



UNITED STATES DEPARTMENT OF COMMERCE
National Telecommunications and
Information Administration
Washington, D.C. 20230

MAY 17 2018

Mr. Julius P. Knapp
Chief, Office of Engineering and Technology
Federal Communications Commission
445 12th Street, SW
Washington, DC 20554

Mr. Donald K. Stockdale, Jr.
Chief, Wireless Telecommunications Bureau
Federal Communications Commission
445 12th Street, SW
Washington, DC 20554

RE: Promoting Investment in the 3550-3700 MHz Band (GN Docket No. 17-258)¹

Dear Mr. Knapp:

The National Telecommunications and Information Administration (NTIA) and the Department of Defense (DOD) have worked in close collaboration with the Federal Communications Commission (FCC or Commission) as it implements the rules governing the Citizens Broadband Radio Service (CBRS) in the 3550-3700 MHz band (3.5 GHz Band). The comprehensive regulatory scheme adopted by the Commission includes specific licensing, technical, and service rules to enable dynamic sharing between multiple tiers of federal and commercial users in the 3.5 GHz Band.² The Spectrum Access System (SAS) is the automated frequency coordinator necessary to maximize efficiency in the band while protecting incumbent spectrum users. The SAS(s) will incorporate information from the Environmental Sensing Capability (ESC), which will be used to increase available spectrum in the coastal and other applicable areas while continuing to protect incumbent DOD radar systems.

In this letter, NTIA: (1) describes the Dynamic Protection Areas (DPAs) that can be used in conjunction with ESCs to enable protection of DOD radar systems while providing flexibility for commercial operations in the 3.5 GHz Band; (2) notifies the FCC of a new exclusion zone at Nellis Air Force Base (AFB), Nevada in accordance with 47 C.F.R. Section 96.15(a)(3); and (3) establishes protections for the quiet zones defined in 47 C.F.R. Section 1.924.

¹ See *Promoting Investment in the 3550-3700 MHz Band*, GN Docket No. 17-258, Notice of Proposed Rulemaking and Order Terminating Petitions, FCC 17-134 (Oct. 24, 2017).

² See *Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band, Order on Reconsideration and Second Report and Order* in GN Docket No. 12-354 (rel., May 2, 2016).

BACKGROUND

On March 24, 2015, NTIA sent a letter to the FCC designating revised exclusion zones for the protection of DOD shipborne and ground-based radar systems that operate or plan to operate in and adjacent to the 3.5 GHz Band.³ Using technical and deployment parameters for small cell systems, and an improved Monte Carlo statistical analysis methodology, NTIA performed an analysis resulting in a reduction of 77 percent of the total area impacted by the original coastal exclusion zones.⁴ In addition to the coastal exclusion zones established for shipborne radar operations, there is a need to protect short duration non-emergency use of shipborne radars during scheduled visits to ports located on inland waterways and a limited number of facilities used by DOD and its contractors for the development and testing of 3.5 GHz Band shipborne radar systems.⁵

The revised exclusion zone analysis was based on Category A Citizens Broadband Radio Service Devices (CBSDs).⁶ In order to provide greater flexibility, the Commission subsequently modified its rules to allow higher power Category B CBSDs to operate in non-rural deployments, which would result in much larger static exclusion zones along the coast impacting the availability of spectrum for commercial users.⁷ As discussed in NTIA's 2015 letter, ESCs can be used to facilitate the conversion of exclusion zones to dynamic protection zones.

DPAs are the implementation of dynamic protection zones. ESCs used in conjunction with DPAs promise to allow CBSDs to be deployed in the current static exclusion zones and enable higher power commercial operations in the 3.5 GHz Band.⁸ If properly executed, DPAs will facilitate the phased deployment of CBSDs while protecting federal radars from aggregate interference.

DPA IMPLEMENTATION

A DPA is a pre-defined local protection area which may be activated or deactivated as necessary to protect DOD radar systems. A number of requirements must be met to effectuate their use.

³ See Letter from Paige R. Atkins, Assoc. Admin., Office of Spectrum Mgt., NTIA, to Julius P. Knapp, Chief, Office of Eng. and Tech., FCC (Mar. 24, 2015) (2015 NTIA Letter), available at http://www.ntia.doc.gov/files/ntia/publications/ntia_letter_docket_no_12-354.pdf.

⁴ See NTIA Technical Report TR-15-517, *3.5 GHz Exclusion Zone Methodology* (June 2015) (reissued in March 2016 to correct typographical errors), available at <http://www.its.bldrdoc.gov/publications/2805.aspx>. This report describes the 3.5 GHz Band study and explains the assumptions, methods, analyses, and system characteristics used to generate the exclusion zones to protect federal radar operations (ship and land based) from aggregate interference.

⁵ 2015 NTIA Letter at 6.

⁶ Category A CBSDs can operate at a maximum equivalent isotropically radiated power (EIRP) of 30 dBm/10 MHz.

⁷ Category B CBSDs can operate at a maximum EIRP of 47 dBm/10 MHz and will only be authorized for use after an ESC is approved and commercially deployed. See 47 C.F.R. 47 Sections 96.15 and 96.67.

⁸ 2015 NTIA Letter at 4.

The geographic area defining the boundaries of the DPA are described as coordinates of polygons. DPAs may be defined for incumbent protection inland or off shore. An activated DPA must be protected from aggregate CBSD interference based on specified protection criteria within the DPA. An ESC shall indicate a DPA is to be activated in a frequency range or set of CBSD channels. If a frequency range is not specified the default range will be 3550-3650 MHz. A minimum wait time shall be established for the DPA to switch from an activated to de-activated state if an ESC does not detect the presence of a radar signal. The polygons describing the DPAs are predefined and expected to be fixed in location, but may be revised over time as needed based on future 3.5 GHz Band radar system requirements.

