WRITTEN STATEMENT BY
STEPHEN M. VOLZ
ASSISTANT ADMINISTRATOR
NATIONAL ENVIRONMENTAL SATELLITE, DATA,
AND INFORMATION SERVICE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

HEARING TITLED
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Chairmen Bridenstine and Loudermilk, Ranking Members Bonamici and Beyer, and Members of the Committee, I am Dr. Stephen Volz, the Assistant Administrator of NOAA's National Environmental Satellite, Data, and Information Service (NESDIS). Thank you for the opportunity to participate in today's hearing on the status of NOAA's satellites.

My testimony today will provide a status update of NOAA's operational satellites that are currently supporting the nation's weather enterprise, along with an update of the acquisition of NOAA's next generation polar-orbiting and geostationary operational satellite systems - Joint Polar Satellite System (JPSS) and Geostationary Operational Environmental Satellite-R (GOES-R) Series Programs, and progress on joint programs with other partners. NOAA maintains productive interagency and international strategic partnerships to develop other programs that provide data to meet validated mission requirements such as satellite altimetry, solar winds monitoring, and radio occultation. NOAA works very closely with NASA, our acquisition agent, and with our industry and academic partners, to implement proven acquisition processes so we can meet our development milestones delivering the essential observations that these satellites provide to the nation. Congressional support has been, and will continue to be, essential to ensure that adequate resources are available to support these programs.

MEETING THE NATION'S SPACE-BASED OPERATIONAL DATA REQUIREMENTS

NOAA's mission to provide science, service, and stewardship to the Nation is fundamentally dependent on comprehensive and accurate observations of our environment. NOAA's satellite observing system provides the observations that are the backbone of its predictive capabilities. NOAA ensures that operational weather, ocean, climate, and space weather information are available 24 hours a day, seven days a week to address our nation's critical civil and military needs for timely and accurate forecasts and warnings of solar storms, extreme weather, and

environmental phenomena, such as hurricanes, tornadoes, thunderstorms, winter storms, floods, wildfires, volcanic ash, fog, and sea ice.

NOAA's NESDIS has managed the operation of polar-orbiting operational environmental satellites since 1966 and geostationary operational environmental satellites since 1974. Over the decades, these systems have supported weather and environmental monitoring programs that are relied upon by users in the United States (U.S.) and around the world. Satellites, anchored and validated by *in situ* ground and airborne observations, provide more than 95 percent of the data routinely assimilated into NOAA's National Weather Service (NWS) numerical weather prediction (NWP) models. These NWP models are used to forecast the weather seven or more days ahead, and, in particular, output from the NWP models are essential to forecasting the development of extreme weather events, including hurricanes and blizzards. Of those satellite observations, more than 80 percent are from polar-orbiting satellites, including the NOAA/NASA Suomi National Polar-orbiting Partnership (Suomi NPP) satellite, which is the primary satellite for weather observations in the afternoon orbit. NOAA's NWP models also rely on data from the European Metop satellites that fly the other primary polar satellite in the mid-morning orbit. Older secondary satellites, such as NOAA's Polar-orbiting Operational Environmental Satellite (POES) and NASA's Earth Observing Satellites (EOS), supplement Suomi NPP.

The American public relies on accurate, reliable, and timely weather information from NOAA's NWS to protect themselves, their families, and their property. The private weather sector, which delivers specialized weather information to its users, also relies on full, free, open, and timely access to NOAA's observations, products, and information, and data provided by NOAA's international partners. NOAA's satellites are an integral part of the nation's observational infrastructure that supports these NWS and private sector forecasting capabilities.

STATUS OF NOAA's SATELLITE SYSTEMS

I. Geostationary Operational Environmental Satellites (GOES)

NOAA's satellites are our observational sentinels in space, providing constant watch for severe weather such as hurricanes, thunderstorms, flash floods, and wildland fires in the Western Hemisphere. The GOES satellites are part of a larger, global partnership, and NOAA maintains agreements with the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) and the Japanese Meteorological Agency, ensuring the full, free, open, and timely sharing of all observational data and through which each agency provides additional backup to the others in the event of the loss of a satellite.

