CGMS-39 NOAA-WP-14
Prepared by NOAA
Agenda Item: I/2
Discussed in WGI

CURRENT AND FUTURE NOAA SATELLITE NETWORKS
In response to CGMS action 37.15

This document provides a description of current and future NOAA satellite networks as well as a list of radio frequencies used/to be used by these networks.

Recommendation proposed: None.

CURRENT AND FUTURE NOAA SATELLITE NETWORKS

NOAA Satellite Networks List*

1
Network name: Polar Operational Environmental Satellites (POES)
Launch of first satellite: October 1978 (TIROS N)
General objective: Earth observation. Collects numerous Earth atmospheric and surface parameters such as ice, snow and vegetation; atmospheric temperatures; moisture, aerosol, and ozone distribution. Monitors solar activity and its effect on the Earth's atmosphere. Also detects and locates Emergency Locator Transmitters (ELTs), Emergency Position-Indicating Radio Beacons (EPIRBs), and Personal Locator Beacons (PLBs) as part of the international COSPAS-SARSAT system.
Orbit: LEO polar at 13:30 and 21:30 (time of ascending node equatorial crossing)
Number of satellites: 2 operational, older satellites' instrument data used if available. Fifteen satellites in series (TIROS-N, NOAA-6 through NOAA-19).
Main ground stations: Fairbanks, Alaska and Wallops Island, Virginia

2
Network name: Joint Polar Satellite System (JPSS) NOAA component of former National Polar-Orbiting Operational Environmental Satellite System (NPOESS))
Expected planning date for launch of first satellite: 2016
General objective: Earth observation. Collects numerous atmospheric and surface parameters such as ice, snow and vegetation; atmospheric and surface temperatures, pressures and moisture content; wind speed, cloud characteristics, aerosol, and ozone distribution. Monitors solar irradiance. Also detects and locates Emergency Locator Transmitters (ELTs), Emergency Position-Indicating Radio Beacons (EPIRBs), and Personal Locator Beacons (PLBs) as part of the international COSPAS-SARSAT system.
Orbit: LEO polar at 13:30 LTAN (local time of ascending node) 17:30 (covered by the Defence Weather Satellite System, DWSS)
Number of satellites: 2 +TBD accommodations for TSIS, SARSAT and ADCS
Main ground station(s): Svalbard (Norway) for T&C and worldwide receptor sites at 15 locations to collect mission data

Note: As directed by the White House, NOAA, with NASA/GSFC it's implementing agent, has assumed oversight of JPSS development, including the Common Ground System to be used by JPSS and DWSS. The Integrated Program Office has been replaced by separate DoD (DWSS) and civilian (JPSS) teams to develop separate satellite systems.

3
Network name: National Polar-Orbiting Operational Environmental Satellite System Preparatory Project (NPP)
Expected planning date for launch of satellite: Late 2011
General objective: Earth observation. Collects and distributes remotely-sensed land, ocean, and atmospheric data to the meteorological and global climate change communities as the responsibility for these measurements transitions from existing Earth-observing missions such as Aqua, Terra and Aura, to the NPOESS. It will provide atmospheric and sea surface temperatures, humidity sounding, land and

ocean biological productivity, and cloud and aerosol properties. NPP will also provide risk reduction with an opportunity to demonstrate and validate new instruments and processing algorithms, as well as to demonstrate and validate aspects of the NPOESS command, control, communications and ground processing capabilities prior to the launch of the first NPOESS spacecraft.
Orbit: LEO polar at 13:30 LTAN (local time of ascending node)
Number of satellites: 1
Main ground station(s): Svalbard (Norway) for T&C and mission data

4
Network name: COSMIC (Constellation Observing System for Meteorology, Ionosphere, and Climate)
Launch of first satellite: April 14, 2006
General Objective: Earth observation. COSMIC is a program designed to provide advances in meteorology, ionosphere research, climatology, and space weather by using GPS satellites using a constellation of six low Earth orbiting micro satellites. The constellation will track radio signals from the Global Positioning System as they pass through Earth's atmosphere. GPS signals undergo changes in frequency and amplitude when they encounter water vapor or other physical components of the atmosphere. Those changes can be measured using a process called radio occultation. The altered signals can be converted into useful profiles of humidity and temperature throughout the lower atmosphere. Information about the electrical structure of the upper atmosphere, Earth's gravitational field, and other data will also be extracted.
Orbit: LEO
Number of Satellites: 6
Main ground stations: Fairbanks, Alaska and Wallops Island, Virginia

Note: A second COSMIC constellation is planned with 12 satellites with 6 likely at 24° and 6 at 72° inclinations with additional tracking stations at Tromso, Norway, two in Antarctica and several equatorial locations yet to be determined. Frequencies will continue in S-band. Current expected launch date is 2014.

