CGMS-XXXIV
WMO WP-38
Prepared by WMO
Agenda item: B.1, B.2, B.3
C.1, C.2, C.3

LIST OF SATELLITES CONTRIBUTING TO THE WMO SPACE-BASED GLOBAL OBSERVING SYSTEM

(Submitted by WMO)

Summary and Purpose of Document

The present document provides information collected and consolidated by WMO, namely with the support of the CBS/OPAG IOS Expert Team on Satellite Systems, on satellite launch dates and main orbital characteristics, as of October 2006.

The following 6 Tables are included:

- Current operational Low Earth Orbit satellites within the WMO GOS
- Current operational Geostationary satellites within the WMO GOS
- Current Research and Development satellites within the WMO GOS
- Future operational Low Earth Orbit satellites within the WMO GOS
- Future operational Geostationary satellites within the WMO GOS
- Future Research and Development satellites within the WMO GOS

Current Operational Low Earth Orbit Satellites within the WMO Global Observing System
Equator Crossing Time (if sun-synchronous orbit): A= ascending (Northward), D=descending (Southward)

Updated on 23 October 2006

Orbit type	Satellites (+operation mode) P=Pre-operational Op=operational B=back-up L=limited availability	Operator	Equator Crossing Time (ECT)	Mean Altitude	Launch date	Status
Sun-synchronous "Morning" orbit E.C.T. between (7:00 – 12:00) and (19:00 – 24:00)	NOAA-17 (Op)	USA/NAA	22:18(A)	810 km	6/02	Functional. AMSU-A1 Failed.
	DMSP-F16 (Op)	USA/NOAA	20:13 (A)		10/03	Defense satellite. SSMIS Data available to civilian users through NOAA.
	DMSP-F15 (B)	USA/NOAA	20:41 (A)	850 km	12/99	Defense satellite. SSMT2 non-functional. Data available to civilian users through NOAA.
	NOAA-14 (B)	USA/NOAA	21:34 (A)	845 km	12/94	Functional. AVHRR and SBUV degraded.
	FY-1D (Op)	China/CMA	20:20 (A)	866 km	5/02	Functional. CHRPT
	METOP-A	EUMETSAT	21:30 (A)	837 km	10/06	In commissioning
Sun-synchronous "Afternoon" (12:00 –17:00)	NOAA-18 (Op)	USA/NOAA	13:42 (A)	854 km	5/05	Functional. Noise on HIRS long wave channels
	NOAA-16 (B)	USA/NOAA	15:29 (A)	850 km	09/00	Functional, no APT. Intermittent problems with AVHRR.
Sun-synchronous "Early morning" (5:00 - 7:00) and (17:00 – 19:00)	DMSP-F13 (Op)	USA/NOAA	18:33 (A)	850 km	03/95	Defense satellite. On orbit 125 months – estimate 7 months of mission life remaining. Data available to civilian users through NOAA.
	DMSP-F14 (B)	USA/NOAA	18:36 (A)	852 km	04/97	Defense satellite. SSMT1 and SSMT2 (microwave temperature and humidity sounder) non-functional. Only 1 functional onboard recorder. Data available to civilian users through NOAA.
	NOAA-12 (L)	USA/NOAA	17:08 (A)	804 km	05/91	Functional (except sounding).
	NOAA-15 (B)	USA/NOAA	17:35 (A)	807 km	05/98	Functional (intermittent problems with AVHRR, AMSU-B & HIRS)

Current Operational Geostationary Satellites within the WMO Global Observing System
Updated on 10 October 2006