NTIA used the following guidelines in defining the coastal DPAs:

- DPAs shall be large enough to ensure DOD's Operational Security (OPSEC) geolocation inaccuracy requirement of 65 nautical miles is satisfied;⁹
- DPAs shall be centered around key naval ports/shipyards;¹⁰
- DPAs for key naval ports/shipyards shall start at the coastline;
- DPAs not corresponding to key ports/shipyards shall start 10 kilometers from the coastline;
- DPA width and depth may vary based on local terrain profiles and other factors; and
- DPAs shall not overlap.

The DPAs for the East, West, Gulf, Alaska, Hawaii, and Puerto Rico coasts are defined in Attachment A.¹¹

DPA Activation/De-Activation

In the absence of an ESC, all DPAs are considered activated on all frequencies. If the SAS loses communications with the ESC or otherwise determines that the ESC has failed, the SAS shall activate all DPAs monitored by the failed ESC, over the entire frequency range for which the DPAs must be protected. The SAS must be capable of determining that an ESC failure has occurred.

DPAs may be activated by notification of an ESC. When the ESC detects radar operation, the ESC will send the DPA identification number and channels that need protection to all associated SASs within 60 seconds. The SAS will then activate that DPA on those

⁹ For OPSEC purposes the SASs and ESCs must not reveal any information pertaining to the movement or position of a federal system. ESC operators and SAS administrators interfacing with one or more ESCs must ensure at all points in their design and operation that the location of federal activity cannot be closely estimated or tracked. Given proposed ESC design constraints, the initial analysis from the DOD suggests a likely position estimate uncertainty of approximately 65 nautical miles.

¹⁰ The key naval ports and shipyards include: Norfolk, VA; Jacksonville, FL; San Diego, CA; Bremerton, WA; Everett, WA; Pearl Harbor, HI; Bath, ME; Newport News, VA; Pascagoula, MS; and New Orleans, LA.

¹¹ When feasible, DPA geographical definition may take into account practical and cost considerations for ESC sensor deployment.

frequencies. The ESC may not notify the SAS of the de-activation of a DPA until at least two hours have passed since the detection of federal incumbent radar activity.

DPA's may also be used for scheduled operations at DOD and its contractor radar facilities where activation/de-activation can be triggered through a notification process specifying a start/stop time and reserved channels.

Whenever any DPA is activated on any given channel, a SAS must ensure that those CBSDs under its management that are members of the "move list" are not transmitting using any grant that has a frequency range that overlaps with the channel from a time starting no later than 300 seconds after the activation of the DPA until no earlier than the time when the DPA becomes de-activated.

DPA Protection Criteria

The protection of a DPA is based on parameters pre-defined for that specific DPA, such that protections across DPAs will not be uniform.

For DPAs defined to protect Navy radars in coastal areas, the protection shall be based on a maximum aggregate received power level from CBSDs at the location of the radar antenna aperture. The aggregate received power from CBSDs shall not exceed a predefined gain adjusted maximum permissible level of -144 dBm/10 MHz as presented at the radar antenna with a 95 percent reliability.¹² The gain adjusted maximum value has been calculated to take into account the effects of radar receive characteristics (*e.g.*, main beam gain, sensitivity, system loss, etc.) to simplify the calculations and also protect classified information. The DPA protection criteria may be changed if required to protect future radars.

The SAS shall calculate the aggregate received CBSD power levels within 3 degrees of horizontal azimuth for all possible bearings at increments of 1.5 degrees at all assumed ship locations. Contributions from CBSDs outside the 3 degree horizontal azimuth may be attenuated by -25 dB. Additionally, a radar antenna elevation angle of zero degrees and an antenna height of 50 meters above sea level shall be assumed in all calculations.

The DPA protection criteria must be met for all assumed ship locations and radar antenna bearings at increments of 1.5 degrees azimuth within the DPA. The SAS shall take into account possible interference from CBSDs regardless of their distance from a DPA. Use of the Extended-Hata/Irregular Terrain Model (ITM) propagation model as documented in Appendix A of NTIA Technical Report TR-15-517 or other more conservative models to simplify computations is acceptable.

¹² Reliability is defined as the probability that aggregate interference from CBSDs remains below the maximum allowed aggregate interference level for the specified time percentage. The aggregate interference level is to be assessed at any protected point on and within the DPA.

NELLIS AFB EXCLUSION ZONE

Section 96.15(a)(3) of the Commission's Rules for CBRS specifies the exclusion zones for federal radiolocation sites. The Rules provide that NTIA may update the list of protected federal sites. NTIA hereby notifies the Commission that it is adding a new exclusion zone for the 3.5 GHz Band at Nellis AFB, Nevada. The coordinates defining the new exclusion zone are provided in Attachment B. The Nellis AFB exclusion zone was developed so as to minimize the impact on populated areas where CBSDs could be deployed.