5
Network name: Jason-2 (OSTM – Ocean Surface Topography Mission)
Launch of first satellite: June 20, 2008
General objective: Earth observation. Jason-2 is a follow-on satellite to the joint CNES/NASA oceanography mission Jason (or Jason-1, launched Dec. 7, 2001). Jason-1, in turn is a follow-on mission of TOPEX/Poseidon (T/P), launched in 1992.

The science objectives of Jason-2/OSTM are to extend the time series of ocean surface topography measurements to: a) obtain a continuous record of observations (with the previous missions), b) to determine the variability of ocean circulation at decadal time scales from combined data record with T/P and Jason-1, c) improve the measure of the time-averaged ocean circulation, d) improve the measure of global sea-level change, and e) improve open ocean tide models.

The mission objectives call for the provision of the same measurement accuracy of Jason-1 (3.3 cm) with a goal of achieving 2.5 cm, and to maintain the stability of the global mean sea level measurement with a drift of less than 1 mm/year over the life of the mission. The overall goal is to better understand the forces behind global

changes of climate and to predict seasonal anomalies in weather patterns; this is vital to understand the physics of the ocean.
Orbit: LEO with 66° inclination angle, 1336 km altitude, 1 hr. 52 min. period
Number of satellites: 1
Main ground station(s): Fairbanks, Alaska; Wallops Island, Virginia and Usingen, Germany

Note: Plans initiated for Jason-3 mission very similar to Jason-2. Planned launch date July 2013. Partnered with CNES, EUMETSAT and NASA. Communications frequencies for the command link and the telemetry/data link are different between Jason-2 and Jason-3.

6
Network name: GOES (Geostationary Operational Environmental Satellites) I-M
Launch of first satellite: April 1994 (GOES-8, GOES-I prior to launch)
General objective: Earth observation. Collects numerous atmospheric and surface parameters such as ice, snow and vegetation; atmospheric temperatures; moisture, aerosol, and ozone distribution using instruments sensing in visible, near-IR, and thermal IR frequencies.

Space and Solar Instruments. Instrumentation on the GOES I-M series monitors the highly-variable solar and near-Earth space environment. These observations are used to protect life and property of those adversely impacted by space weather conditions. The measurements made by these instruments contribute to the global Earth and Solar observations that are used in NOAA's operations to continuously specify and forecast conditions in the space environment.
Other. The satellites also detect Emergency Locator Transmitters (ELTs), Emergency Position-Indicating Radio Beacons (EPIRBs), and Personal Locator Beacons (PLBs) as part of the international COSPAS-SARSAT system.
Orbit: Geostationary; locations: 75W and 135W.
Number of satellites: 5
Main ground station(s): US: Wallops VA (primary), Greenbelt MD (backup), Boulder CO (solar instrument data), Goldstone CA (contingency support).

7
Network name: GOES N-P Satellite series
Launch of first satellite: May 2006 (GOES-13, GOES-N prior to launch)
General objective: Earth observation. Collects numerous atmospheric and surface parameters such as ice, snow and vegetation; atmospheric temperatures; moisture, aerosol, and ozone distribution using instruments sensing in visible, near-IR, and thermal IR frequencies.

Space and Solar Instruments. Instrumentation on the GOES N-P series to monitor the highly-variable solar and near-Earth space environment will continue a long history of space weather observations collected by the GOES program. These observations are used to protect life and property of those adversely impacted by space weather conditions. The measurements made by these instruments will contribute to the global Earth and Solar observations that are used in NOAA's operations to continuously specify and forecast conditions in the space environment.