Sector	Satellites currently in orbit (+mode) P: Pre-operational Op: Operational B: Back-up L: Limited availability	Operator	Location	Launch date	Status
WEST – PACIFIC (108° E-180° E)	MTSAT-1R (Op)	JAPAN	140°E	26/02/05	Fully Functional
	MTSAT-2 (B)	JAPAN	145° E	18/02/06	Back-up to MTSAT-1R until 2010, then operational
	GOES-9 (B)	USA/NOAA	160°E	05/95	Dissemination is not activated
EAST - PACIFIC (180°W-108°W)	GOES-11 (Op)	USA/NOAA	135°W	05/00	Operational GOES-West position
WEST-ATLANTIC 108°W-36°W)	GOES-10 (B)	USA/NOAA	Drifting to 60° W	04/97	Inverted, solar array anomaly, DCP interrogator on back-up Relocated at 60°W for South-America coverage
	GOES-12 (Op)	USA/NOAA	75°W	7/ 01	Solar X-Ray Imager anomaly in Sept. 2005
	GOES-13 (P)	USA/NOAA	89.5°W	05/06	In commissioning
EAST ATLANTIC (36°W-36°E)	Meteosat-6 (B)	EUMETSAT	10°E	11/93	Rapid Scanning Service. Minor gain anomaly on IR imager
	Meteosat-8 (Op)	EUMETSAT	3.4°W	28/08/02	EUMETCast, no LRIT
	Meteosat-9 (P)	EUMETSAT	0°	21/12/05	In commissioning
INDIAN OCEAN (36°E-108°E)	Meteosat-7 (B)	EUMETSAT	Drifting to 57.5°E°	02/97	Will replace Meteosat-5 for IODC
	Meteosat-5 (Op)	EUMETSAT	63°E	03/91	IODC, functional but high inclination mode
	GOMS-N1 (B)	RUSSIA	76°E	11/94	Since 9/98 in stand-by
	FY-2C (Op)	CHINA/CMA	105°E	19/10/04	Functional
	INSAT 3-C	INDIA	74°E	24/01/02	No meteorological payload. Used for dissemination of processed meteorological data in broadcast mode in S-Band only over India and neighbouring countries. No WEFAX .
	Kalpana-1 (Op) (METSAT)	INDIA	74°E	12/09/02	Dedicated meteorological satellite.
	INSAT-3A (Op)	INDIA	93.5°E	10/04/03	Operationali since 24/04/03. A 3-channel VHRR imager and CCD payload available for use similar to INSAT-2-E.

Current R & D satellites within the WMO Global Observing System

sorted in alphabetical space agency order

Equator Crossing Time (if sun-synchronous orbit): A= ascending (Northward), D=descending (Southward)

Updated on 23 October 2006

Satellites	Space Agency	Equator Crossing Time + Altitude	Launch date	Instruments	Status, applications and other information
PARASOL	CNES	13 :32 (A) 705 km	18/12/04	POLDER	Characterisation of clouds and aerosols microphysical and radiative properties. Data can be accessed for level 1 at <http://parasol-polder.cnes.fr/> and for level 2 and more at <http://www-icare.univ-lille1.fr/>
SPOT-5	CNES	10:30 (D) 832 km	05/2002	DORIS, HRG, HRS, VEGETATION	Cartography, land surface, agriculture and forestry, civil planning and mapping, digital terrain models, environmental monitoring
CBERS-02	CNSA + AEB	10:30 (D) 778 km	10/2003	CCD camera, IRMSS, WFI	China-Brazil cooperation satellite for land monitoring
ERS-2	ESA	10:30 (D) 785 km	04/95	Altimeter, SAR, SAR-wave, ATSR, Scatterometer, GOME	Due to OB recorder problems in 06/03, the LBR mission is ensured over ESA agreed acquisition stations Operations extended till 2008.
ENVISAT	ESA	10:00 (D) 800 km	03/2002	ASAR, RA-2 AATSR, MERIS GOMOS, MIPAS MWR, SCHIAMACHY	▪ MIPAS is operated in discontinuous scenario. ▪ GOMOS performs regularly with reduced azimuth range since 29 august 2005. ▪ RA has experienced some anomalies since Feb 2006 Operations extended 3 years (till 2010)
PROBA	ESA	10: 30 (D) 615 km	10/2001	CHRIS	Drifting orbit. Technology experiment. AO Science mission since 2003.
Oceansat-1	ISRO	12:00am D 723 km	05/1999	OCM	Ocean and land monitoring + MSMR operational in 1999-2002
Resourcesat-1	ISRO	10:30 (D) 817 km	10/2003	AWIFS	Land monitoring 4 channel camera
Cartosat-1	ISRO	10:30 (D) 618 km	05/2005	Carto-dem	High resolution stereo imagery 2 Panchromatic cameras
ALOS	JAXA	10:30 (D) 700km	24/01/06	ALOS	Advanced Land Observing Satellite (mapping, precise land coverage observation, disaster monitoring, resource surveying)
TRMM	JAXA/ NASA	non-sun-synchronous (35° incl) 402 km	28/11/97	PR (Precipitation Radar) TMI (TRMM MW Imager) CERES, VIRS LIS (Lightning Imaging Sensor)	Measures tropical rainfall/precipitation and radiation energy Precipitation Radar (PR) provided by JAXA Satellite bus and other instruments provided by NASA CERES no longer functional
EP-TOMS	NASA	12 :00am(D) 740 km	02/07/96	Total Ozone Mapping Spectrometer	(Total Ozone Mapping Spectrometer - Earth Probe) measures total column ozone and its variation on a daily basis