NOAA's two operational GOES satellites, operating over the Pacific Ocean and off the east coast of the United States over the Atlantic Ocean (known as GOES-West and GOES-East, respectively) provide consistent, reliable service and are currently supporting the nation's weather needs. GOES-East and GOES-West are operating nominally and are providing data every 15 minutes to weather forecasters to support their forecasts and warnings. Although GOES-West experienced a component anomaly (i.e., loss of one of the two remaining star trackers) in April 2015, the satellite continues to operate on the single remaining star tracker,

continuing to meet all user performance requirements while the engineering team works with the component manufacturer to attempt to recover the affected subsystem. In November, the GOES-East sounder filter wheel failed, however, the imager continues to support NWS weather forecasting needs. An on-orbit spare (GOES-14) is available as a backup in the event either of the operational satellites fails to meet performance requirements. The GOES satellites complement *in situ* observational systems, such as NOAA's Doppler Radar network, NOAA's Hurricane Hunters, surface observation platforms and ocean buoys, to provide NWS forecasters with near real-time data used to support operational weather forecasts.

NOAA is working with NASA as its acquisition partner and with the support of the private sector to complete the development of the GOES-R series satellites, NOAA's next-generation geostationary environmental satellite constellation. The advanced GOES-R Series Program content remains unchanged since the Congressional Baseline report was submitted in February 2013. The GOES-R Series Program consists of four spacecraft (GOES-R, -S, -T, and -U) and associated instruments, ground system and its antennas, mission management, product generation and distribution, and enterprise management. This constellation will provide data continuity through 2036. The GOES-R series will provide GOES continuity as well as needed and widely-anticipated enhancements of required weather and space weather data, such as three times more channels, four times better resolution, and five times faster scans than the current GOES-East and GOES-West satellites. The enhanced GOES-R series capabilities are the result of the instrument suite that includes:

- Advanced Baseline Imager (ABI)
- Geostationary Lightning Mapper (GLM)
- Space Environmental In Situ Suite (SEISS)
- Extreme Ultra Violet / X-Ray Irradiance Sensor (EXIS)
- Solar Ultra Violet Imager (SUVI), and
- Magnetometer

II. Update on the GOES-R Series development

In 2015 the GOES-R Series Program team, co-led by NOAA and NASA and working with the spacecraft manufacturer, Lockheed Martin, completed the assembly and integration of the first satellite in the new series, GOES-R. After a thorough review of the remaining work needed prior to launch, NOAA, with input from the combined GOES-R team, moved the GOES-R launch planning date from March 2016 to October 2016. NOAA, NASA, and Lockheed Martin will continue close coordination as the final year of activities are completed leading up to the GOES-R launch. The GOES-R team is applying all lessons learned from the last two years of GOES-R satellite development to ensure a timely and successful completion of the GOES-S, -T-, and -U satellites.

Status of the GOES-R satellite

In late August, the GOES-R satellite completed thermal vacuum testing at Lockheed Martin's facility in Littleton, Colorado. Successful completion of this test, which simulates the extreme hot and cold temperatures it will experience in space as it orbits the Earth, is an important

milestone for the satellite. The satellite is now being prepared for vibration testing, which will simulate the experience of launching into space aboard the Atlas V launch vehicle.

The GOES-R Series Program successfully completed its Flight Operations Review at the NOAA Satellite Operations Facility in Suitland, Maryland, on November 6, 2015 with all criteria rated "green" by the independent review team, indicating that the Program is able to execute all phases and modes of mission operations, data processing, and analysis.

