

**Before the
Federal Communications Commission
Washington, DC 20554**

In the Matter of)
)
Amendment of the Commission’s Rules) ET Docket No. 23-121
Regarding Implementation of the Final)
Acts of the World Radiocommunication)
Conference (Sharm el-Sheikh, 2019))
(WRC-19), Revision to Table Mountain)
Radio Quiet Zone Field Strength Limits)

**REPLY COMMENTS OF THE
NATIONAL ACADEMY OF SCIENCES’
COMMITTEE ON RADIO FREQUENCIES**

The National Academy of Sciences, through its Committee on Radio Frequencies (hereinafter, CORF),¹ hereby submits its Reply Comments² in response to the Federal Communications Commission’s (FCC’s) *Notice of Proposed Rulemaking* (NPRM) in the above-captioned docket, FCC 25-59 (released December 9, 2025). In these comments, CORF discusses protections for passive Earth remote sensing and radio astronomy observations in connection with proposed updated rules for earth stations in motion communicating with geostationary orbit (GSO) fixed-satellite service space stations in the 17.7–19.7 GHz and 27.5–29.5 GHz bands, fixed earth stations transmitting at 49.7–50.2 GHz and 50.4–50.9 GHz (“50 GHz”), and for Global Maritime Distress Safety Systems at 1.6 GHz.

I. Introduction – Radio Astronomy and the Earth Exploration Satellite Service

CORF has a substantial interest in this proceeding because it represents the

¹ See the Appendix for the membership of the Committee on Radio Frequencies.

² CORF herein replies to the Comments filed in this proceeding by CTIA, Verizon, and Iridium Communications, Inc.

interests of the users of the passive scientific bands of the radio spectrum, including users of the Radio Astronomy Service (RAS) and the Earth Exploration Satellite Service (EESS) bands.

As the FCC has long recognized, radio astronomy is a vitally important tool used by scientists to study the universe. It was through the use of radio astronomy that scientists discovered the first planets outside the solar system, circling a distant pulsar. The Nobel Prize–winning discovery of pulsars by radio astronomers has led to the recognition of a widespread population of rapidly spinning neutron stars with surface gravitational fields up to 100 billion times stronger than that on Earth. Subsequent radio observations of pulsars have revolutionized understanding of the physics of neutron stars and have resulted in the first experimental evidence for gravitational radiation, which was recognized with the awarding of another Nobel Prize. Radio astronomy has also enabled the discovery of organic matter and prebiotic molecules outside the solar system, leading to new insights into the potential existence of life elsewhere in the Milky Way Galaxy. Radio spectroscopy and broadband continuum observations have identified and characterized the birth sites of stars in the Milky Way, the processes by which stars slowly die, and the complex distribution and evolution of galaxies in the universe. The enormous energies contained in the enigmatic quasars and radio galaxies discovered by radio astronomers have led to the recognition that most galaxies, including the Milky Way, contain supermassive black holes at their centers, a phenomenon that appears to be crucial to the creation and evolution of galaxies.

Synchronized observations using widely spaced radio telescopes around the world with Very Long Baseline Interferometry give extraordinarily high angular

resolution, far superior to that which can be obtained using the largest optical telescopes on the ground or in space. Indeed, the first image of a supermassive black hole in the M87 galaxy and its shadow were obtained by such an array of radio telescopes,³ followed most recently by observations of the black hole at the center of the Milky Way Galaxy.⁴

The critical scientific research undertaken by RAS observers, however, cannot be performed without access to interference-free spectral bands. Notably, the emissions that radio astronomers receive are extremely weak: a radio telescope receives less than 1 percent of one-billionth of one-billionth of a watt from a typical cosmic object. Because radio astronomy receivers are designed to pick up such remarkably weak signals, radio observatories are particularly vulnerable to interference from in-band emissions, spurious and out-of-band emissions (OOBEs) from licensed and unlicensed users of neighboring bands, and emissions that produce harmonic signals in the RAS bands, even if those human-made emissions are weak and distant.

