAT Earth Observation (EO) Portal registration service for all near-real-time data services disseminated via EUMETCast, FTP over the Internet and direct dissemination. New users can consult the EO Portal tutorials, which walk them through all aspects of creating a new account and adding and managing subscriptions. Registered users can log in to update their user profile, modify service subscriptions, request decryption hardware and/or software and renew license agreements. The EO Portal registration service is the second milestone in the EUMETSAT EO Portal evolution, the first being the collections discovery service, known as the Product Navigator, available since November 2008. Future EO Portal milestones will offer users the capability to register and manage their archived data orders with the Data Centre and their subscriptions to the User Notification Service. When finalised, the EO Portal will offer the user community single sign-on access to all data services offered by EUMETSAT.

For further information, contact the User Service Helpdesk:

Tel: +49 6151 807 366/377
Fax: +49 6151 807 379
E-mail: ops@eumetsat.int
Website: www.eumetsat.int
Profile: Richard Kamlet

Farewell to Head of Finance

Richard Kamlet is retiring this year after working for EUMETSAT for nearly two decades. As Head of Finance over the last six years, he oversees the organisation’s accounts, financial planning and budget process.

Richard’s “37 years of hard work in finance” began as an internal auditor and then in accounting in the steel industry in his hometown of Strasbourg, France. He began working in the European space field in 1985, when he became Head of Accounting for the European Space Agency (ESA) European Space Research and Technology Centre (ESTEC) in Noordwijk, the Netherlands. Richard joined EUMETSAT in 1991 as Head of the Budget Section, “looking for new challenges after ESA as a specialist in accounting.”

“International standards like IPSAS are so important.”

He uses this experience to oversee the Finance Division’s core tasks: planning, budgeting, accounting, collecting the contributions of Member States, and investing the organisation’s funds wisely, earning “millions of euros in interest.” He adds that the Finance Division provides financial advice and services, including for the travel of EUMETSAT employees, “keeping in mind service excellence and the trust of the stakeholders and auditors”, which he points out are linked.

One of the projects Richard’s division is working on is the introduction of International Public Sector Accounting Standards (IPAS) at EUMETSAT. “IPAS is progressing very well,” he reports, “on schedule of the roadmap agreed by Council.” The project manager began her work in April 2009 and EUMETSAT employees were informed of the project during a General Assembly on 8 July 2009. Richard describes 2010 as a “crucial year”, with the finalization of the redesign of business processes at EUMETSAT by the end of July. He will no longer be at EUMETSAT in 2012, until when IPSAS will be implemented with the first annual accounts being IPSAS-compliant, followed by its finalisation in 2013. Based on his experience at ESA, Richard says EUMETSAT’s Finance Division is similar to that of other international organisations, which he points out are not bound to follow national rules. Furthermore, international organisations “have to take into account national differences in which the same word can have a different meaning,” Richard observes. “This is why international standards like IPSAS are so important.”

Richard has witnessed the Finance Division grow gradually from the six staff when he was recruited by EUMETSAT to 13 of eight different nationalities working there today. He values the mix of “old talent” of staff who have been in the division for many years and the “new blood” of recent recruits.

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Richard sees becoming Head of Finance as the highlight of his career. He names among his achievements working as part of the team which successfully implemented FAME, the introduction of SAP at EUMETSAT, and presenting documents to delegate bodies. The latter involved “defending my and my team’s work in front of a high-level international body and gaining the trust of delegations.”

Richard plans to spend the first six months of his well-deserved retirement “doing nothing, especially avoiding planning.” After that, he intends to review the situation, “starting planning again” and pursuing his hobbies.

Career path

- 2004: became Head of Finance at EUMETSAT
- 1991: joined EUMETSAT as Head of Budget
- 1987: became Head of Accounting Section of ESA/ESTEC
- 1985: joined ESA/ESTEC as Head of General Accounting Office
- 1981: became Head of General Accounting Service and Treasury of Laminoirs de Strasbourg
- 1978: joined Laminoirs de Strasbourg as Deputy Head of General Accounting Service and Treasury
- 1977: returned to Forges de Strasbourg as internal auditor
- 1976: began one year of military service
- 1973: joined Forges de Strasbourg as internal auditor

Private life

- married with three children, skiing, tennis, jogging
Global meteorological satellite update