Reasons for the Change of the GOES-R Launch Readiness Date

Once satellite integration and testing began in late 2014, the spacecraft vendor experienced challenges that resulted in schedule erosion. The challenges were due to complications that were related to the complexity of the GOES-R spacecraft. To meet the GOES-R mission requirements, the spacecraft must support stringent instrument interface needs, including separate Earth and sun pointing platforms, and complex command and data handling capabilities. This schedule erosion occurred at a rate that challenged achievement of the March 2016 launch date. In early 2015, GOES-R experienced a failure of the Solar Array Drive Assembly (SADA). The SADA is part of the mechanism that holds the solar array on to the spacecraft bus, and rotates to allow the wing to always face the sun. The additional time required to remove, fix, reinstall, and test the SADA made achievement of the March 2016 launch date very unlikely.

NOAA has known for some time that the integration and test schedule was aggressive, yet believed that the March 2016 launch date was achievable and the GOES-R team continued to address the integration challenges. In the May – July 2015 timeframe, it became clear to NOAA, NASA, and Lockheed Martin that Lockheed Martin would not be able to maintain the pace needed to meet a March 2016 launch date based on integration and test (I&T) execution inefficiencies, including complications associated with the complexity of the spacecraft and the SADA failure.

As a result, NOAA, in its role as the overall GOES-R Series program manager, consulted with NASA and Lockheed Martin to initiate the steps to establish a new supportable launch readiness date. The next possible launch date was in October 2016 and we determined that the GOES-R satellite would be ready with reasonable schedule reserve for that date. With a new launch date of October 2016, the government and its contractors can focus on completing the GOES-R satellite and meet the expectations of our users and stakeholders. I want to stress that there are still risks in front of us to get this newly designed, highly capable and complex satellite launched on time. An example of this includes concerns with failed transistor parts in the Scalable Power Regulator Units (SPRUs) that would affect the satellite's ability to charge and discharge its batteries. Troubleshooting of the failed transistors revealed high moisture and nickel dendritic growth inside the transistor. Consequently, we have directed Lockheed Martin to remove all transistors from the affected lot and install replacements. We anticipate these repairs will take a couple months to complete but do not expect it to affect GOES-R's launch schedule at this time.

Status of the GOES-S Satellite

The GOES-R Series Program continues to make steady progress with the GOES-S spacecraft and the six flight instruments. All GOES-S instruments have been delivered for integration to the GOES-S spacecraft. The ABI, EXIS, and SEISS instruments were delivered in September 2015, and the GLM was delivered in November 2015. The SUVI and EXIS instruments have been successfully installed on the GOES-S solar pointing platform. The GOES-S System Module integration and testing continues. Additionally, the GOES-S propulsion module was delivered in October 2015 to the Lockheed Martin Denver facility in preparation for integration with the GOES-S system module. With the GOES-R launch delay, NOAA expects a downstream impact on the development schedule for the GOES-S satellite. The GOES-R Series Program is currently assessing the extent to which the GOES-S satellite will be delayed.

Status of the GOES-R Series Ground System

Excellent progress continues to be made on the ground system. The satellite command and control system and the data processing and distribution capability have been delivered, initial checkout and testing has been completed and they are now in the hands of the operations team. All NOAA Satellite Operations Facility antennas have completed their certification, are being used for current operations, and are ready for GOES-R operations. Two 16-meter antennas at NOAA's Wallops, Virginia Command, Data, and Acquisition Station are complete and available for current operations. The GOES-R Series Program also completed its third successful Data Operations Exercise which delivered 14 days of simulated data to the NWS.

II. Polar-orbiting Operational Environmental Satellites

NOAA's polar-orbiting operational environmental satellites provide full global coverage for a broad range of weather and environmental applications. Placed in the afternoon orbit, these satellites provide observations to support NOAA's three to seven-day operational weather forecasts, operational weather "nowcasting" in Alaska and polar regions, and environmental monitoring and prediction.