The FCC has also long recognized that satellite-based Earth remote sensing is a critical and uniquely valuable resource for monitoring the state of the global atmosphere, oceans, land, and cryosphere. For certain applications, satellite-based passive microwave remote sensing represents the only practical method of obtaining

³ See The Event Horizon Telescope Collaboration, 2019, *The Astrophysical Journal Letters*, 875, L1. <https://doi.org/10.3847/2041-8213/ab0ec7>. See also J. Greene, "Black Hole Photo Was No Big Surprise to Scientists. Here's Why It's Still a Big Deal," *Washington Post*, April 12, 2019, <https://www.washingtonpost.com/opinions/2019/04/12/black-hole-photo-was-no-big-surprise-scientists-heres-why-its-still-big-deal/>; S. Kaplan and J. Achenbach, "See a Black Hole for the First Time in a Historic Image from the Event Horizon Telescope," *Washington Post*, April 10, 2019, <https://www.washingtonpost.com/science/2019/04/10/see-black-hole-first-time-images-event-horizon-telescope/>; and D. Overbye, "Darkness Visible, Finally: Astronomers Capture First Ever Image of a Black Hole," *New York Times*, April 10, 2019, <https://www.nytimes.com/2019/04/10/science/black-hole-picture.html>.

⁴ See The Event Horizon Telescope Collaboration, 2022, *The Astrophysical Journal Letters*, 930, L2. <https://doi.org/10.3847/2041-8213/ac6674>.

atmospheric and surface data for the entire planet.⁵ EESS (passive) data have made critical contributions to the study of meteorology, atmospheric chemistry, climatology, hydrology, and oceanography. Currently, instruments operating in the EESS (passive) bands provide regular and reliable quantitative atmospheric, oceanic, land, and cryospheric measurements to support a variety of scientific, commercial, and government (civil and military) data users. EESS (passive) satellites represent billions of dollars in investment and provide data for major governmental users, including the National Oceanic and Atmospheric Administration (NOAA), the National Science Foundation, the National Aeronautics and Space Administration, the military (especially the U.S. Navy and U.S. Air Force), the U.S. Department of Agriculture, the U.S. Geological Survey, the Federal Emergency Management Agency, and the U.S. Forest Service. These agencies use EESS data on issues impacting trillions of dollars in the U.S. economy, as well as safety of life,⁶ national security,⁷ and scientific investigation.

Satellite remote sensing data are an essential resource for accurate weather prediction. NOAA and its National Weather Service are major users of these data. NOAA has estimated that about *one-third of the U.S. economy*—trillions of dollars

⁵ For a more detailed summary of how passive Earth remote sensing (EESS) works, see “The Spectrum Needs of U.S. Space-Based Operations: An Inventory of Current and Projected Uses,” National Telecommunications and Information Administration, Office of Spectrum Management, July 2021 (*NTIA Report*), pp. 13–18, <https://www.ntia.gov/report/2021/spectrum-needs-us-space-based-operations-inventory-current-and-projected-uses> (last viewed January 14, 2026).

⁶ See, e.g., *NTIA Report*, p. 21: “Should a disaster occur, EESS has a crucial role in disaster management. EESS data shows heat levels, as well as sea and lake ice levels, to help identify the areas affected, plan relief operations, and monitor the recovery from a disaster” (citations omitted).

⁷ See, e.g., “From Orbit to Operations: How Weather Satellites Support the National Security Mission,” Hearing before the Subcommittee on the Environment, Committee on Science, Space and Technology, U.S. House of Representatives, January 13, 2026; written testimonies of Irene Parker, Deputy Assistant Administrator, National Oceanic and Atmospheric Administration; Col. Bryan D. Mundhenk, Chief, Weather Operations Division, U.S. Air Force; and Christopher Ekstrom, Deputy Oceanographer and Navigator, U.S. Navy, <https://science.house.gov/2026/1/subcommittee-environment-hearing> (last viewed January 14, 2026).

annually—is sensitive to weather and climate.⁸ A NOAA report⁹ estimated that weather forecasts alone generated \$35 billion in annual economic benefits to U.S. households in 2016. NOAA has also stated that “NOAA weather forecasts and warnings are critical to people living in areas subject to severe weather, and to all Americans who depend on the economic vitality that these regions contribute. Accurate predictions of extreme weather location and severity are essential. Having time to prepare for extreme events limit their impact.”¹⁰

The critical research performed by Earth remote sensing scientists cannot be performed without access to interference-free bands. A report released by the National Telecommunications and Information Administration stated that:

[D]ue to the extreme sensitivity required to sense physical phenomena such as water vapor—in different heights of the atmosphere—and sea salinity, passive sensing bands are extremely vulnerable to interference coming from transmitters operating in adjacent bands with unwanted emissions extending into the passive band.¹¹

The signals measured by EESS (passive) sensors are extremely weak compared to those emitted by active communication services as they correspond to thermal emission and would be considered “noise” in any active use of the radio spectrum. Furthermore, the scientific information is obtained not as much from the signals themselves as from the yet smaller variations (spatial and temporal) within those signals that enable quantification of meteorological processes, natural variability, and longer-term changes.

