TO: All Interested Parties JS

FROM: Jessica Schultz, Deputy Director, Weather Surveillance Radar - Model 1988 Doppler (WSR-88D) Radar Operations Center (ROC)

SUBJECT: Lowering the Minimum Scan Angle of the KEVX WSR-88D serving the Eglin Air Force Base (AFB), FL, area

DATE: August 24, 2023

In accordance with provisions of the National Environmental Policy Act of 1969, the WSR-88D ROC prepared a Draft Environmental Assessment (EA) analyzing the potential environmental effects of lowering the minimum scan angle of the KEVX WSR-88D serving the Eglin AFB, FL, area. The Draft Environmental Assessment is available for public review and comment. The Draft EA may be obtained at:

https://www.roc.noaa.gov/WSR88D/SafetyandEnv/EAReports.aspx

The KEVX WSR-88D is an existing radar facility located about 40 miles east-northeast of Eglin AFB in Walton County, FL. The KEVX WSR-88D, commissioned in 1993, is one of 159 WSR-88Ds in the nationwide network. The KEVX WSR-88D antenna transmits a narrow focused main beam with a width of 1 degree. In normal operation, the radar antenna rotates horizontally to cover all directions (i.e., azimuths). The radar antenna also varies the scan angle at which it points with respect to the horizon. Currently, the WSR-88D operates at a minimum of scan angle of +0.5 degrees (deg) above the horizon. The ROC proposes to reduce the minimum scan angle of the KEVX WSR-88D from the current minimum of +0.5 deg to +0.3 deg (i.e., 0.2 deg lower than existing) to provide enhanced coverage of the lower portions of the atmosphere. No construction activities or physical modification of the KEVX WSR-88D would be required to implement the proposed action; the only change would be to the radar's operating software.

NWS will accept written comments on the Draft EA until September 30, 2023. Please submit comments via either email or regular mail to:

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Comments sent by regular mail must be postmarked September 30, 2023. After the end of the Draft EA review period, the ROC will prepare a Final EA containing responses to all comments. NWS will not make any decision on implementing the proposed action until completion of the environmental review. Thank you for your interest in this important project.

SENSOR ENVIRONMENTAL LLC
www.sensorenvirollc.com

Draft Environmental Assessment Report • August 2023

ENVIRONMENTAL ASSESSMENT (EA)

LOWERING THE MINIMUM SCAN ANGLE OF THE WEATHER SURVEILLANCE RADAR - MODEL 1988, DOPPLER (WSR-88D) SERVING THE EGLIN AIR FORCE BASE, FLORIDA AREA

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Executive Summary

The Weather Surveillance Radar, Model 1988 Doppler (WSR-88D) Radar Operations Center (ROC) is composed of representatives from the National Weather Service (NWS) of the Department of Commerce, the Air Force Weather Agency (AFWA) of the Department of Defense, and the Federal Aviation Administration (FAA) of the Department of Transportation. The ROC operates the existing WSR-88D serving the Eglin Air Force Base (AFB), FL, area. The International Civil Aviation Organization designator for the radar is KEVX and the radar is located in a rural area about 2 miles southeast (SE) of Redbay, Walton County, FL and about 40 miles east-northeast (ENE) of Eglin AFB. The KEVX WSR-88D was commissioned in August 24, 1992 and has been in continuous operation since 1992. It is one of 159 WSR-88Ds in the nationwide network.

The KEVX WSR-88D is an S-band Doppler, dual polarized weather radar, which ROC uses to collect meteorological data to support weather forecasts and severe weather warnings for the Eglin AFB, FL, area. The KEVX WSR-88D antenna transmits a narrow focused main beam with a width of 1 degree. In normal operation, the WSR-88D antenna rotates horizontally to cover all directions (i.e., azimuths). The radar antenna also varies the scan angle at which it points with respect to the horizon. The scan angle is measured along the axis of the main beam and can be changed in 0.1 deg increments. Currently, the KEVX WSR-88D operates at a minimum of scan angle of +0.5 degrees (deg) above the horizon. ROC proposes to reduce the minimum scan angle of the KEVX WSR-88D from the current minimum of +0.5 deg to +0.3 deg (the proposed action). Lowering the minimum scan angle would provide enhanced coverage of the lower portions of the atmosphere. No construction activities or physical modification of the KEVX WSR-88D would be required to implement the proposed action; the only change would be to the radar's operating software.