Partnership with EUMETSAT

Through NOAA's partnership with EUMETSAT, their Metop satellite constellation (Metop A and Metop B), which fly in the mid-morning orbit, has provided a significant amount of the critical observations that NOAA assimilates into its operational NWP models. NOAA is working with EUMETSAT to integrate the three NOAA instruments[1] that will be hosted on the Metop C satellite when it launches in 2018. EUMETSAT hosted the same three NOAA-provided instruments which currently fly on the Metop A and Metop B. By leveraging these data from EUMETSAT, NOAA avoids the cost of building and launching its own satellite system in the mid-morning orbit. NOAA is also working with EUMETSAT as they develop their Metop-Second Generation constellation which will be launched and operational in the early 2020s. NOAA and EUMETSAT plan to establish a new agreement in December 2015 which will continue this very successful polar-orbiting partnership over the next two decades with mutual full, open, free, and timely data sharing.

[1] Space Environment Monitor (SEM); Advanced Very High Resolution Radiometer (AVHRR); Advanced Microwave Sounding Units (AMSU).

II.1 Status of Suomi NPP

The Suomi NPP satellite is NOAA's primary afternoon polar-orbiting satellite; it was launched in October 2011 with a five-year design life. Its Advanced Technology Microwave Sounder and Cross-track Infrared Sounder instruments provide operational data to NOAA's operational NWP models. The Visible Infrared Imaging Radiometer Suite instrument provides operational now-casting observations in Alaska and polar regions, in addition to other environmental observations. Other NOAA, NASA, and Department of Defense legacy system satellites are currently providing additional observations from the afternoon orbit and other orbit crossing times.

Suomi NPP continues to function well, completing its fourth year on orbit on October 28, 2015. The second annual Operations Status Review, followed by the NOAA/NASA Suomi NPP Joint Steering Group, confirmed that the mission is meeting or exceeding expectations in quality of the data products. Recently the JPSS Program completed a first edition of the Suomi NPP Longevity Plan, and NOAA has implemented steps as recommended in that plan to maintain the long-term health of Suomi NPP. NOAA's annual lifetime analysis report indicates a high probability (greater than 80 percent) that the expected lifetime of Suomi NPP will extend beyond JPSS-1 launch and commissioning. The pace of user adoption of Suomi NPP data has substantially exceeded past missions flying new design instruments for the first time.

Partnership with Japan Aerospace Exploration Agency (JAXA)

The NOAA partnership with JAXA continues to provide important returns to our forecasting products. The JAXA Global Change Observation Mission 1-Water (GCOM-W) supplies data to meet key JPSS Program water cycle observation requirements. NOAA forecasters are using data from the GCOM-W polar-orbiting satellite which flies the Advanced Microwave Scanning Radiometer 2 (AMSR2) instrument. AMSR2 data improve forecasters' ability to monitor the development, location, and structure of tropical cyclones, specifically, high-resolution imagery and rainfall measurements that aid hurricane specialists and weather forecasters in tracking the precipitation intensity, location, and structure of tropical cyclones, (also known as hurricanes). Ice concentration information from AMSR2 and ice coverage information from the Multisensor Analyzed Sea Ice Extent product are blended together to substantially improve ice forecast skill. By leveraging these data from JAXA, NOAA avoids the cost of building and launching its own satellite system in order to produce AMSR2 data.

II.2 Status of JPSS-1 development

NOAA is working with NASA as its acquisition partner and with the support of the private sector to continue building NOAA's next-generation polar-orbiting operational environmental satellite constellation, the JPSS Program. The JPSS Program consists of three satellites, Suomi NPP, JPSS-1 and JPSS-2; associated instruments, the ground system, mission management and operations, product generation and distribution, and management. The JPSS Program is focused to support the weather mission and the following instruments:

- Advanced Technology Microwave Sounder (ATMS)
- Cross-track Infrared Sounder (CrIS)
- Visible Infrared Imaging Radiometer Suite (VIIRS)
- Ozone Mapping and Profile Suite (OMPS)-Nadir[2]
- Clouds and the Earth's Radiant Energy System (CERES), only on Suomi NPP and JPSS-1 and accommodations for a NASA-provided Radiation Budget Instrument (RBI) on JPSS-2