⁸ See NOAA Weather homepage, <https://www.noaa.gov/weather> (last viewed January 14, 2026).

⁹ See “NOAA by the Numbers,” June 2018, p. 8, <https://www.noaa.gov/sites/default/files/legacy/document/2019/Nov/NOAA-by-the-Numbers-Accessible-Version-Corrected-17-JUL-18%20%281%29.pdf> (last viewed January 14, 2026).

¹⁰ See “NOAA’s Contribution to the Economy; Powering America’s Economy and Protecting Americans” NOAA, 2018, p. 8, <https://www.noaa.gov/sites/default/files/legacy/document/2019/Nov/NOAA-Contribution-to-the-Economy-Final.pdf> (last viewed January 14, 2026).

¹¹ See *NTIA Report*, *supra* note 5, p. 15.

Accurate scientific interpretation of these measurement variations for weather forecasting or Earth system research demands confidence that the observed variations reflect true geophysical processes, not the presence or absence of interfering emissions. As EESS sensors in space monitor globally and view large swaths of the surface at one time, they are thus subject to aggregate interference from emitters in the area scanned (both the areas on Earth and the regions of cold space used for calibration) or from other directions via antenna sidelobes.

II. Protection of Radio Astronomy at 1610.6–1613.8 MHz

The NPRM proposes to allocate the 1613.8–1626.5 MHz band to the Maritime Mobile-Satellite Service (MSS) on a primary basis for federal and non-federal shared use to provide additional satellite coverage to the Global Maritime Distress and Safety System (GMDSS) subject to four footnotes listed in the U.S. Table of Allocations. One of those footnotes would be ITU Footnote 5.208B, which would protect stations of the RAS observing in the adjacent 1610.6–1613.8 MHz band from harmful interference. CORF supports this proposal, as it would serve the public interest in protecting an important band for scientific observations.

The 1610.6–1613.8 MHz band is used for spectral line observations of the hydroxyl radical (OH). The OH transition at rest frequency 1612.231 MHz is one of the most important spectral lines for RAS and is listed as such in the International Telecommunication Union Radiocommunication Sector (ITU-R) Recommendation ITU-R RA.314-10.¹² OH was the first cosmic radical to be detected at radio frequencies and

¹² The spectral line at 1612.231 MHz is also listed as one of the lines of greatest importance to radio astronomy, see *Handbook on Radio Astronomy* (ITU Radiocommunication Bureau, 2013), p. 37, Table 3.2, https://www.itu.int/dms_pub/itu-r/opb/hdb/R-HDB-22-2013-PDF-E.pdf (last viewed February 26, 2026).

continues to be a powerful research tool. The study of OH lines provides information on a wide range of astronomical phenomena, including the formation of protostars and the evolution of stars. For these reasons, RAS observations in this critical band have long been subject to protection; for example, in Section 25.213 of the FCC's rules. RAS has a co-primary allocation in the 1610.6–1613.8 MHz band and the MSS is permitted only Earth-to-space. Footnote US342¹³ also applies in this band. U.S.-based RAS facilities that make use of sensitive receivers in this band include the Green Bank Radio Telescope in West Virginia and the Karl G. Jansky Very Large Array in New Mexico. Future facilities such as the Deep Synoptic Array in Nevada will also be sensitive to this range. Accordingly, CORF supports the proposal in the NPRM to use Footnote 5.208B to protect RAS from interference from MSS and GMDSS operations by reference to Resolution 739 (Rev. WRC-19).

III. Protection of Remote Sensing/EESS at 50.2–50.4 GHz

The NPRM proposes an update to its rules for earth stations in non-geostationary Fixed Satellite Service (FSS) systems. Specifically, the FCC proposes to modify US156 of the FCC's rules to reflect WRC-19's revision of the limits for unwanted emissions into the 50.2–50.4 GHz passive band from earth stations in the FSS (Earth-to-space) that transmit in the 49.7–50.2 GHz and 50.4–50.9 GHz bands. CORF supports this proposal as serving the public interest in protecting critical remote sensing/EESS observations at 50.2–50.4 GHz.