PROTECTION OF QUIET ZONES

NTIA's Institute for Telecommunication Sciences (ITS) is the Department of Commerce entity with delegated responsibility for protecting the Table Mountain Radio Receiving Zone from possible harmful interference.¹³ Field strengths of radiated signals from CBSDs operating in the 3.5 GHz Band that are received on this 1800 acre protected site should not exceed a power-flux density of -85.8 dBW/m² in the authorized bandwidth of service.¹⁴ ITS historically has coordinated all proposed frequency assignments to stations, including assignments to stations established under group authority, within specified conditions of power and radial distances from the Table Mountain reference point. Under the FCC's Part 96 Rules for the CBRS, the SAS is the automated frequency coordinator for frequency, bandwidth, and power assignments for priority access licenses and general authorized access CBSDs. As such, the only practical and effective way to ensure protection of the Table Mountain quiet zone from harmful interference from CBRS is for the Commission to require that the SAS shall have the capability and responsibility to ensure that operation of CBSDs complies with the field strength limits specified in Section 1.924(b)(1) of the FCCs rules.¹⁵

On April 19, 2018, NTIA sent a letter to the Chiefs of the FCC's Offices of Engineering and Technology (OET) and Wireless Telecommunications Bureau (WTB) seeking concurrence

¹³ The Table Mountain Radio Receiving Zone is an 1800 acre site in the vicinity of the reference point at coordinates 40.130660 degrees North Latitude, -105.244596 degrees West Latitude. NTIA was originally delegated the authority to protect Table Mountain by the Secretary pursuant to Department Organization Order 10-10, § 4. The authority has since been codified in the NTIA Organization Act, 47 USC 902(b)(1), and delegated to ITS pursuant to Department Organization Order 25-7, § 7. *See also* Commerce Real Property Management Manual, § 2.2.2.

¹⁴ NTIA Manual of Regulations and Procedures for Federal Radio Frequency Management, Section 8.3.20 (rev. Sept. 2015); 47 C.F.R. Section 1.924(b)(1).

¹⁵ 47 C.F.R. Section 1.924(b)(1).

that for CBRS a SAS will be required to ensure protection of Table Mountain.¹⁶ On April 20, 2018, the OET and WTB Chiefs responded, confirming the FCC will require through the SAS certification process that SASs effectively coordinate CBSDs around Table Mountain in a manner consistent with the obligations in Section 1.924 of the Commission's rules as described in the NTIA Letter.¹⁷ Given its importance as a critical resource for sensitive radio and electromagnetic experiments, NTIA defines an activated DPA at the Table Mountain Radio Receiving Zone reference point provided in Attachment C for the 3.5 GHz Band, with the protections as currently defined in Section 1.924(b).¹⁸

The National Radio Astronomy Observatory (NRAO) site located at Green Bank, Pocahontas County, West Virginia and the Naval Radio Research Observatory (NRRO) site at Sugar Grove, Pendleton County, West Virginia are radio quiet zones where restrictions on radio signals are required to minimize possible impacts on the operations of radio astronomy and other facilities highly sensitive to interference.¹⁹ To ensure that the protections to the NRAO and NRRO quiet zones accorded by the FCC rules are implemented by the SAS, NTIA defines an exclusion zone in the 3.5 GHz Band for CBSDs at these sites. The coordinates for the exclusion zone are provided in Attachment C.

The Arecibo Observatory performs measurements from 1 to 10 GHz. The 3.5 GHz band is not a band in which all emissions (including harmonics, spurious, and out-of-band) are to be avoided. Consistent with the requirements in Section 1.934(d) of the FCC's rules, 3.5 GHz Band CBSD operations in Puerto Rico are required to notify the Arecibo Spectrum Manager as described in Attachment C.

In order to increase access and flexibility for commercial users while protecting critical federal shipborne radar systems, NTIA recommends that the FCC replace the static coastal exclusion zones for the 3.5 GHz Band with DPAs. NTIA also revises the list of exclusion zones

¹⁶ See Letter from Paige R. Atkins, Assoc. Admin., Office of Spectrum Mgt., NTIA to Julius P. Knapp, Chief, Office of Eng. and Tech., FCC and Donald Stockdale, Chief, WTB, FCC (Apr. 19, 2018) (NTIA Letter), available at <https://go.usa.gov/xQZ5s>. In the letter, NTIA asserted that the only practical and effective way to ensure protection of the Table Mountain quiet zone would be to ensure that operation of CBSDs complies with the field strength limits specified in Section 1.924(b)(1) of the FCC's rules "either by (1) the SAS acting as a substitute for the traditional licensee or applicant and coordinating the frequency, bandwidth and power of CBSDs on behalf of the CBSDs, or (2) the SAS withholding permission to transmit for any CBSD that could place a signal over Table Mountain in excess of the field strength limit in the bandwidth of service specified in Section 1.924(b)(1) of the FCC's rules without evidence of prior coordination with the Table Mountain Radio Frequency Coordinator." *Id.* at 2.

¹⁷ See Letter from Julius P. Knapp, Chief, Office of Eng. and Tech., FCC and Donald Stockdale, Chief, WTB, FCC to Paige R. Atkins, Assoc. Admin., Office of Spectrum Mgt., NTIA (Apr. 20, 2018), available at <https://go.usa.gov/xQZPj>.

¹⁸ The Table Mountain DPA will be activated 100 percent of the time.

¹⁹ 47 C.F.R. 1.924(a); NTIA Manual of Regulations and Procedures for Federal Radio Frequency Management, Section 8.3.9 (rev. Sept. 2015).

in the 3.5 GHz Band to include the Nellis AFB and the NRAO/NRRO quiet zone sites,²⁰ and defines an activated DPA for the Table Mountain Radio Receiving quiet zone. NTIA looks forward to our collaborative efforts in completing the SAS and ESC approval process to realize the full sharing potential in the 3.5 GHz Band while protecting critical federal operations.

If you have any questions, please contact me or Edward Drocella, Chief, Spectrum Engineering and Analysis Division, Office of Spectrum Management at edrocella@ntia.doc.gov or (202) 482-2608.

Sincerely,



Paige R. Atkins
Associate Administrator
Office of Spectrum Management

Attachments

²⁰ The list of 3.5 GHz federal exclusion zones are available at <https://www.ntia.doc.gov/fcc-filing/2015/ntia-letter-fcc-commercial-operations-3550-3650-mhz-band>.