The launch commitment date for the JPSS-1 satellite of no later than the second quarter of FY 2017 remains unchanged since the Congressional Baseline Report was submitted in November 2014. JPSS-1 satellite integration and test work is on track. The JPSS Program encountered an issue with ATMS that delayed its delivery to the spacecraft by more than a year, until December 2015. However, the team managed the overall systems integration to maintain the JPSS-1 launch date. The issue stemmed from a set of parts built under the predecessor program. The ATMS had to be disassembled and the problem parts repaired; then the instrument required re-assembly and retest. That retest is going well, and ATMS is forecast to be delivered prior to the need date at the end of December 2015.

Status of the JPSS ground segment

Suomi NPP was launched in 2011 as a NOAA-NASA risk reduction mission, which we decided to use operationally as a gap mitigation measure between the end of the NOAA-19 useful life and when JPSS-1 would begin to provide data for operational use. The ground system met the performance requirements for this risk reduction mission but was not designed with the necessary features required to meet NOAA's operational mission requirements for IT security and 24x7 robustness. The JPSS Ground System upgrade, Block 2, will meet all NOAA's operational requirements. The version of the JPSS ground segment currently deployed continues to support operations. The Block 2 upgrade provides multi-mission capability, supportable modern hardware and software, IT security features, and robustness. All the hardware and software have been deployed at all operating sites and all the major integration activities have been conducted. Parts of the new system have transitioned to operations with the currently deployed system.

The new system recently progressed into its second integrated test exercising all functions, and supported the first joint test with the JPSS-1 satellite. From the tests, we have identified issues to be addressed and added additional expertise to the ground development team. An independent review of the ground system is scheduled to occur shortly. The Ground System Block 2 will continue the support to Suomi NPP in FY 2016 and provide the additional support needed for the JPSS-1 launch in early FY 2017.

The schedule of remaining ground system test and verification events and activities will continue to be coordinated with the JPSS-1 flight schedule to minimize conflicts and ensure readiness for the JPSS-1 launch.

[2] The OMPS-Nadir and -Limb sensors are currently flying on Suomi NPP. NOAA will fund OMPS-Nadir for JPSS-1, JPSS-2, PFO/JPSS-3 and PFO/JPSS-4. NASA will fund and provide OMPS-Limb for JPSS-2.

II.3 Status of JPSS-2 development

The JPSS-2 development is well underway. All four instruments are in the parts procurement, sub-assembly integration, and test phase. Some significant risks have been successfully addressed as these instruments progress. The spacecraft work for JPSS-2 was initiated in July 2015, and the first review milestone for it was successfully conducted this fall. The JPSS Program is working towards the accelerated JPSS-2 launch commitment date of the first quarter of FY 2022.

In summary, Suomi NPP is performing very well, and despite some challenges in both flight and ground, we are within budget and on schedule for JPSS-1 and JPSS-2.

II.4 Polar Follow-on (PFO)

The FY 2016 budget requested $380 million for PFO to initiate a robust polar observing system in the afternoon orbit through approximately 2038. PFO is a necessary continuation of the JPSS Program, poised to be implemented with the receipt of FY 2016 appropriations.

This planning is aimed at achieving a robust and fault-tolerant position as recommended by the Government Accountability Office (GAO), the Office of Inspector General, external reviews by the Tom Young-chaired Independent Review Team (IRT), and Congressional direction. The PFO plan achieves a resilient and fault-tolerant position by 2023 and secures that position through approximately 2038. To implement the plan, the President's FY 2016 budget requested funds to acquire two additional satellites as copies of the JPSS-2 model - PFO/JPSS-3 and PFO/JPSS-4. This request represents the minimum funding required to achieve robustness at the earliest possible date. This funding provides continuation of all instrument contracts for PFO/JPSS-3 and PFO/JPSS-4 and ensures best value by continuing a two instrument block buy based on the design and manufacturing processes proven with the JPSS-2 instrument procurements. The PFO plan retires significant instrument development hardware and schedule risks through smooth continuation of the JPSS-2 contracts. It also enables the soonest delivery of the PFO/JPSS-3 and PFO/JPSS-4 missions to a launch ready state to secure a robust polar constellation as early as possible (in 2023). The availability of PFO/JPSS-3 hardware will provide NOAA the option to launch a contingency sounder-only mission in the event JPSS-1 fails earlier than expected or the JPSS-2 satellite experiences a launch mishap. To ensure that the planning activities remain on track, NOAA has successfully utilized prior support from Congress to prepare the necessary contractual actions needed for rapid progress starting early in FY 2016.