Other. The satellites also detect Emergency Locator Transmitters (ELTs), Emergency Position-Indicating Radio Beacons (EPIRBs), and Personal Locator Beacons (PLBs) as part of the international COSPAS-SARSAT system.
Orbit: Geostationary; locations: 75W and 135W.
Number of satellites: 3
Main ground station(s): US: Wallops VA (primary), Greenbelt MD (backup), Boulder CO (solar instrument data), Goldstone CA (contingency support).

8
Network name: GOES R Series Meteorological Satellites
Expected planning date for launch of first satellite: Late 2015
General objective: Earth observation. Collects numerous atmospheric and surface parameters such as ice, snow and vegetation; atmospheric temperatures; moisture, aerosol, and ozone distribution using instruments sensing in visible, near-IR, and thermal IR frequencies.

Space and Solar Instruments. Instrumentation on the GOES R series to monitor the highly-variable solar and near-Earth space environment continues a long history of space weather observations collected by the GOES program. These observations are used to protect life and property of those adversely impacted by space weather conditions. The expanded services from this new series of GSO MetSats will improve the opportunity to support forecasters at NOAA's Space Environment Center; customers in other government agencies, such as DoD and NASA; commercial users of space weather services; and international space environment services. The instruments that contribute to new services and products include: the Solar Imaging Suite (SIS), that will measure solar x-rays and solar EUV radiation; and the energetic particle instruments, called the SEISS (Space Environment In-Situ Suite), that will provide multiple measurements characterizing the charged particle population, including measurements of the electron, proton, and heavy ion fluxes. Finally, Earth's magnetic field will be measured by a magnetometer (MAG) which is part of the spacecraft procurement. The measurements made by these instruments will contribute to the global Earth and Solar observations that are used in NOAA's operations to continuously specify and forecast conditions in the space environment.

Other. The satellites will also detect Emergency Locator Transmitters (ELTs), Emergency Position-Indicating Radio Beacons (EPIRBs), and Personal Locator Beacons (PLBs) as part of the international COSPAS-SARSAT system.
Orbit: Geostationary; locations: 75W and 137W.
Number of satellites: 2 + 2
Main ground station(s): US: Wallops VA; Fairmont, WV (backup).

9
Network name: DSCOVR (Deep Space Climate Observatory) (aka TRIANA wrt ITU)
Expected planning date for launch of first satellite: TBD
Note: DSCOVR is currently unfunded with undefined spectrum requirements. It's program schedule is TBD.
General objective: Earth and solar observations. The DSCOVR program is critical for predicting space weather, solar wind and geomagnetic storm activities critical to the nation's power and transportation industries. The DSCOVR satellite will contain a solar wind sensor, a new Coronal Mass Ejection (CME) Imager called the compact coronagraph (CCOR), a Plasma Magnetometer Solar Weather Instrument (PlasMag)

important for solar wind observations, and two climate instruments that will look at the sunlit earth from its L1 vantage point approximately a million miles away. The climate instruments are the National Institute of Standards & Technology Absolute Radiometer (NISTAR) and the Earth Polychromatic Imaging Camera (EPIC). DSCOVR will help ensure that NOAA continues to supply geomagnetic storm warnings to support key industries such as the commercial airline, electrical power, and GPS industries. The DSCOVR Program is a partnership with NOAA, NASA, and DoD. DoD will provide the launch services and NOAA will be responsible for the day-to-day operation of the spacecraft. DSCOVR will use the international Real-Time Solar Wind network for data downlink.

Orbit: L-1

Number of Satellites: 1

Main ground stations: Wallops Island, Virginia (command and control); Real-Time Solar Wind network (data downlink).

*The latest flyout summary for NOAA GSO and NGSO missions can be found at: http://www.nesdis.noaa.gov/FlyoutSchedules.html.

NOAA SATELLITES

(Status:23 September 2011)

TABLE 1: EARTH-TO-SPACE & SPACE-TO-SPACE FREQUENCIES (FWD)