ATTACHMENT A DYNAMIC PROTECTION AREA DEFINITIONS

This attachment defines the Dynamic Protection Areas (DPAs) along the East, Gulf, West, Alaskan, Hawaii, and Puerto Rican coasts to protect shipborne radar systems operating in the 3550-3650 MHz band. The red lines are for DPAs associated with key naval ports/shipyards.²¹ The specific coordinates for the DPAs are available at <https://www.ntia.doc.gov/fcc-filing/2015/ntia-letter-fcc-commercial-operations-3550-3650-mhz-band>.

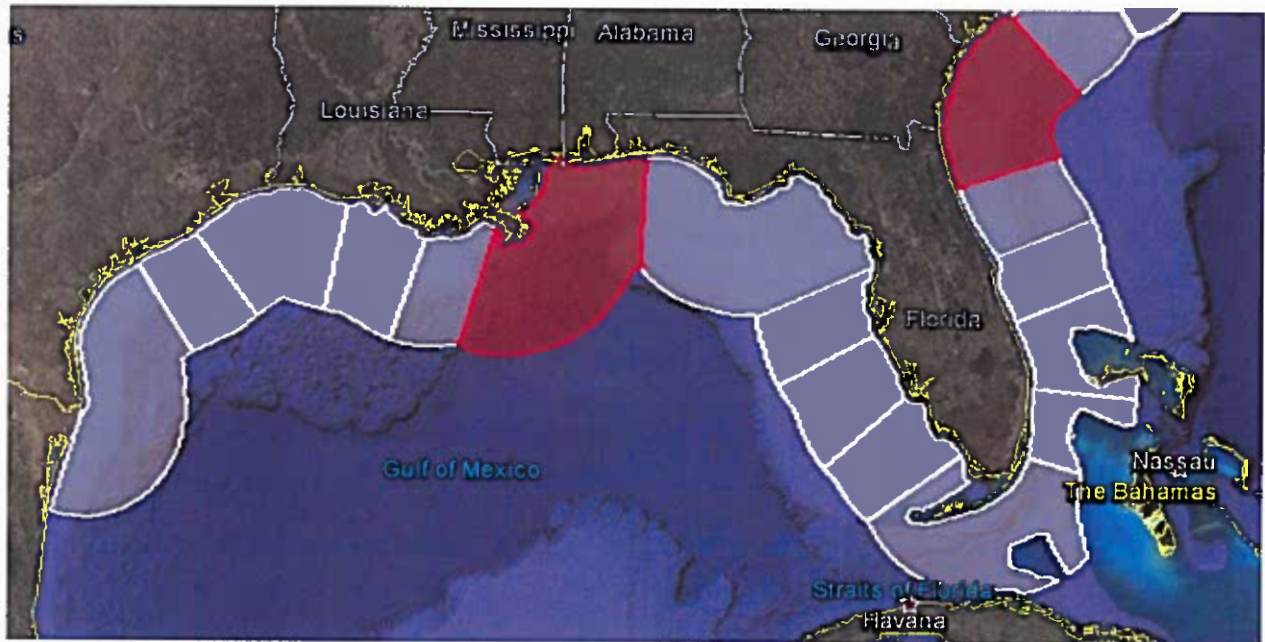


Figure A-1. Gulf Coast DPA

²¹ The key naval ports and shipyards include: Norfolk, VA; Jacksonville, FL; San Diego, CA; Bremerton, WA; Everett, WA; Pearl Harbor, HI; Bath, ME; Newport News, VA; Pascagoula, MS; and New Orleans, LA.