In addition, PFO tests the cutting-edge microwave sensor, EON-MW, to be hosted on a proven cubesat platform. This approach develops and demonstrates potentially revolutionary technologies which could lower cost and enable the development of more robust future systems. The launch of EON-MW in FY 2019 will provide near-term gap mitigation benefits for NOAA's current systems.

III. Solar Wind Measurement from Lagrange-1

NOAA has an operational requirement for continuous measurement of solar wind data from Lagrange-1 point, which is approximately 1 million miles toward the Sun from Earth. Solar wind is the constant stream of charged particles and magnetic fields emitted from the sun. Like terrestrial weather in Earth's atmosphere, space weather refers to conditions like solar wind in the solar system and particularly in near-Earth space. Space weather events can cause geomagnetic storms, and solar wind data are the sole input for short-term warnings (15 - 45 minutes) of such geomagnetic storms. Geomagnetic storms have the potential to cause significant economic impact to telecommunications and electrical grid infrastructure that are particularly sensitive to these space weather phenomena.

III.1 Status of the Deep Space Climate Observatory (DSCOVR)

The DSCOVR satellite was successfully launched in February 2015 to meet solar wind operational requirements of the NWS Space Weather Prediction Center (SWPC) and the Air Force Space Weather Agency. These solar wind requirements have been met until now by using data from NASA's research satellite, the Advanced Composition Explorer (ACE). However, the ACE mission was launched in 1997 and has been operating beyond its design life. DSCOVR has a five-year planned mission and provides continuity of these data at the Lagrange-1 point. DSCOVR reached its intended orbit on schedule this June and has been undergoing post-launch calibration and validation activities. The DSCOVR satellite was successfully handed from NASA to NOAA for operational command and control on October 28, 2015. After extended commissioning and calibration, the NWS SWPC will transition to using DSCOVR data operationally, expected in Spring 2016.

Currently, NOAA's space-based solar wind detection system is operating as a single-string constellation. The President's FY 2016 Budget request initiates a number of steps to build in robustness to this important data requirement through two separate funding requests. The first is to provide funds to operate DSCOVR, and the second is to provide funds to begin to analyze options from the Analysis of Alternatives for critical space weather observations and to initiate development of the Space Weather Follow-on mission. A typical development cycle for a program of this type is 48 months from contract award to launch; therefore it is imperative that NESDIS begin this work in FY 2016 in order to begin the detailed program work in FY 2017. This schedule enables the Space Weather Follow-on mission to be in place soon after the DSCOVR satellite reaches its five-year mission life in 2020.

IV. Satellite Altimetry – Jason series

Starting with Topex/Poseidon and continuing with Jason-1 and Jason-2, NOAA has used satellite altimetry data to provide precise measurement of sea surface height for several applications, including but not limited to, ocean modeling, forecasting El Niño/La Niña events, and hurricane intensity prediction. The Jason series program is a joint program among NOAA, NASA, EUMETSAT, and CNES (the French Space Agency), with costs shared among all partners and data shared globally on a full, free, open, and timely basis.