<table>
<thead>
<tr>
<th>Europe</th>
<th>Satellite</th>
<th>Launch date</th>
<th>Orbit type</th>
<th>Additional information</th>
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<tr>
<td></td>
<td>Meteosat-6</td>
<td>20 Nov 1995</td>
<td>GEO 67.5°E</td>
<td>provides data collection platform acquisition support and the backup service for Meteosat-7</td>
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<td>Meteosat-7</td>
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<td>GEO 57.5°E</td>
<td>provides Indian Ocean Data Coverage services</td>
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<td>Meteosat-8</td>
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<td>GEO 9.5°E</td>
<td>provides the Rapid Scanning Service and the backup service for Meteosat-9</td>
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<td>21 Dec 2005</td>
<td>GEO 0°</td>
<td>provides the primary operational service</td>
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<td>MSG-3</td>
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<td>MSG-4</td>
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<td>GEO</td>
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<td>MTG-S-1 and -2</td>
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<td>Metop-A</td>
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<td>SSO mid-morning</td>
<td>primary satellite of the JPSS</td>
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<td>Metop-B</td>
<td>2012</td>
<td>SSO mid-morning</td>
<td></td>
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<td>Metop-C</td>
<td>2016</td>
<td>SSO mid-morning</td>
<td></td>
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<td></td>
<td>Jason-2</td>
<td>30 Jun 2008</td>
<td>LEO 96° inclination</td>
<td></td>
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<td></td>
<td>Jason-3</td>
<td>mid-2013</td>
<td>LEO 96° inclination</td>
<td>result of NPOESS restructuring</td>
</tr>
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</table>

| USA          | GOES-11 (East)     | 3 May 2000      | GEO 135°W  |                                                                                       |
|              | GOES-12 (West)     | 23 Jul 2001     | GEO 60°W   |                                                                                       |
|              | GOES-13 (East)     | 15 Mar 2006     | GEO 75°    |                                                                                       |
|              | GOES-14            | 27 Jun 2009     | GEO 109°   | stored in orbit                                                                       |
|              | GOES-15            | 4 Mar 2010      | GEO 90°    |                                                                                       |
|              | GOES-R             | 2013            | GEO 135° or 75° W |                                                                                       |
|              | GOES-S             | 2016            | GEO 135° or 75° W |                                                                                       |
|              | NOAA-15            | 13 May 1998     | SSO early morning | secondary satellite for Metop-A                                                              |
|              | NOAA-16            | 21 Sep 2003     | SSO afternoon | secondary satellite for NOAA-18                                                                |
|              | NOAA-17            | 24 Jun 2002     | SSO mid-morning | secondary satellite for Metop-A                                                              |
|              | NOAA-18            | 20 May 2005     | SSO afternoon | backup spacecraft for NOAA-19                                                                  |
|              | NOAA-19            | 20 May 2005     | SSO afternoon | primary spacecraft of JPSS                                                                   |
|              | NPP                | late 2011       | SSO        |                                                                                       |
|              | JPSS               |                 | SSO        | result of NPOESS restructuring                                                             |

| Russia       | Meteor-N1          | 17 Sep 2009     | SSO morning | commissioning phase                                                                   |
|              | Meteor-N2          | 2010            | SSO morning |                                                                                       |
|              | Meteor-N3          | 2012            | SSO morning |                                                                                       |
|              | Electro-N1         | 2010/2011       | LEO 79°E   |                                                                                       |
|              | Electro-N2         | 2011            | LEO 4.0°E  |                                                                                       |
|              | Electro-N3         | 2013            | GEO        |                                                                                       |

| China        | Fengyun-1D         | 15 May 2002     | SSO early morning | primary polar-orbiting satellite                                                           |
|              | FY-2C              | 19 Oct 2004     | GEO 123.5°E | primary geostationary satellite                                                            |
|              | FY-2D              | 15 Nov 2006     | GEO 96.5°E  | backup for FY-2C                                                                         |
|              | FY-2E and -2G      | 22 Dec 2008     | GEO 109°E  |                                                                                       |
|              | FY-3A              | 27 May 2008     | SSO        | first of the second generation of Chinese polar-orbiting meteorological satellites       |
|              | FY-3B              | 2010            | SSO        |                                                                                       |
|              | FY-3C to -3G       | 2013-2021       | SSO        | planned for biorell launches in the 2013-2021 timeframe                                  |

| Japan        | MTSAT-1R           | 26 Feb 2005     | GEO 140°E  |                                                                                       |
|              | MTSAT-2            | 18 Feb 2006     | GEO 140°E  | backup for MTSAT-1R                                                                    |
|              | MTSAT follow-on    | 2014            | GEO 140°E  |                                                                                       |

| India        | KALPANA-1          | 12 Sep 2002     | GEO 74°E   | formerly METSAS India’s first exclusively meteorological satellite                     |
|              | INSAT-3A           | 10 Apr 2003     | GEO 93.5°E |                                                                                       |
|              | INSAT-3D           | 2010            | GEO 93.5°E | planned to have 19-channel sounder                                                      |
|              | OCEANSAT-1         | 26 May 1999     | LEO        |                                                                                       |
|              | OCEANSAT-2         | 23 Sep 2009     | LEO        |                                                                                       |
|              | SARAL              | 2011            | LEO        |                                                                                       |
|              | Megha-Tropiques    | 2010            | LEO        |                                                                                       |

| South Korea  | COMS                | 2010            | GEO 128.2°E |                                                                                       |
|              | COMS follow-on      | 2017            | GEO 128.2° or 116.2°E |                                                                                       |

More information on these events can be found on the EUMETSAT website: www.eumetsat.int