Satellites	Space Agency	Equator Crossing Time + Altitude	Launch date	Instruments	Status, applications and other information
Landsat 7	NASA	10:05 (D) 705 km	15/04/99	ETM+ (Enhanced Thematic Mapper Plus)	well-calibrated, multispectral, moderate resolution, substantially cloud-free, sunlit digital images of the Earth's continental and coastal areas and selected coral reefs
QuikSCAT (Quick Scatterometer)	NASA	06:00 (A) 803 km	19/06/99	SeaWinds	Sea surface wind speed and direction data for global climate research and operational weather forecasting and storm warning
Terra	NASA	10 :30 (D) 705 km	18/12/99	CERES, MISR, MODIS, MOPITT, ASTER	Measurement of Earth' climate system, atmosphere, land, oceans and interactions with solar radiation
ACRIMSAT	NASA	10 :50 (D) 720 km	20/12/99	ACRIM 3	Active Cavity Radiometer Irradiance Monitor Satellite measures total solar irradiance
NMP EO-1 (New Millennium Program Earth Observing-1)	NASA	10 :01 (D) 705 km	21/11/00	Advanced Land Imager, Hyperion, LAC(atmospheric corrector)	demonstrates and validates advanced technology instruments (multi and hyperspectral), spacecraft systems, and mission concepts in flight
Jason-1	NASA/ CNES	non-sun-synchronous (66° incl) 1336 km	07/12/01	LRA (Laser retroreflector array) Poseidon-2 solid state radar altimeter, DORIS receiver , Jason Microwave Radiometer , BlackJack GPS Receiver	Ocean surface topography follow-on mission to TOPEX/Poseidon. Monitors global ocean circulation for global climate prediction
GRACE (Gravity Recovery and Climate Experiment)	NASA/ DRL	non-sun-synchronous (89°incl) 485 km	17/03/02	- Star Camera Assembly - GPS BlackJack Receiver - Instruments Processing Unit - Laser Retro-Reflector Assembly - K-Band Ranging Instruments - SuperSTAR Accelerometers	accurate global and high-resolution determination of static and time-variable components of Earth's gravity field measurement of: - Gravitational field - GPS atmospheric and ionospheric limb sounding
Aqua	NASA	13:30 (A) 705 km	04/05/02	AMSR-E, AIRS, HSB, AMSU-A, CERES, MODIS	collects data on Earth's water cycle, precise atmospheric, land and oceanic measurements, and interaction with solar radiation AMSR-E provided by JAXA. HSB provided by INPE (no longer functional)
ICESat (Ice, Cloud, and Land Elevation Satellite)	NASA	Circular non sun-synchronous (94° incl) 600 km	12/01/03	GLAS (Geo-science Laser Altimeter System), GPS BlackJack receiver	measures ice sheet topography, ice sheet elevation changes, cloud and aerosol heights, land topography and vegetation characteristics.

Satellites	**Space Agency**	**Equator Crossing Time + Altitude**	**Launch date**	**Instruments**	**Status, applications and other information**
SORCE (Solar Radiation and Climate Experiment)	NASA	non-sun-synchronous (40° incl) 640 km	25/01/03	- XPS (Extreme Ultraviolet (XUV) Photometer System) - TIM (Total Irradiance Monitor) - SIM (Spectral Irradiance Monitor A&B) - SOLSTICE (Solar Stellar Irradiance Comparison Experiment A&B)	Provides total solar irradiance measurements and full solar spectral irradiance measurements. Continuation of ACRIMSAT total solar irradiance measurements.
Aura	NASA	13:45 (A) 705 km	15/07/04	HIRDLS, MLS (Microwave Limb Sounder), OMI (Ozone Monitoring Instrument), TES	Comprehensive measurements of atmospheric chemistry and trace gasses : HIRDLS = High Resolution Dynamic Limb Sounder (IR) TES = Tropospheric Emission Spectrometer
CALIPSO	NASA/ CNES	13 :30 (A) 705 km	28/04/06	CALIOP, WFC, IIR	Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations for climate predictions
CloudSat	NASA/ CSA	13:30 (A) 705 km	28/04/06	Cloudsat Profiling Radar (CPR)	global cloud properties (applications: air quality, aviation safety, disaster management, energy and water management)
Monitor-E	ROSCOS-MOS	10:30 550 km	27/08/05	Land Observing Satellite	Surface mapping, support to disaster management and monitoring the effects of pollution. Two optical cameras.
Compass-2	ROSCOS-MOS	400-550 km 79° incl	26/05/06	Radio-frequency analyzer	Microsatellite for monitoring anomaly phenomena in the Earth ionosphere
Resurs-DK	ROSCOS-MOS	360-690 km 70.4° incl	15/06/06	Land Observing Satellite	