In April 1993, ROC prepared a National Environmental Policy Act (NEPA) document titled, *Supplemental Environmental Assessment (SEA) of the Effects of Electromagnetic Radiation from the WSR-88D Radar*. That document analyzed operating the WSR-88D at a minimum scan angle of +0.5 degree (deg). This Draft EA builds on that prior study by examining the possible effects of operating the KEVX WSR-88D at a minimum scan angle of +0.3 (i.e., 0.2 deg lower than the minimum scan angle examined in the April 1993 SEA). Operating this radar at a lower scan angle would increase the area of radar coverage, providing additional data on atmospheric conditions to ROC forecasters and other data users. The area covered at 2,000 ft above site level (ASL) would increase by 51.4%. Coverage at 2,000 ft elevation over the Gulf of Mexico would extend from the current 40 miles south of the Gulf shoreline to about 60 miles. This radar coverage improvement would be very beneficial to NWS and AFWA weather forecasters and others parties (e.g., public safety agencies and emergency responders) using the radar information.

The lower minimum scan angle would not result in the KEVX WSR-88D main beam illuminating structures or the ground surface within safe setback distances for exposure of

personnel or activities/devices potentially sensitive to radiofrequency (RF) exposure. All safe setback distances would be met. The proposed action would slightly increase radiofrequency (RF) exposure levels in the vicinity of the KEVX WSR-88D. As shown in Table S-1, during normal operation of the radar with rotating antenna, RF exposure would comply with the safety standards developed by the Institute of Electrical and Electronic Engineers (IEEE) and adopted by the American National Standards Institute (ANSI) for the general public and workers. Federal Communications Commission (FCC) and Occupational safety and Health Administration (OSHA) safety levels would also be met at all locations.

Table S-1: RF Power Density within Main Beam of KEVX WSR-88D at Minimum Scan Angle of +0.3 deg Compared to ANSI/IEEE Safety Standards

Location / Distance from Radar	Time-Averaged Power Density (mW/cm^2)	ANSI/IEEE General Public RF Safety Standard		ANSI/IEEE Occupational RF Safety Standard	
		Safety Standard (mW/cm^2)	Factor Below Std	Safety Standard (mW/cm^2)	Factor Below Std
Surface of Radome	0.603	1.0	1.66	5.0	7.9
Closest Structure - Cell Phone Tower (11,250 ft)	0.000064	1.0	15,600	5.0	78,100
Closest Illuminated Ground (7,600 ft)	0.00014	1.0	7,100	5.0	35,700

During infrequent stationary antenna operation, RF exposure levels within the WSR-88D main beam would exceed ANSI/IEEE and FCC safety levels for exposure of the general public within 1,740 ft of the WSR-88D antenna. FCC and ANSI/IEEE occupational safety levels would be exceeded within 777 ft. The KEVX WSR-88D operating at +0.3 deg would not impinge on the ground surface or any structures within those distance and risks to human health would not result.

Because the KEVX WSR-88D operates in a frequency band dedicated to government radiolocation services and the main beam would not impinge on the ground surface in the radar vicinity, the proposed action would not cause radio interference with television, radio, cellular telephone, personal communications devices (PCDs), electro-explosive devices, fuel handling, or active implantable medical devices.

WSR-88D RF emissions have the potential to cause electromagnetic interference (EMI) with sensitive equipment used at astronomical observatories. Two astronomical observatories are

located within 150 miles of the KEVX WSR-88D. A minimum scan angle of +0.3 deg would not result in the WSR-88D main beam impinging on either of those observatories.