NGSO NETWORKS

SATELLITE	FREQUENCY (MHz)	DIRECTION	EMISSION DESIGNATOR	D.B.I.U.[1]	NOTES
Jason-2 (OSTM)/Jason-3	401.25	E-S	23K0G1D	2008 / 2013	DORIS
POES	401.65	E-S	4K00G1D	1978	Data Collection Platforms
NPOESS/JPSS	401.635	E-S	4K00G1D	2017	Data Collection Platforms
POES	406.025 406.050	E-S	4K00G1D	1978 / 2017	Search and Rescue EPIRB
NPOESS/JPSS	406.050	E-S	4K00G1D	2017	Search and Rescue EPIRB
NPOESS/JPSS NPP	1227.6	S-S Rx	24M0G1D	2017 / 2011	GPS-to-NPOESS/NPP
NPOESS/JPSS NPP	1575.42	S-S Rx	24M0G1D	2017 / 2011	GPS-to-NPOESS/NPP
Jason-2 (OSTM)/Jason-3	2036.25	E-S	95K0G1D	2008 / 2013	DORIS
COSMIC	2039.5	E-S	64K0G1D	2006	Command
POES	2026	E-S	2M00G2D	1998	Command
NPP	2067.3	E-S E-S S-S Rx	4K0G7DDT 256K0G7D 6M04G7DDC	2011	Command Command TDRSS FWD
Jason-2 (OSTM)	2088.878	E-S	8K00G2D	2008	Command
Jason-3	2040.493	E-S	8K00G2D	2013	Command
DSCOVR	TBD				
NPOESS/JPSS	2106.4	E-S E-S S-S Rx	8K0G7DDT 512KG7D 6M16G7DDC	2017	Command Command TDRSS FWD

TABLE 2: EARTH-TO-SPACE & SPACE-TO-SPACE FREQUENCIES (FWD)
GSO NETWORKS

SATELLITE	FREQUENCY (MHz)	DIRECTION	EMISSION DESIGNATOR	D.B.I.U.[2]	NOTES
GOES 11-15 / GOES R	401.70 (GOES 15 & R only) 401.85	E-S	N0N N0N	1994 / 2006 / 2015	Pilot
GOES 11-15 / GOES R	401.7-402.4	E-S	1K20G1DEN 300HG1DEN 400HG1DBN	1994 / 2006 / 2015	DCPR
GOES 11, 12	406.025 406.05	E-S	4K00G7D	1994	Search and Rescue
GOES 13, 14, 15	406.025 406.028	E-S	3KG1D	2006	Search and Rescue
GOES R	406-406.1	E-S	1K60G1D	2015	Search and Rescue
GOES R	2027.4 2027.1 (proposed shift)	E-S	1M19G1D	2015	HRIT/ EMWIN
GOES 11-15	2027.7	E-S	4M22G9D 4M22G1DBN	1994 2006	PDR
GOES 11-15	2033.0	E-S	50K00F9C 586KG1DCN	1994 2006	LRIT
GOES 11-15	2034.2	E-S	34K00G7D, 2M00G7D, 64K00G9D 36K0G2DBN	1994 2006	Command
GOES 13, 14, 15	2034.7	E-S	27K0G1DCN	2006	EMWIN
GOES 13, 14, 15	2034.8875 2034.9000 2034.9125	E-S	11K0G1DCN	2006	DCPI
GOES 11, 12	2034.9, 2034.9125	E-S	300K00G9D	1994	DCPI
GOES R	2032.775 2032.8250	E-S	88K9G1DDC	2015	DCPI
GOES R	2034.2 2034.6	E-S	128KG1DCN 40K0G2DCN	2015	Command

[1] DBIU: Date of Bringing Into Use

	2036		34K0G2DCN		
GOES R	2036.0	E-S	40K0G2DCN 2M00G3N	2015	Command/ Ranging
GOES R	7220 7216.6 (proposed shift)	E-S	12M0G1DEN	2015	GRB