Future Operational Low Earth Orbit Satellites within the WMO Global Observing System
Updated on 10 October 2006

Orbit type	Future LEO Satellites	Operator	Equator Crossing Time	Altitude	Planned launch date	Other information
Sun-synchronous Morning ECT in (7:00 12:00) and (19:00 – 24:00)	METOP-B	EUMETSAT	09:30 (D)	837 km	2011	AHRPT
	METOP-C	EUMETSAT	09:30 (D)	837 km	2015	AHRPT
	FY-3A	CHINA/CMA	10:00 (D)	836 km	2007	AHRPT/MPT
	METEOR M-1	RUSSIA	10:20 (A)	830 km	2006	AHRPT
	METEOR M-2	RUSSIA	10:20	830 km	2008	AHRPT
	DMSP F-18	USA/NOAA	08:00 (D)	833 km	03/2008	SSMI/S
Sun-synchronous Afternoon (12:00 – 17:00) (00:00 – 05:00)	FY-3B	CHINA/CMA	14:00 (A)	836 km	2009	AHRPT/MPT
	NOAA-N'	USA/NOAA	14:00 (A)	850 km	2009	
	NPP (NPOESS Preparatory Project)	USA NOAA/NASA	13:30 (A)	833 km	2009	VIIRS, CrIS, ATMS, OMPS/Nadir
	NPOESS-C1	USA/NOAA	13:30 (A)	833 km	2013	VIIRS, CrIS, ATMS, CERES, OMPS/Nadir
	NPOESS-C3	USA/NOAA	13:30 (A)	833 km	2020	VIIRS, CrIS, ATMS, MW imager OMPS/Nadir
Sun-synchronous Early morning (5:00 - 7:00) (17:00 – 19:00)	DMSP-S17	USA/NOAA	17:30 (A)	833 km	11/2006	(SSMI/S)
	DMSP-S19	USA/NOAA	17:30 (A)	833 km	10/2010	(SSMI/S)
	DMSP-S20	USA/NOAA	17:30 (A)	833 km	10/2012	(SSMI/S)
	NPOESS-C2	USA/NOAA	17:30 (A)	833 km	2016	VIIRS, MW imager
	NPOESS-C4	USA/NOAA	17:30 (A)	833 km	2022	VIIRS, MW imager
Non sun-synchro-nous.	JASON-2 (Ocean Surface Topography Mission)	NASA/NOAA/ EUMETSAT/ CNES	(66° inclin.)	1336 km	06/2008	follow-on of Jason-1 sea surface topography measurement

Future Operational Geostationary Satellites within the WMO Global Observing System
Updated on 8 September 2006

Sector	Future geostationary satellites	Operator	Planned location	Planned launch	Other remarks
EAST PACIFIC (180°W-108°W) AND WEST ATLANTIC (108°W-36°W)	GOES-O	USA/NOAA	135° W or 75° W	2007 (TBC)	
	GOES-P	USA/NOAA	135° W or 75° W	2008	
	GOES-R	USA/NOAA	135° W or 75° W	2014	ABI,GLM, SIS, SEISS Advanced Baseline Imager Geostationary Lightning Mapper Solar Imaging Suite Space Environment In-Situ Suite
	MSG-3	EUMETSAT	0°	2011	
	MSG-4	EUMETSAT	0°	2012	
INDIAN OCEAN (36°E-108°E)	Electro-L N1	Russia	76°E	2007	
	Electro-L N2	Russia	76°E or 14.5°E (TBC)	2010	
	Electro-L N3	Russia	76°E or 14.5°E (TBC)	2015	
	INSAT-3D	India	TBD	Q4 2007	Dedicated Meteorological mission with improved 6-channel Imager and 19-channel Sounder.
	FY-2D	China/CMA	86.5 E	2006	5-channel VISSR, LRIT
	FY-2E	China/CMA	123 E	2009	5-channel VISSR, LRIT
	FY-2F	China/CMA	86.5 E	2011	5-channel VISSR, LRIT
	FY-2G	China/CMA	123 E	2013	5-channel VISSR, LRIT
WEST PACIFIC (108°E-180°E)	COMS	Korea/KMA	128.2° E	2008	5-channel HRIT/LRIT
	MTSAT follow-on	JAPAN	140° E	2015	