Lowering the minimum scan angle of the KEVX WSR-88D would not require physical changes to the radar, vegetation removal, or ground disturbance. The proposed action would not result in significant effects in the following subject areas:

- Land Use and Coastal Zone Management
- Geology, Soils, and Seismic Hazards
- Drainage and Water Quality
- Transportation
- Air Quality
- Flood Hazards
- Wetlands
- Biological Resources / Protected Species
- Cultural and Historic Resources
- Environmental Justice / Socioeconomic Impacts
- Farmlands
- Energy Consumption
- Visual Quality/ Light Emissions
- Solid and Hazardous Waste
- Wild and Scenic Rivers

ROC evaluated the benefits and potential impacts of lowering the minimum center of beam scan angle of the KEVX WSR-88D to each angle between +0.4 and +0.0 deg in 0.1 degree increments. Operating the KEVX WSR-88D at alternative minimum scan angle of +0.4 deg would result in similar environmental effects as the proposed action. Like the proposed action, significant environmental effects would not result. A minimum scan angle of +0.4 deg would increase the radar's coverage area, but by less than the proposed action (i.e., minimum scan angle of +0.3) deg. Minimum scan angles lower than +0.3 deg would not increase coverage area and would result in increased ground clutter returns. Thus, a minimum scan angle of +0.3 deg is the most beneficial among those considered by the ROC.

The no action alternative would result in continued operation of the KEVX WSR-88D at the existing minimum scan angle of +0.5 deg. The improvements in radar coverage resulting from the proposed project would not be achieved. The no-action alternative would not change RF exposure levels from existing. Under both the proposed action and the no action alternative, RF exposure during normal WSR-88D operations would conform to safety standards established by ANSI/IEEE, OSHA, and FCC. Similar to the proposed action, the no-action alternative would not cause significant effects to the natural or man-made environment.

The ROC will distribute the Draft EA to interested members of the public and government agencies for review and comment. Comments on the Draft EA will be accepted by ROC during a minimum 30-day comment period which will end on September 30, 2023. The ROC will provide official responses to all pertinent comments received during the Draft EA comment period in a Final EA report. The ROC will make a decision whether to implement the proposed lowering of the KEVX WSR-88D minimum scan angle after the Final EA report is completed.

CONTENTS

FIGURES

TABLES

ABBREVIATIONS

AAMI	Association for Advancement of Medical Instrumentation
AFB	Air Force Base
AFWA	Air Force Weather Agency
AGL	above ground level
ANSI	American National Standards Institute
ASL	above site level
Deg	degree(s)
CMP	Coastal Management Program
DoA	Department of Agriculture
E	east
EA	Environmental Assessment
E.O.	Executive Order
EED	electro-explosive device
EMI	electromagnetic interference
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FCC	Federal Communications Commission
FEMA	Federal Emergency Management Agency
FL	Florida
FONSI	Finding of No Significant Impact
ft	foot, feet
HERO	Hazards of Electromagnetic Radiation to Ordnance
IEEE	Institute of Electrical and Electronics Engineers
JSPO	Joint System Program Office
KEVX	WSR-88D serving the Eglin AFB, FL, area
m	meter(s)
MBTA	Migratory Bird Treaty Act (of 1918)
MHz	megahertz
mi	mile(s)
MPE	maximum permissible exposure
MSL	mean sea level
mW/cm^2	milliwatts per square centimeter
NAO	NOAA Administrative Order
N	north
NEPA	National Environmental Policy Act
NEXRAD	Next Generation Weather Radar (also known as WSR-88D)
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
NTIA	National Telecommunications and Information Agency
NE	northeast
NW	northwest
NWS	National Weather Service
PEIS	Programmatic Environmental Impact Statement
RF	radiofrequency
ROC	Radar Operations center

S	south
SE	southeast
SW	southwest
SEA	Supplemental Environmental Assessment
SHPO	State Historic Preservation Office
sq mi	square mile(s)
std	standard
U.S.	United States
USAF	U.S. Air Force
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
W	west
WSR-88D	Weather Surveillance Radar – 1988, Doppler

1 BACKGROUND AND SCOPE OF REPORT

1.1 BACKGROUND

The Weather Surveillance Radar, Model 1988 Doppler (WSR-88D) Radar Operations Center (ROC) is composed of representatives from the National Weather Service (NWS) of the National Oceanic and Atmospheric Administration within the Department of Commerce, the Air Force Weather Agency (AFWA) of the Department of Defense, and the Federal Aviation Administration (FAA) of the Department of Transportation. The ROC operates a nationwide network of 159 weather radars that provide critical real-time information on atmospheric conditions to weather forecasters.