The 49.7–50.2 GHz and 50.4–50.9 GHz bands used for satellite earth station

¹³ Per Footnote US342, "all practicable steps shall be taken to protect the radio astronomy service from harmful interference. Emissions from spaceborne or airborne stations can be particularly serious sources of interference to the radio astronomy service."

communications in the NPRM are immediately proximate (on both sides) to the 50.2–50.4 GHz oxygen absorption band, which is essential for atmospheric temperature profiling and surface emission characterization. This band is critical for the surface characterization, which is necessary for both lower atmospheric temperature profiling and to retrieve precipitation intensity at the surface (liquid or solid). The FCC has previously recognized the 50.2–50.4 GHz EESS band “essential for the calibration of other passive band data.”¹⁴

The 50–60 GHz EESS (passive) bands have a very long history for operational observations, beginning in 1978, with the Microwave Sounding Unit launched on the NOAA Television and Infra-Red Observation Satellite and extending to the current NOAA Joint Polar Satellite Series (JPSS).¹⁵ Multiple international space agencies currently use these frequency bands as well. Continuity missions are planned by the U.S. and international space agencies that extend at least through 2048. Together, these represent substantial investments.

CORF notes that the entire 50–60 GHz temperature sounding spectral region is critically important for weather prediction forecast accuracy, disaster management, and long-term weather and Earth system trend assessment. As such, the satellite observations made in this spectral band have “useable” lifespans extending long after their initial use in numerical weather analysis and forecasting applications.

¹⁴ See *Implementation of the Final Acts of the World Radiocommunication Conference (WRC-07), Other Allocation Issues, and Related Rule Updates*, Notice of Proposed Rulemaking and Order, 27 FCC Rcd 14598 at ¶ 107 (2012).

¹⁵ See <https://www.nesdis.noaa.gov/our-satellites/currently-flying/joint-polar-satellite-system>. Additionally, it should be noted that observations at 51.76 GHz have been in operational use on the JPSS Advanced Technology Microwave Sounder instrument since 2012, with current and planned missions extending out through at least 2041. This frequency band increases the sensor sensitivity to the lower atmosphere temperature profile.

The 50.2–50.4 GHz band has a primary allocation for EESS (passive) and is protected under RR 5.340 (“all emissions prohibited”). This band is also referenced in mandatory limits in ITU-Resolution 750 (Rev. WRC-19) governing the level of unwanted emissions from FSS Earth-to-space links.

Although CORF supports the implementation of stricter limits in its proposed modification to U.S. Footnote 156 for OOB in the 50.2–50.4 GHz spectra, as noted below, further protection might be warranted despite these recommended limits and considering the expected proliferation and increased spatial density of Earth stations and increased number of uplink beams per station.

Based on the recommendations set in ITU-R RS.2017-0, the maximum interference level for an EESS sensor operating in the 50.2–50.4 GHz spectra is –166 dBW per 200 MHz of bandwidth. The maximum interference levels in ITU-R RS.2017-0 are allowed to be exceeded for defined percentages of area or observing time, and for nadir and conical scanning remote sensors operating in the bands being considered here the exceedance fraction is $f = 0.01\% = 10^{-4}$. In order to convert maximum interference levels as stated in ITU-R RS.2017-0 that are only allowed to exceed those levels for a fraction f , one approach is to use a suitable gain factor for the sidelobe level from a single uplink beam. These sidelobes are at a large enough angle off boresight such that, on average, the exceedance fraction defined in ITU-R RS.2017 is satisfied for this beam while the Earth station is within the EESS sensor footprint. For non-geostationary orbit (NGSO) or GSO stations without a model of the uplink beam pattern, it is necessary to invoke a generic sidelobe model. The generic near sidelobe model in the ITU-R S.456-6 is used for Earth station antenna performance standards. The solid

angle subtended by a small angle ϑ (radians) around the uplink boresight is $\Omega = \pi\vartheta^2$. If the Earth station beam pointing is assumed to be randomly distributed across a hemispherical sky within a 15 to 90 degree elevation angle (solid angle 1.48π), then encounters within an angular distance ϑ will occur a fraction $\Omega/1.48\pi = \vartheta^2/1.48$ of the time. Setting $\vartheta^2/1.48 = f$, then for $f = 10^{-4}$, $\vartheta = 0.012$ rad = 0.6 deg. Calculating the transmitter unwanted emission level using an uplink antenna gain factor corresponding to this angle off boresight will ensure that for the remaining fraction $(1 - f)$ of the time, the unwanted emission threshold will not be exceeded for this uplink beam. Based on ITU-R S.456-6¹⁶ and considering that the ground station beams have very high gains (around 57 dBi), a near-side lobe gain of G_t 32 dBi at 0.6 degree off boresight¹⁷ will be assumed for nadir and conical sounders.