Future R & D satellites within the WMO Global Observing System

(Updated on 23 October 2006)

(by planned launch dates. Equator Crossing Time: A= ascending (Northward), D=descending (Southward))

Satellites	Space Agency	Equator Crossing Time + Altitude	Launch date	Status, applications and other information
HY-1B	CNSA	10:30 (D) 798 km	2006	Ocean monitoring CCD camera, OCTS
GOCE	ESA	250 km (dawn-dusk)	05/2007	Gravity mission
SMOS	ESA	6:00 (A) 755 km	09/2007	Salinity & Soil moisture
CBERS-2B	CNSA + AEB	10:30 (D) 778 km	2007	China-Brazil cooperation Land monitoring CCD camera, WFI
HJ-1A	CNSA	10:30 (D) 650 km	2007/ 2008	Land monitoring CCD camera Hyperspectral camera
HJ-1B	CNSA	10:30 (D) 650 km	2007/ 2008	Land monitoring CCD camera IR camera
HJ-1C	CNSA	6:00 (D) 500 km	2007/ 2008	Land monitoring S-band SAR
Oceansat-2	ISRO	12:00 am (D)	2007/ 2008	OCM(ocean colour), ROSA (Radio-occultation) , Scatterometer
GOSAT	JAXA & Japan's Ministry of Environment	13:00 666km	08/2008	Greenhouse Gases Observing Satellite monitoring the distribution of the density of carbon dioxide
ADM-Aeolus	ESA	18:00 (A) 405 km	09/2008	Wind profile by Lidar
OCO	NASA	13 :15 (A) 705 km	09/2008	Orbiting Carbon Observatory (observations of atmospheric carbon dioxide) 3 grating spectrometers
Glory	NASA	13:30 (A) 705 km	12/2008	in framework of Climate Change Research Initiative (CCRI) global distribution of natural and anthropogenic aerosols Airborne Polarimeter Sensor (APS) Total Irradiance Monitor (TIM)
Resourcesat-2	ISRO	10:30 (D) 817 km	2008/ 2009	Land monitoring AWIFS 4-channel camera
Aquarius	NASA/ CONAE	6:00 657 km	03/2009	Global sea surface salinity (SSS): L-band Radiometer (LBR) and Scatterometer (LBS)

Satellites	Space Agency	Equator Crossing Time + Altitude	Launch date	Status, applications and other information
Megha-Tropiques	ISRO (+CNES)	Non sun-synchronous (20° incl) 870 km	2009	Monitoring convective systems, water cycle and energy budget in tropical atmosphere MADRAS (microwave imager), SAPHIR (humidity microwave sounder) 183 GHz, SCARAB (outgoing radiative flux at TOA)
CRYOSAT-2	ESA	717 km (92° incl)	03/2009	Polar ice monitoring (replacing CRYOSAT-1 lost on launch failure in October 2005)
CBERS-3	CNSA + AEB	10:30 (D) 778 km	2009	Land monitoring CCD camera, IRMSS, WFI
LDCM Landsat Data Continuity Mission	NASA/US Geological Survey	828 km (at equator) sun-synchronous	07/2010	Extension of Landsat record of multispectral 30m resolution
GPM (core-satellite)	NASA/ JAXA	407 km Non sun-synchronous (65° incl)	12/2012	Global Precipitation Measurement, follow-on and expanded mission of the current TRMM
EarthCare	ESA-JAXA	10:30 (D) 450 km	12/2012	ATLID, BBR, CPR, MSI . Cloud, radiation and aerosol interaction processes