The network radars operated by ROC are named Weather Surveillance Radar-Model 1988 Doppler (WSR-88D) after the year they were first put into service and their capabilities to use Doppler shift measurements to determine wind velocities. They are also known as Next Generation Weather Radars (NEXRADs). Like all active radars, the WSR-88D transmits a radio signal, which reflects off targets and returns to the radar. The radar measures the strength of the return signal, its direction of return, and the time between transmission and return, which allows determination of the target characteristics. Because the WSR-88D has the potential to cause electromagnetic effects on the environment, ROC carefully considered these effects and strives to prevent effects, or when effects cannot be avoided, mitigate the significance of those effects. To that end, the NEXRAD Joint System Program Office (JSPO) prepared environmental reports evaluating potential electromagnetic effects of the WSR-88D during planning and implementation of the WSR-88D network. In 1984, the JSPO issued the first environmental document which considered electromagnetic effects (among other effects). That report is titled: *Next Generation Weather Radar Programmatic Environmental Impact Statement (PEIS), Report R400-PE201* [ROC, 1984]. In 1993, JSPO issued a supplemental report updating the analysis contained in the 1984 PEIS to account for changes since 1984 in electromagnetic standards and guidelines and developments in radar design and operational modes. The supplemental report is titled *Final Supplemental Environmental Assessment (SEA) of the Effects of Electromagnetic Radiation from the WSR-88D Radar* [NEXRAD JSPO, 1993]. The 1993 SEA analyzed the potential electromagnetic effects of operating the WSR-88D at a minimum scan angle of +0.5 degree (deg) above horizontal, measured at the center of the WSR-88D main beam. The minimum scan angle of +0.5 deg represented the lowest scan angle used by WSR-88Ds at that time.

The ROC operates the WSR-88D serving the Eglin Air Force Base (AFB) FL, area. The radar identifier is KEVX and the radar is located in a rural area about 2 miles southeast (SE) of Redbay, Walton County, FL, and about 40 miles east-northeast (ENE) of the runways at Eglin AFB. The KEVX WSR-88D is part of the nationwide WSR-88D network. The ROC proposes to operate the KEVX WSR-88D at a minimum scan angle of +0.3 deg, which is lower than the

current minimum scan angle of +0.5 deg above the horizon. Operating the KEVX WSR-88D at this lower scan angle was not analyzed in the 1993 SEA.

The ROC follows procedures established by National Oceanic and Atmospheric Administration (NOAA), the parent agency of NWS, for evaluation of the potential environmental consequences to comply with the National Environmental Policy Act (NEPA). Procedures to be followed are set forth in NOAA Administrative Order (NAO) 216-6A (NOAA, 2016). Because ROC's proposed action of operating the KEVX WSR-88D at a minimum scan angle below +0.5 deg has the potential to cause environmental effects, there is a need to analyze potential environmental consequences, determine their significance, and develop measures to mitigate adverse impacts if necessary.

1.2 SCOPE OF REPORT

This Draft EA report analyzes the potential effects on persons and activities in the vicinity that could result from implementing the proposed action (i.e., lowering the KEVX WSR-88D minimum scan angle to +0.3 deg). Potential environmental effects of alternative minimum scan angles and the no-action alternative (i.e., continued operation of the KEVX WSR-88D at the current minimum scan angle of +0.5 deg) are also considered for comparison purposes. As part of that analysis, the findings of the 1993 SEA have been updated to account for changes in safety standards and guidelines that have been occurred since 1993 and site -specific conditions at the KEVX WSR-88D site and vicinity. The scope of this EA is limited to analyzing potential effects from lowering the minimum scan angle of the KEVX WSR-88D. Because the types of electromagnetic effects that may result and their significance depends on local conditions, uses and topography, the analysis and findings in this EA are specific to the KEVX WSR-88D, and do not apply to other WSR-88Ds or the WSR-88D network as a whole.

2 PURPOSE AND NEED

NWS is the nation's premiere meteorological forecasting organization. The agency's official mission is as follows:

> "The National Weather Service (NWS) provides weather, hydrologic, and climate forecasts and warnings for the United States, its territories, adjacent waters and ocean areas, for the protection of life and property and the enhancement of the national economy. NWS data and products form a national information database and infrastructure which can be used by other governmental agencies, the private sector, the public, and the global community [NWS, 2009]".