The current satellite on orbit is Jason-2. Jason-2 was launched in 2008 and is operating two years beyond its design life of five years, and it continues to provide data to support civil and military

user requirements. The follow on, Jason-3, has been developed and was scheduled for launch in August 2015 on a SpaceX Falcon 9 launch vehicle. However, the loss of the SpaceX International Space Station resupply mission on June 28, 2015 has delayed the launch until the successful resolution of the SpaceX-related launch issues. We anticipate SpaceX will conclude their Accident Investigation Team activity with the FAA soon, and that the NASA Launch Services Program (LSP) will shortly thereafter also conclude their Independent Review Team (IRT). The results of the NASA LSP-led IRT will inform whether NASA believes that the SpaceX launch vehicle is ready to successfully launch the Jason-3 satellite. The goal is to launch Jason-3 in time to provide for on-orbit calibration with Jason-2.

The President's FY 2016 Budget request for Jason-3 proposes to transition the acquisition, development, and deployment of future space-based ocean altimetry observations to NASA, who will work in partnership with EUMETSAT and other European partners. NOAA and NASA and its European partners are discussing the appropriate data sharing agreements that will provide for continued support of NOAA's operational data requirements.

V. Radio Occultation – COSMIC Series

The Constellation Observing System for Meteorology, Ionosphere, and Climate (COSMIC) activity is a six-satellite constellation launched in 2006 as a joint collaboration research effort with costs and responsibilities shared among Taiwan, National Science Foundation, NASA, the U.S. Air Force (USAF), and University Corporation for Atmospheric Research (UCAR). Using data from the COSMIC mission, NOAA validated that atmospheric soundings provided through this radio occultation (RO) approach improved the quality of NWP forecasts. NOAA began using these experimental system observations operationally in NWS NWP models shortly after the observations were available in 2006. These RO data have been made available globally on a full, free, open, and timely basis. NOAA's Commercial Policy outlines how NOAA would evaluate commercially available RO data that could supplement data from the COSMIC series to support NOAA's weather and environmental observation requirements.

V.1 Status of the COSMIC-1 Series

The satellites in the COSMIC-1 series reached the end of their design lives in April 2011; currently one satellite has failed and two satellites are in degraded operation, leaving five of the original six satellites that are still providing data or in a degraded capacity.

V.2 Status of COSMIC-2 Development

The COSMIC-2 constellation is a continuation of the COSMIC-1 mission with advanced technology that will significantly increase the geographic coverage and quantity of observations. Under a partnership agreement between the United States (NOAA and USAF) and Taiwan, the COSMIC-2 mission will develop and deploy an operational constellation of 12 Global Navigation Satellite System (GNSS) Radio Occultation (RO) satellites; the first six will be launched into an equatorial orbit, and the second six into a polar orbit. The COSMIC-2 constellation is expected to provide ten times the number of daily soundings that COSMIC-1 currently provides, which would increase the benefits to weather forecasting. Activities to

support launch of the first set of satellites in equatorial orbit, COSMIC-2A, are on track for a planned launch in in late FY 2016 / early FY 2017.

COSMIC-2B, the polar-orbiting second set of six satellites, is at the beginning stages of development with the goal of a planned late FY 2018 / early FY 2019 launch date. Taiwan has received permission to acquire the COSMIC-2B spacecraft buses, and NOAA has requested funds in the President's FY 2016 Budget request to begin development of the COSMIC-2B instruments. NOAA is working with NASA's Joint Agency Satellite Division in the Science Mission Directorate to provide the acquisition of the COSMIC-2B instruments.

VI. Solar Irradiance, Data, and Rescue (SIDAR)

SIDAR is an international partnership among the United States, CNES, and the Department of National Defence – Canada (DND). CNES and DND are jointly providing the equivalent of approximately USD $100 million of support in the form of SARSAT and Argos ADCS instruments for the SIDAR program. NOAA funded development of the Total and Spectral Solar Irradiance Sensor (TSIS). The President's FY 2016 Budget proposed transfer of TSIS to NASA for launch to the International Space Station by 2017. This transfer was completed at the beginning of FY 2016. NASA's Earth Science Division within the Science Mission Directorate is responsible for seeking TSIS flight opportunities.