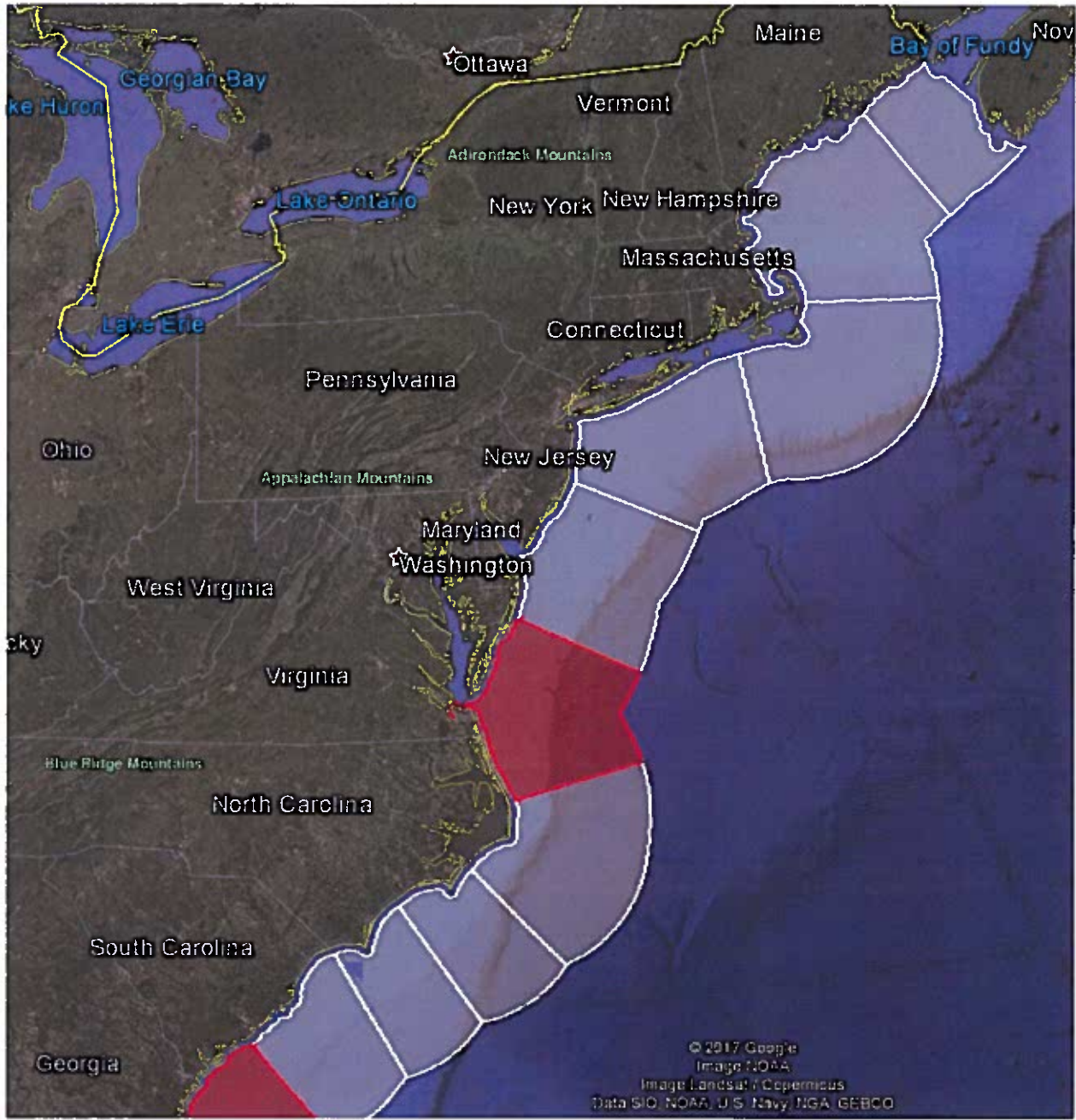


Figure A-2. East Coast DPA



Figure A-3. West Coast DPA

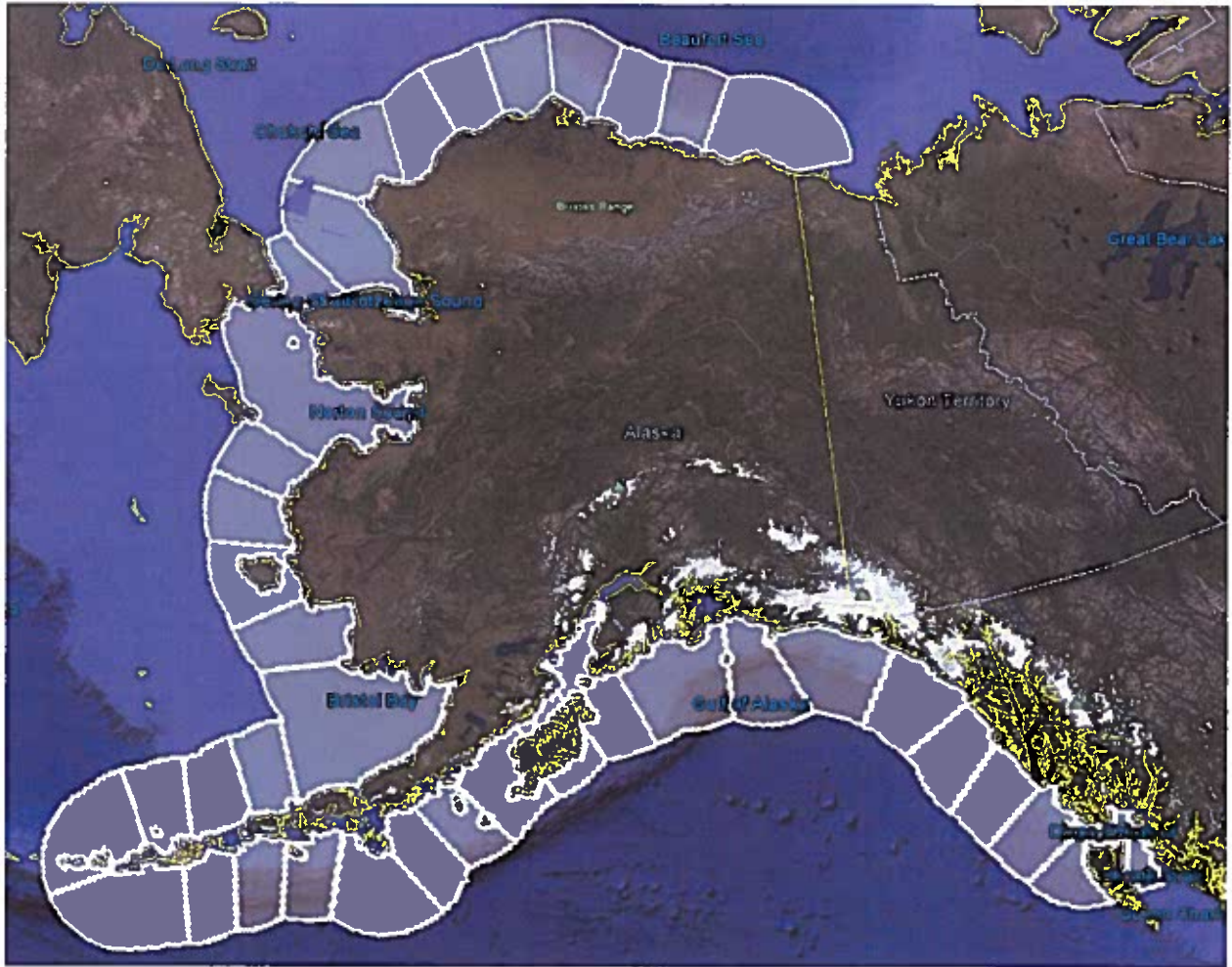


Figure A-4. Alaska Coast DPA

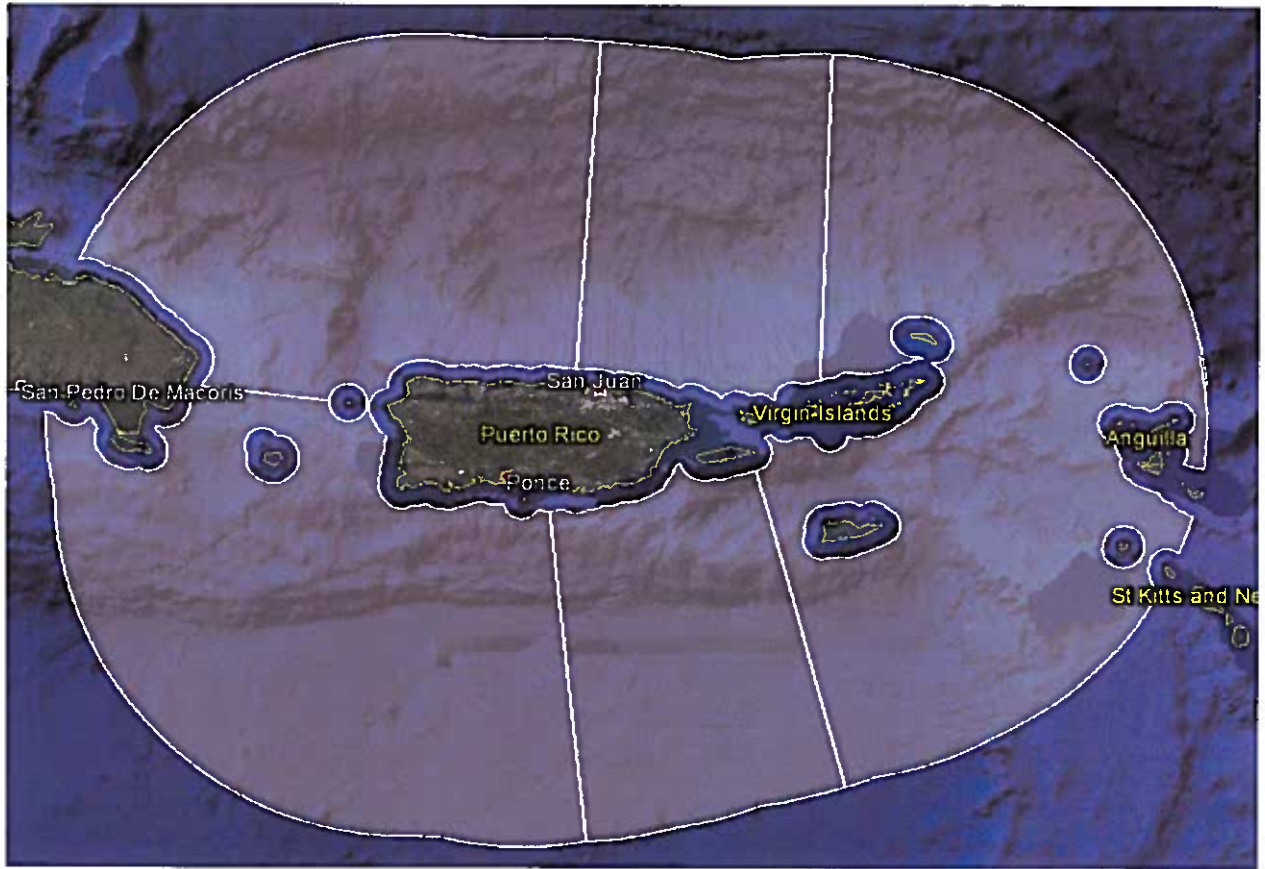


Figure A-5. Puerto Rico DPA

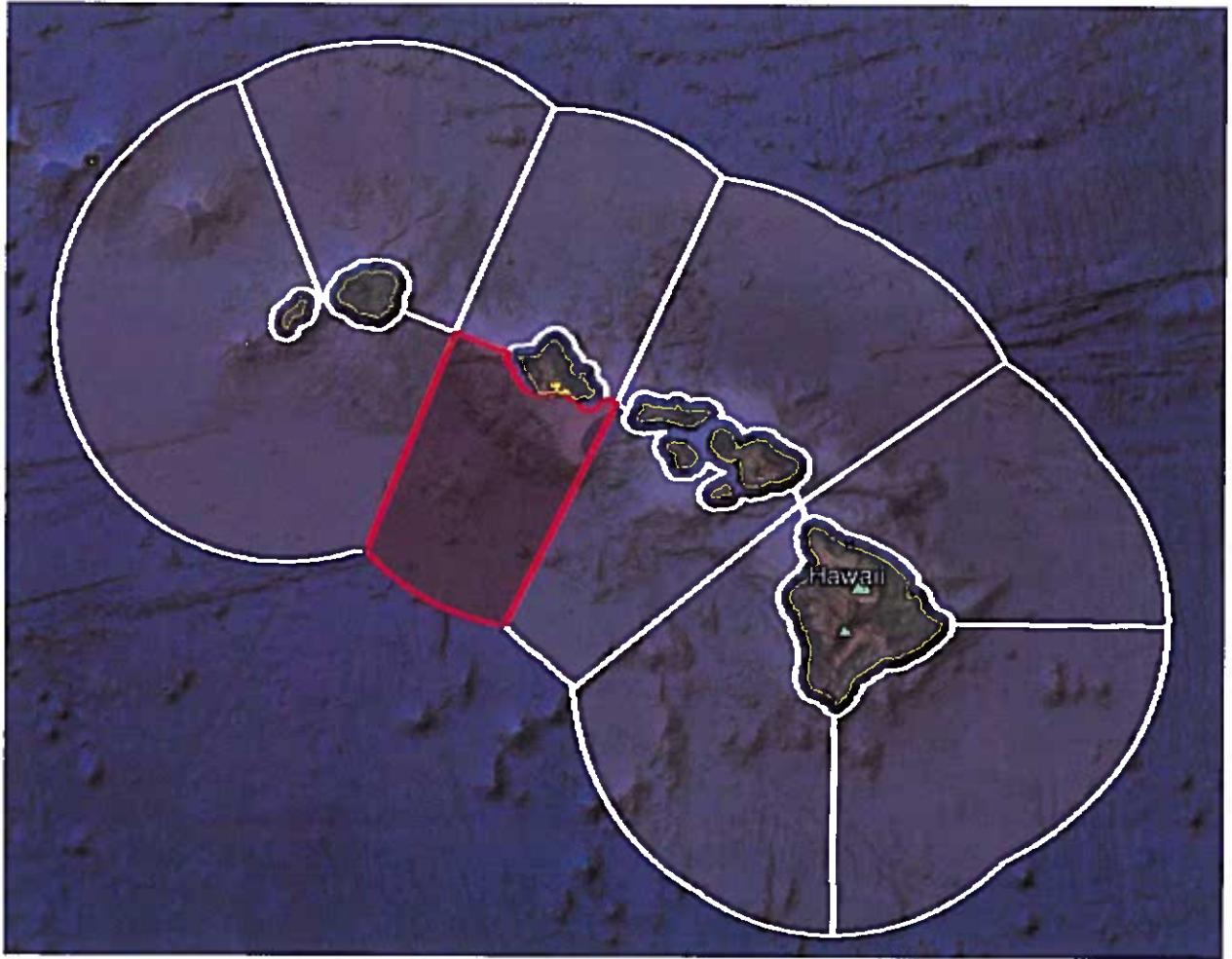


Figure A-6. Hawaii DPA

**ATTACHMENT B
NELLIS AIR FORCE BASE EXCLUSION ZONE**