NWS, AFWA, and FAA are part of the ROC, which operates a nationwide network of 159 WSR-88Ds. Data from the WSR-88Ds is used to improve the accuracy of forecasts, watches, and warnings. As an example, the WSR-88D generates precipitation estimates allowing prediction of river flooding in hydrological basins of the area. The ROC then disseminates advance flood warnings to local and state public safety, emergency managers, and the public, allowing them to take appropriate actions to minimize hazards to life and property. Because the meteorological phenomena of greatest interest occur with a few thousand feet (ft) of the ground surface, radar coverage of lower portions of the atmosphere is of great value to forecasters.

However, the elevation above the ground at which the WSR-88D can collect atmospheric data increases with distance from the radar due to earth curvature and the upward tilt of the radar beam, which is currently +0.5 deg or greater. The proposed action of lowering the KEVX WSR-88D minimum scan angle to +0.3 deg would expand the geographic area with radar coverage below 10,000 ft AGL, a substantial benefit to forecasters and other users of WSR-88D data. This EA report describes the improvements in radar coverage that would result if the ROC operates the KEVX WSR-88D serving the Eglin AFB, FL, area at a minimum scan angle of +0.3 deg and the environmental effects that may result.

The National Oceanic and Atmospheric Administration (NOAA) is the parent agency of the NWS and the ROC follows NOAA requirements for complying with the National Environmental Policy Act (NEPA) are contained in NOAA Administrative Order (NAO) 216-6A, *Compliance with the National Environmental Policy Act, Executive Orders 12114, Environmental Effects Abroad of Major Federal Actions; 11988 and 13690, Floodplain Management; and 11990 Protection of Wetlands* (NOAA, 2016)], and the Companion Manual for NOAA Administrative Order 216-6A; Policies and Procedures for Compliance with the National Environmental Policy Act and Related Authorities (NOAA, 2017). ROC is subject to those requirements. Appendix E of the NOAA Companion Manual specifies the proper level of NEPA review for actions proposed by NOAA components and lists types of actions that are categorically excluded from the need to prepare a NEPA analysis document (e.g., an EA or environmental impact statement [EIS]). Categorical Exclusion G6, which addresses NEXRAD Radar Coverage, states that

"Actions that change the NEXRAD radar coverage patterns that do not lower the lowest scan angle and do not result in direct scanning of previously non-scanned terrain by the NEXRAD main beam" are categorically excluded from NEPA (NOAA, 2017). The proposed action would not meet these specifications and does not qualify for categorical exclusion treatment. Therefore, NEPA analysis is required for the proposed lowering of the KEVX WSR-88D minimum scan angle to +0.3 deg; this EA report satisfies that requirement.

3 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

3.1 PROPOSED ACTION

3.1.1 DESCRIPTION OF KEVX WSR-88D

The WSR-88D network collects data on weather conditions and provides critical inputs to forecasters. The network is composed of 159 radars, most of which were installed in the late 1980s and 1990s. Each radar includes a roughly 28-ft diameter dish antenna mounted on a steel lattice tower of varying height (depending on local conditions), and shelters housing electronic equipment, a standby power generator and fuel tank, and a transitional power maintenance system. The dish antenna rotates 360 deg and is covered by a fiberglass radome to protect it from the elements.

Figure 1 is a photograph of the KEVX WSR-88D, which was commissioned on August 24, 2023 and has been in continuous operations since being commissioned. The KEVX WSR-88D serves the Eglin AFB, FL, area and is operated by the ROC. The KEVX WSR-88D is located is located about 2 miles SE of Redbay, Walton County, FL (see Figure 2). The radar antenna, radome, and steel-lattice tower are standard. Table 1 provides information on the KEVX WSR-88D.