When NOAA-19 was launched in February 2009, it carried two communications instrument suites: the Search and Rescue Satellite-aided Tracking (SARSAT) and Argos Data Collection System (Argos DCS).

Cospas-Sarsat is an international, humanitarian search and rescue system that uses satellites to detect and locate emergency beacons carried by ships, aircraft, or individuals. The system consists of a network of satellites, ground stations, mission control centers, and rescue coordination centers. Search and rescue instruments are flown on polar-orbiting satellites. These instruments detect signals transmitted from emergency beacons on the Earth's surface. The search and rescue instruments are built by the DND and by CNES and provided to NOAA for flight and on-orbit operations. Since SARSAT went operational in 1982, more than 37,000 people have been rescued worldwide, including 7,700 people in the U.S.; 240 people were rescued in the U.S. in 2014. The United States Code of Federal Regulations requires that general aviation[3] and maritime[4] vessels carry these emergency location beacons on-board.

The Argos Data Collection and location System (DCS) is a data collection and relay program that provides global coverage and platform location. The Argos system aboard polar-orbiting satellites provides worldwide coverage. Additionally, incorporating the Argos instrument on a moving satellite allows for locating an *in situ* platform using Doppler shift calculations. This positioning capability permits a wide variety of applications such as monitoring drifting ocean buoys and studying wildlife migration paths. A global operational system since 1970, Argos DCS has nearly 2,000 users who currently track more than 20,000 active platforms placed on

[3] 14 CFR 91.207 - Emergency locator transmitters

[4] 46 CFR Part 25, Subpart 25.26 - Emergency Position Indicating Radio Beacons (EPIRB)

wildlife, meteorological and oceanographic buoys, fishing vessels, and other sensitive commodities. Notably, U.S. applications account for approximately 40 percent of total system use, on average; there are 44 distinct projects being managed by various NOAA offices.

Both constellations require replenishment to ensure continuity of these critical services. The President's FY 2016 Budget request for SIDAR is NOAA's plan to accommodate SARSAT and enhanced Argos Advanced DCS (Argos ADCS) instruments for launch in 2019. The FY 2016 Budget request transfers the built Total and Spectral Solar Irradiance Sensor (TSIS) to NASA for launch onto the International Space Station in 2017.

NESDIS is finalizing an interagency agreement with the U.S. Air Force to use its Hosted Payload Solution (HoPS) contract for commercial hosting of the Argos Advanced-Data Collection System (A-DCS) and SARSAT instruments. NOAA funding requested in FY 2016 enables NOAA to continue work with the HoPS program.

CONCLUSION

The nation's weather satellite programs are proceeding well through the final integrated systems test phase leading to the planned launch of GOES-R in October 2016, and JPSS-1 no later than March 2017. This progress is only possible with the close coordination between NOAA and NASA, and its partners, and with the continued support of the Administration and the Congress. We are confident in the combined expertise of our NOAA, NASA, and aerospace partner teams, and the proven acquisition processes that have supported the successes of the GOES-R Series and JPSS Programs. NOAA has been working steadily to rebuild the robustness of the geostationary and polar-orbiting satellite constellations, while taking maximum advantage of existing NOAA and international and interagency partner orbital assets to provide robustness and redundancy today. NOAA is also progressing well in the development of other satellite systems in partnership with other U.S. and international agencies. The Jason-3 satellite has completed development and is awaiting resolution of SpaceX launch issues before it can be launched. The COSMIC-2A satellites are on schedule for launch in late FY 2016 / early FY 2017. NOAA is preparing to pursue commercial hosted payload opportunities to provide continuity of the SARSAT and Argos-Data Collection System using Air Force contracting processes.

Finally, NOAA values the long-standing interest by the Committee in NOAA's satellite programs. We understand the difficult fiscal environment that we find ourselves in and appreciate the Congressional support to ensure that these critical national programs are supported to the maximum extent possible.