TABLE 3: SPACE-TO-EARTH FREQUENCIES
&
SPACE-TO-SPACE FREQUENCIES (RTN)
NGSO NETWORKS

SATELLITE	FREQUENCY (MHz)	DIRECTION	EMISSION DESIGNATOR	D.B.I.U.[3]	NOTES

[2] DBIU: Date of Bringing Into Use

POES	137.35 and 137.77 (or 137.1 and 137.9125) 137.50 and 137.62	S-E	38K00F1D 46K00G1D	1978 1978	APT TIP Data
NPOESS/JPSS	465.9875	S-E	5K00G1D	2017	Data Collection Platforms
POES	1544.5	S-E	900KG2D	1978	Search and Rescue
NPOESS/JPSS	1544.5	S-E	750KG2D	2017	Search and Rescue
POES	1698, 1702.5, 1707	S-E	5M34G7D	1978	HRPT
NPOESS/JPSS	1707	S-E	6M0G7D	2017	LRD
COSMIC	2215	S-E	64K0G1D 4M56G1D	2006	Telemetry, sensor data
POES NPP	2247.5	S-E	4M55G7D 6M04G7DDC	1978 2011	TT&C
NPP	2247.5	S-S Tx	6M04G7DDC	2011	TDRSS RTN
Jason-2 (OSTM)	2268.465	S-E	839KG1D	2008	TM/SMD
Jason-3	2215.92	S-E	839KG1D	2013	TM/SMD
DSCOVR	TBD				
NPOESS/JPSS	2287.5	S-E S-S Tx	6M16G7DDC 6M16G7DDC	2017	TT&C TDRSS RTN
Jason-2 (OSTM) Jason-3	5300	S-E	100MQ3N 320MQ3N	2008 2013	Altimeter
NPOESS/JPSS	5300	S-E	100MP0N	2017	Altimeter
NPP	7812	S-E	30M0G7D	2011	HRD
NPOESS/JPSS	7834	S-E	32M0G7D	2017	HRD
NPP	8212.5	S-E	300M0G7D	2011	SMD
Jason-2 (OSTM) /Jason-3	13575	S-E	320MQ3N	2008 2013	Altimeter
NPOESS/JPSS	13575	S-E	320MP0N	2017	Altimeter
NPOESS/JPSS	26700	S-E	300MG7D	2017	SMD (RHCP)

TABLE 4: SPACE-TO-EARTH FREQUENCIES
&

[3] DBIU: Date of Bringing Into Use

SPACE-TO-SPACE FREQUENCIES (RTN)

GSO NETWORKS

SATELLITE	FREQUENCY (MHz)	DIRECTION	EMISSION DESIGNATOR	D.B.I.U.[4]	NOTES
GOES-R	468.775 468.825	S-E	88K9G1D	2015	DCPI
GOES / GOES 11-15	468.8125 468.8250 468.8375	S-E	11K0G1DCN	1994, 2006	DCPI
GOES 11-15	1544.5	S-E	300K00G2D 500KG7DBF	1994 2006	SAR
GOES R	1544.5	S-E	100KG7DBF	2015	SAR
GOES 11-15	1676	S-E	5M20G9D 5M20G7DDX	1994 2006	Sensor Data
GOES 11-15	1681.478	S-E	200K00G9D 400KG7DDX	1994 2006	MDL
GOES-R	1683.3 (Domestic) 1679.9 (proposed shift) 1683.6 (International) 1680.2 (proposed shift)	S-E	400KG7D	2015	DCPR
GOES 11-15	1685.7	S-E	4M22G9D 4M22G1DBN	1994 2006	PDR
GOES R	1690 1686.6 (proposed shift)	S-E	12M0G1DEN	2015	GRB
GOES 11-15	1691	S-E	50K00F9C 586KG1DCN	1994 2006	WEFAX/LRI LRIT
GOES 13, 14, 15	1692.7	S-E	27K0G1DCN	2006	EMWIN
GOES 11-15	1694	S-E	4K00G9D 16K0G1DBN	1994 2006	Telemetry
GOES 11, 12	1694.45	S-E	NON	1994	Pilot
GOES 11-15	1694.5 1694.8	S-E	400K00G9D (GOES only) 400KG7DBF (GOES N only 400KG7DEF (GOES N only)	1994 2006 2006	DCPR
GOES R	1696.3 1693.0 (proposed shift)	S-E	73K0G1DCN 8K0G1DCN	2015	Telemetry

GOES R	1697.4 1694.1 (proposed shift)	S-E	1M19G1DDN	2015	HRIT/ EMWIN
GOES 11, 12	2208.586	S-E	2M50G2D	1994	Telemetry/ Ranging
GOES 11, 12	2209.086	S-E	2M00G2D	1994	Telemetry/ Ranging
GOES 13, 14, 15	2209.086	S-E	2M10G2DBN 2M00G3N 2M10G9W	2006	Telemetry/ Ranging
GOES R	2211.041	S-E	2M10G2D 2M00G3N 2M10G9W	2015	Telemetry/ Ranging
GOES R	8220	S-E	130MG1D	2015	SD

[4] DBIU: Date of Bringing Into Use