Table 1: Information on KEVX WSR-88D serving the Eglin AFB, FL, area

Elevation, ground surface at tower base (mean sea level, MSL)	140 ft
Elevation, center of antenna (MSL)	222 ft
Tower Height (m)	20 m (66 ft)
Latitude (WGS84)	30° 33’ 52” N
Longitude (WGS84)	85˚ 55’ 17” W
Operating Frequency	2,705 megaHertz (MHz)
Spot Blanking or Sector Blanking used	No

Figure 1: Photograph of KEVX WSR-88D serving Eglin AFB, FL, area

Figure 2: Location of KEVX WSR-88D

3.1.2 Proposed Change in Minimum Scan Angle

The WSR-88D is designed to detect and track weather phenomena within a roughly 230 mi distance of the radar. It accomplishes this task by emitting a narrow main beam from a rotating dish antenna. The antenna rotates continuously around a vertical axis to cover the surrounding area. The main beam scan angle is the number of degrees above or below horizontal at the center of the main beam. The upward tilt of the antenna (and therefore the scan angle of the main beam) can be changed, allowing the radar to scan the sky at angles up to + 60.0 deg and down to -1.0 deg; however, in current operation, the maximum scan angle is +19.5 deg and the minimum scan angle is +0.5 deg.

The WSR-88D main beam has a total width of 1 deg in the horizontal and vertical directions (i.e., beam edge is ½ deg from the center of the beam), as shown in Figure 3. The power density of the WSR-88D is greatest at the center of the beam and decreases towards the edge of the beam. At the edge of the main beam, the power density is one half of the center of beam power density. In current operation, the minimum scan angle of the main beam is +0.5 deg (i.e., 0.5 deg above horizontal at the center of the main beam) and the lower edge of the main beam (i.e., lower half-power point) is at 0.0 deg or horizontal. ROC proposes to reduce the minimum center of beam scan angle to +0.3 deg, which is 0.2 deg lower than the current minimum scan angle, placing the lower edge of the main beam at -0.2 deg.

Figure 4 is a schematic drawing showing the change in coverage that would result from lowering the KEVX WSR-88D minimum scan angle. The floor of coverage would decrease slightly. Because the lowered radar main beam would not be significantly obstructed by nearby terrain, buildings, or trees, the radar would cover portions of the atmosphere which are currently not covered. Table 2 shows the improvement in radar coverage that would be achieved, which ranges from 51.4% increase in coverage area at 2,000 ft above site level (ASL) to 21.9% increase at 10,000 ft ASL. Coverage at 2,000 ft elevation over the Gulf of Mexico would extend from the current 40 miles south of the Gulf shoreline to about 60 miles. Figures 5, 6, and 7 show the improvement in radar coverage that would be achieved at 2,000 ft, 5,000 ft, and 10,000 ft ASL, respectively. The improvement in WSR-88D coverage would be beneficial to NWS and AFWA forecasters and other users of radar data (e.g., emergency response mangers, water managers, farmers, transportation officials).

Table 2: Existing and Proposed Radar Coverage Areas for KEVX WSR-88D

Minimum Center of Beam Scan Angle (deg)	Coverage Floor (deg)	Area Covered (sq. mi.)		
		2,000 ft ASL	5,000 ft ASL	10,000 ft ASL
+0.5 (existing)	0.0	10,977	28,150	56,778
+0.3 (proposed)	-0.2	16,615 (+51.4%)	36,826 (30.8%)	69,187 (+21.9%)