The maximum allowed unwanted emission power P_t can be calculated using a link budget with maximum interference level P_r , G_t of the uplink sidelobe, sensor antenna gain G_r , free space loss L_{fs} , and atmospheric absorption loss L_{atm} . Sensor parameters from recommendation ITU-R RS.1861-1 are used to calculate the link budget. The link budget can be given as follows:

$$P_t = P_r - G_t - G_r + L_{fs} + L_{atm}$$

Unwanted emission limits for representative sensors from recommendation ITU-R RS.1861-1 are shown in Table 1 below.

¹⁶ CORF recognizes that ITU-R S.465-6 is intended for use up to 31 GHz, but notes that at present the ITU does not provide a similar recommendation for use at higher millimeter wave frequencies.

¹⁷ CORF recognizes that the sidelobe definitions are for antenna patterns at an angle greater than 1 degree off boresight and has used the lower dBi value for the transmit gain.

TABLE 1 Unwanted Emission Levels for Representative Earth Remote Sensing Instruments

ITU-R RS.1861-1 Sensor Designation	Channel Frequency Band (GHz)	Sensor Antenna Gain G_r (dB)	Altitude (km)	Incidence Angle (deg)	Free Space Path Distance (km)	Free Space Path Loss L_{fs} (dB)	Atmospheric Absorption Loss L_{atm} (dB)	Max Unwanted Emission Level P_t (dBW / 200MHz)
I2	50.2–50.4	34.4	830	57.5	1544	190.2	5.9	–36.2
I4	50.2–50.4	37.9	824	0/52	824/1338	184.8/189.0	3.1/5.1	–47.9/–41.7
I7	50.2–50.4	53.0	407	50	633	182.5	4.9	–63.5
I8	50.2–50.4	52.8	830	65	1963	192.3	7.5	–50.9
I9	50.2–50.4	36.3	595	0/62	595/1267	181.9/188.5	3.2/6.7	–49.1/–39.0

The GSO and NGSO modifications to U.S. Footnote 156 in the NPRM recommend unwanted emission levels that range from –45dBW/200MHz to –10dBW/200MHz for transmitted emission, dependent on viewing geometry, and antenna gain, as well as uplink control. The calculations presented in Table 1 illustrate that these recommendations are in most cases going to result in received power levels above the maximum unwanted emissions levels as stated in ITU RS.2017-0, and hence provide inadequate protections for EESS.

These limits also consider only a single uplink station and single uplink beam, and the problem is expected to become worse with increased deployment density. As such, while CORF supports the spirit of the proposal in the NPRM as providing some protection for EESS at 50.2–50.4 GHz, CORF suggests the FCC consider lowering the limits to meet the ITU RS.2017-0 levels and also consider the impact of potential aggregate emissions.

IV. Protection of EESS/Remote Sensing at 18.6–18.8 GHz from Emissions at 17.7–19.7 GHz and 27.5–29.5 GHz

The 18.6–18.8 GHz band has a primary allocation for EESS (passive). In

conjunction with measurements at 6.6, 10.6, and 36.5 GHz, observations in the 18.6–18.8 GHz band are used over ocean areas to retrieve surface wind speed (and direction for polarimetric microwave radiometers) from emissions from the rough ocean surface. This band also contributes information to measurements of over-ocean rain rate (in conjunction with information derived from other bands ranging from 10–90 GHz), sea-surface temperature (for which it reduces uncertainty related to surface roughness), precipitable water (water vapor), cloud liquid water, and soil moisture. The polarization of observed 18 GHz signals provides information on sea-ice concentration (in conjunction with measurements across many other bands from 1.4–90 GHz).

Remote sensing of land properties also makes heavy use of 18.6–18.8 GHz measurements, with snow cover and snow water equivalent estimated from 18 GHz observations in conjunction with measurements at 6.6, 10.6, 36.5, and 90 GHz. Similarly, mapping of continental ice relies on 18 GHz measurements along with those in other bands from 1.4–90 GHz. Estimates of over-land rain rate derive from measurements from 10–180 GHz, with the 18 GHz information being particularly valuable for observing extreme precipitation associated with severe weather events.