This attachment defines the geographic area for a new exclusion zone at Nellis Air Force Base (AFB), Nevada. The latitudes and longitudes defining the exclusion zone are provided in Table B-1. The geographic area of the exclusion zone is shown in Figure B-1.²²

Table B-1

Latitude (North)	Longitude (West)
37.77370891	-117.3847624
37.52660916	-117.2909838
36.86825737	-116.6040324
36.81615227	-115.8145576
37.12971814	-115.2331684
37.4493138	-115.0412003
38.04284478	-115.2375586
38.40520145	-115.9181073
38.04658732	-117.2352589

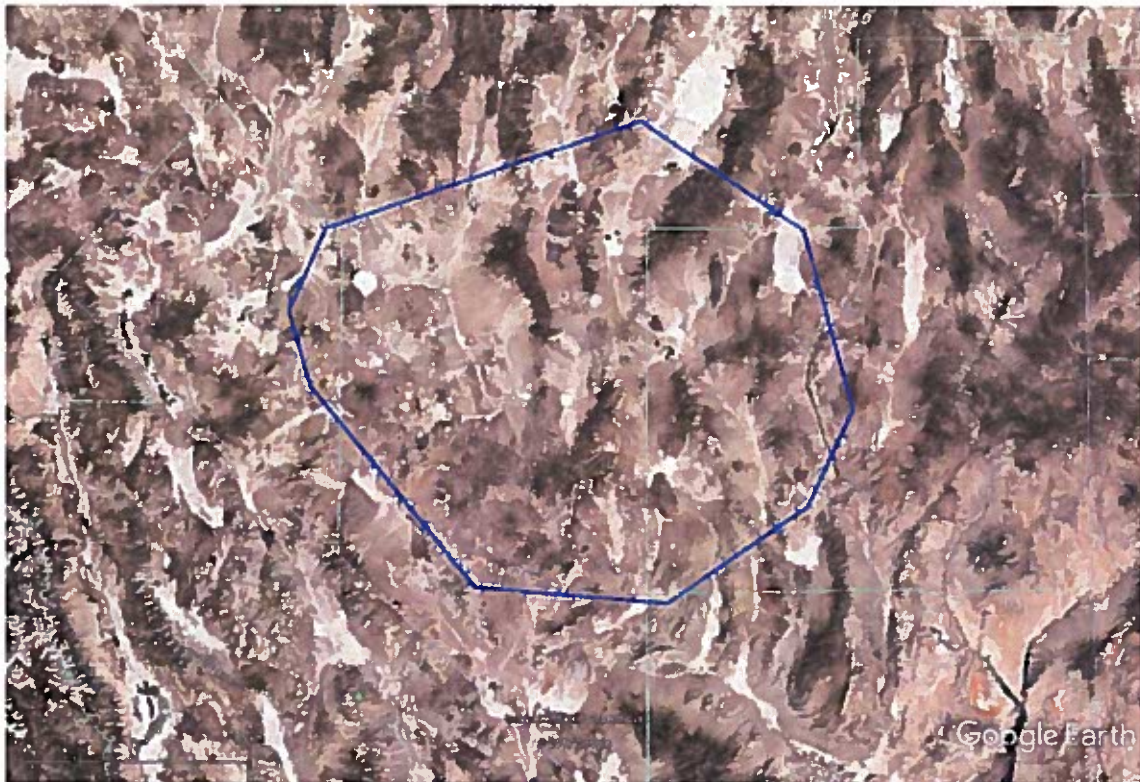


Figure B-1. Nellis AFB Exclusion Zone

²² The exclusion zone impacts 0.2849 percent of the population in Nevada and 0.0025 percent of the United States population.