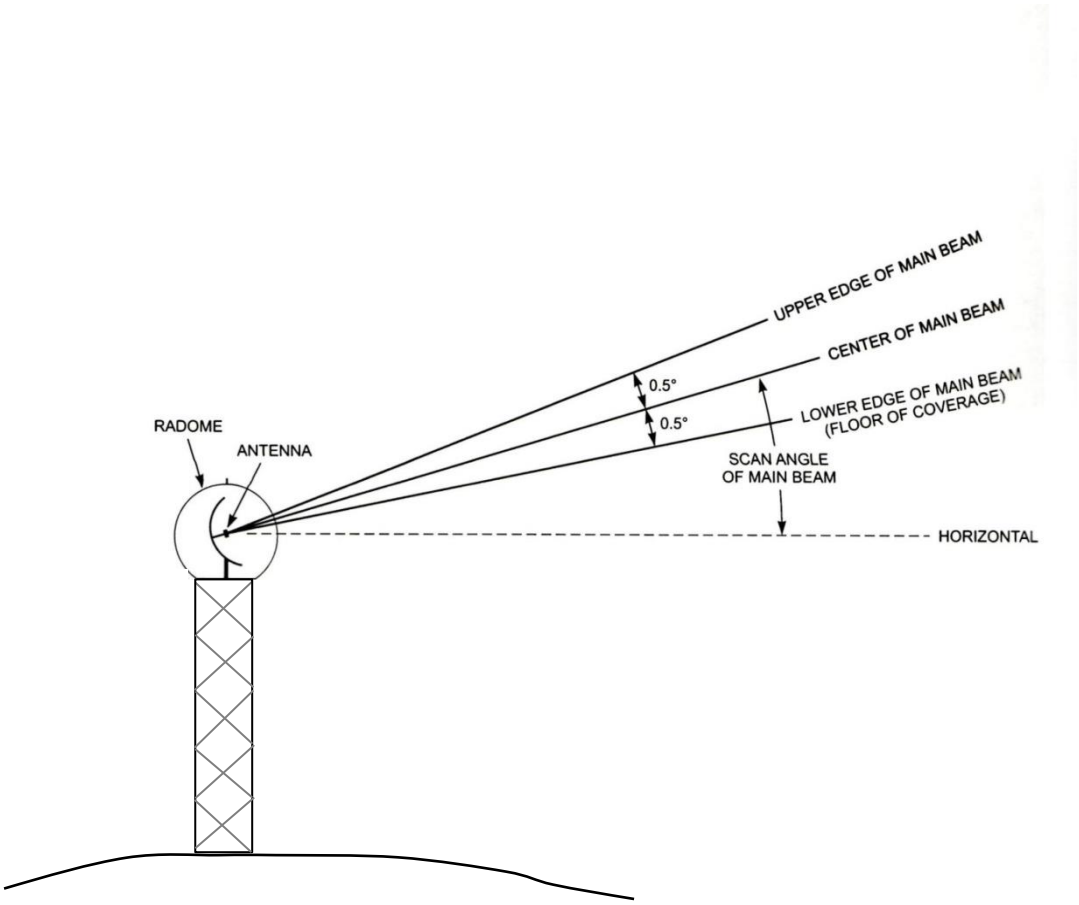

Figure 3: Schematic of WSR-88D Main beam

(Not to scale, width of main beam exaggerated)