It is important to note that operational weather forecasting systems use information from the 18.6–18.8 GHz band and other bands as a combined system. Strong interference in this band reduces the measurement quality for all of the geophysical variables described above, even if other bands are interference free. In the worst-case scenario, if the impact of interference is large enough to give inaccurate information, but not so large as to be clearly identifiable and removed, weather forecasting systems will be fed inaccurate information, jeopardizing the accuracy of their

predictions.

The NPRM proposes to add Footnote 5.517A to the 17.7–19.7 GHz (space-to-Earth) and 27.5–29.5 GHz (Earth-to-space) frequency bands of the U.S. Table of Allocations. Footnote 5.517A states that “the operation of earth stations in motion (ESIMs) communicating with geostationary orbit FSS (GSO FSS) space stations in the 17.7–19.7 GHz (space-to-Earth) and 27.5–29.5 GHz (Earth-to-space) frequency bands shall be subject to the application of Resolution 169 (WRC-23) as described in the *WRC-23 Final Acts*.” This requires that ESIMs are subject to the same power flux density (PFD) limits as the FSS in these bands. At 18.6–18.8 GHz, RR 21.16.2 limits FSS (space-Earth) to a PFD that protects EESS measurements in a typical footprint from having error budgets dominated by isotropically scattered reflections from satellite downlinks. US255 limits FSS (space-earth) to the same level. While both US255 and the new footnote that points to RR 21.16.2 provide some protection to EESS observations at 18.6–18.8 GHz, if there are a large number of ESIMs in a single EESS observation footprint, these protections still may not be enough. CORF supports the proposal in the NPRM to use Footnote 5.517A to reference Resolution 769 (Rev. WRC-23) but notes the protection to EESS at 18.6–18.8 GHz may only just be on the edge of what is required and the FCC should consider enhancing the protection further at 18.6–18.8 GHz to ensure the veracity of these vital EESS measurements in the case of multiple ESIMs in a single EESS footprint.

V. Conclusion

CORF generally supports the FCC’s proposed implementation of the Final

Acts of WRC-19. Protection of sensitive remote sensing and radio astronomy observations would serve the public interest in promoting important scientific research and public safety. CORF reaffirms the importance of continuing footnote protection for RAS in the 1610.6–1613.8 MHz band and protection of EESS passive bands at 50.2–50.4 GHz and 18.6–18.8 GHz. While CORF notes that the proposed revisions regarding 50.2–50.4 GHz and 18.6–18.8 GHz unfortunately do not meet, or only barely meet, the protection levels required for compliance with ITU-RS.2017, CORF supports these proposals because they at least provide some additional protection for EESS observations in those bands. However, CORF recommends the FCC consider stricter limits to protect 50.2–50.4 GHz and 18.6–18.8 GHz especially in the likely case of significant aggregate emissions from multiple ESIMs in a single EESS observation footprint.

Respectfully submitted,

NATIONAL ACADEMY OF
SCIENCES' COMMITTEE ON
RADIO FREQUENCIES

A handwritten signature in black ink that reads "Marcia McNutt". The signature is written in a cursive style with a long, sweeping horizontal line extending to the right from the end of the name.

Marcia McNutt
President, National Academy of Sciences

Direct correspondence to:

CORF
National Academies of Sciences,
Engineering, and Medicine
500 Fifth Street, NW, Keck 954
Washington, DC 20001
(202) 334-3520

March 11, 2026

Appendix

Committee on Radio Frequencies

Members

David G. Long, Brigham Young University, *Co-Chair*

Karen L. Masters, Haverford College, *Co-Chair*

Héctor G. Arce, Yale University

Nancy L. Baker, Naval Research Laboratory (retired)

Reyhan Baktur, Utah State University

Shamibrata Chatterjee, Cornell University

Laura B. Chomiuk, Michigan State University

Kshitija Deshpande, Embry-Riddle Aeronautical University

Tomas E. Gergely (retired)

Christopher Kidd (retired)

David G. Lubar, The Aerospace Corporation

Sidharth Misra, NASA Jet Propulsion Laboratory

Bang D. Nhan, National Radio Astronomy Observatory (Virginia)

Jeffery J. Puschell (NAE), Northrop Grumman

Suzanne Staggs (NAS), Princeton University

Staff

Kristen Garofali, Responsible Staff Officer

Christopher J. Jones, Responsible Staff Officer