ATTACHMENT C PROTECTION OF RADIO QUIET ZONES

TABLE MOUNTAIN RADIO RECEIVING ZONE

Figure C-1 defines a single point dynamic protection area (DPA) for the Table Mountain Radio Receiving Zone that is always active. The reference point is at 9 meters above ground level at the coordinates: 40.130660 degrees North Latitude, -105.244596 degrees West Latitude. The DPA is calculated based on a received power at the reference point that must not exceed -118 dBW in the authorized bandwidth of the service (power flux-density of -85.8 dBW/m^2 assuming a 0 dBi gain antenna).



Figure C-1. Table Mountain Radio Receiving Zone DPA Reference Point

NATIONAL RADIO ASTRONOMY OBSERVATORY AND NAVAL RADIO RESEARCH OBSERVATORY EXCLUSION ZONE

Figure C-2 defines the geographic area for an exclusion zone at the National Radio Astronomy Observatory (NRAO) and Naval Radio Research Observatory (NRRO), based on the area defined in 47 C.F.R. Section 1.924(a). The exclusion zone is the area bounded by South of $39^{\circ} 15' N$, North of $37^{\circ} 30' N$, West of $78^{\circ} 30' W$, and East of $80^{\circ} 30' W$.



Figure C-2. NRAO and NRRO Exclusion Zone

ARECIBO OBSERVATORY

Figure C-3 defines the geographic area for the Puerto Rico Coordination Zone which extends 100 miles from the center of the dish at 18.3464 N and 66.75282 W. Licensees planning to construct and operate a new permanent base or fixed station to be located on the islands of Puerto Rico, Desecheo, Mona, Vieques, and Culebra, or for a modification of an existing authorization which would change the frequency, power, antenna height, directivity, or location of a station on these islands and would increase the likelihood of the authorized facility causing interference, shall notify:

Interference Office
Attention: Spectrum Manager Arecibo Observatory
HC3 Box 53995
Arecibo, Puerto Rico 00612

Any correspondence to the Spectrum Management Arecibo Observatory should also be sent to the National Science Foundation Spectrum Management Office (esm@nsf.gov) and the Arecibo Program Officer Ashley Zauderer (bezauder@nsf.gov).

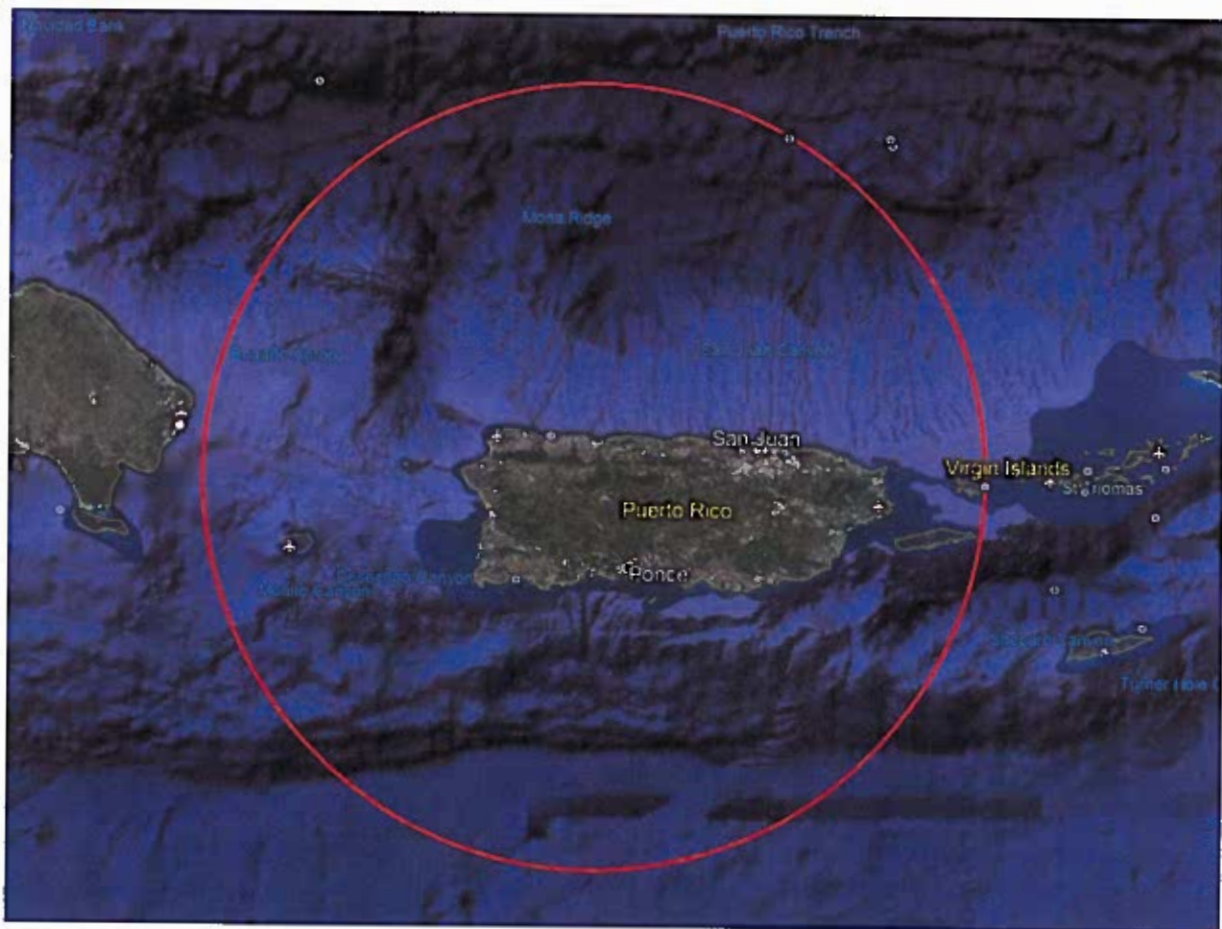


Figure C-3. Puerto Rico Coordination Zone