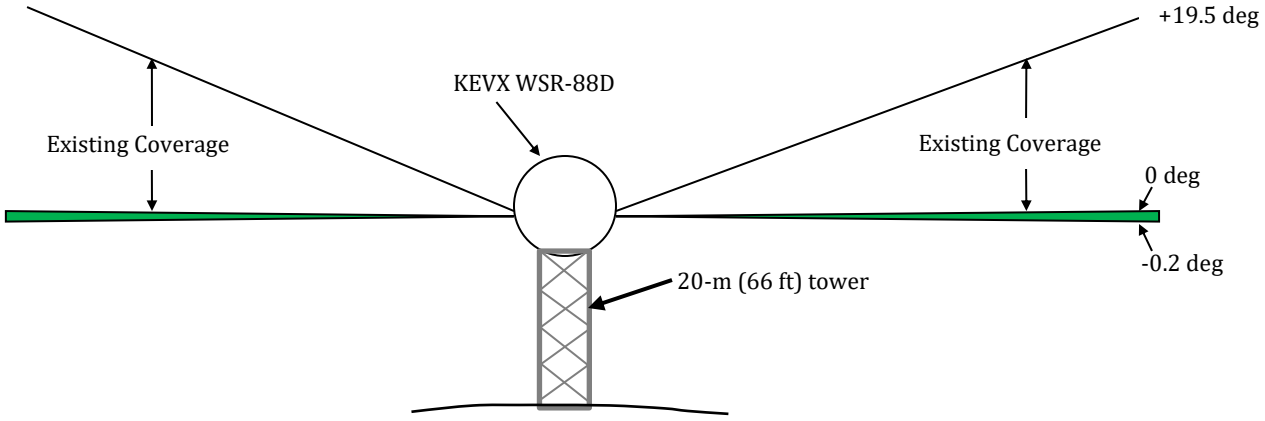

Figure 4: Drawing of Proposed Additional Radar Coverage

Figure 5: Existing and Proposed KEVX WSR-88D Coverage at 2,000 ft ASL

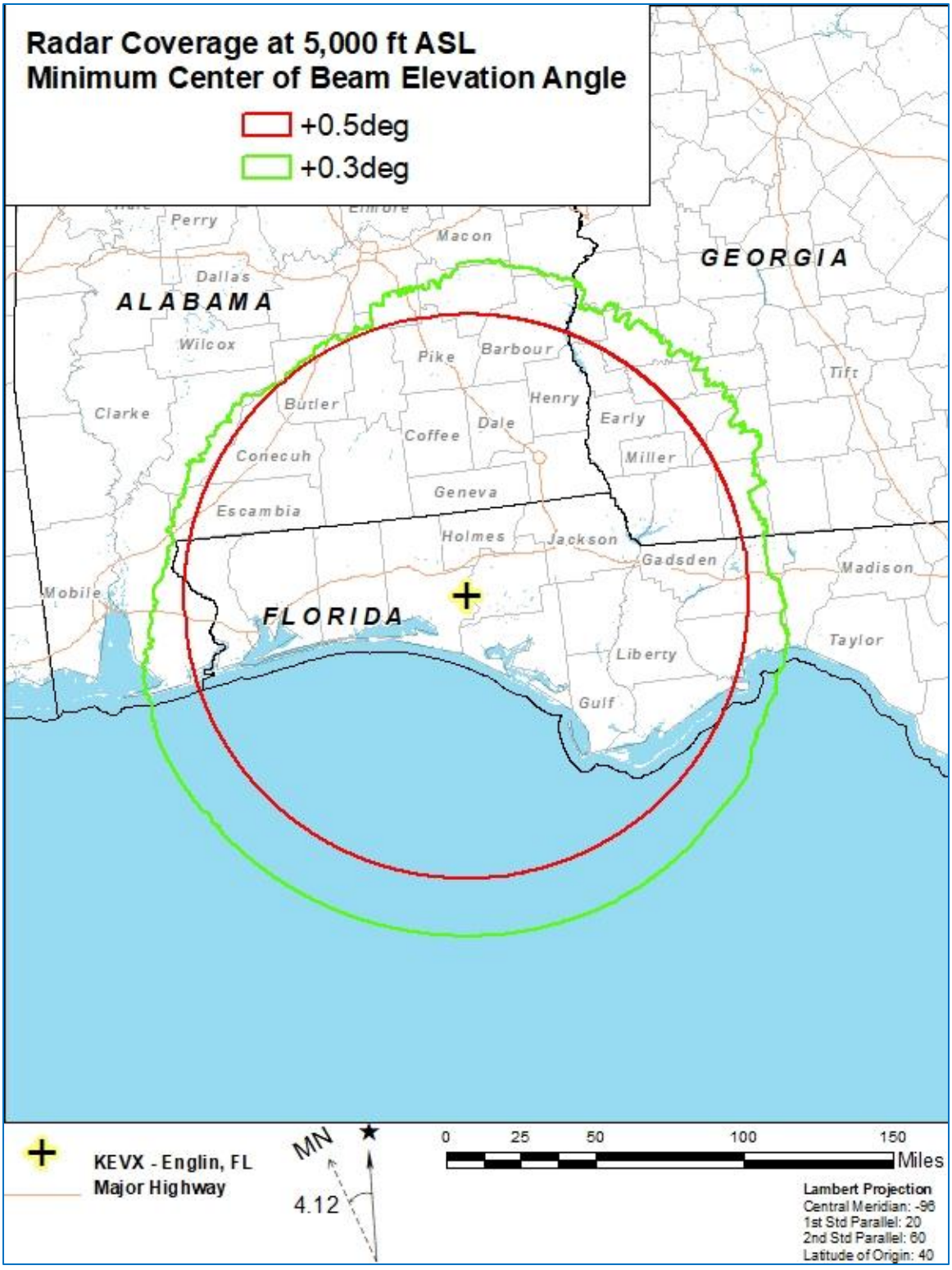

Figure 6: Existing and Proposed KEVX WSR-88D Coverage at 5,000 ft ASL

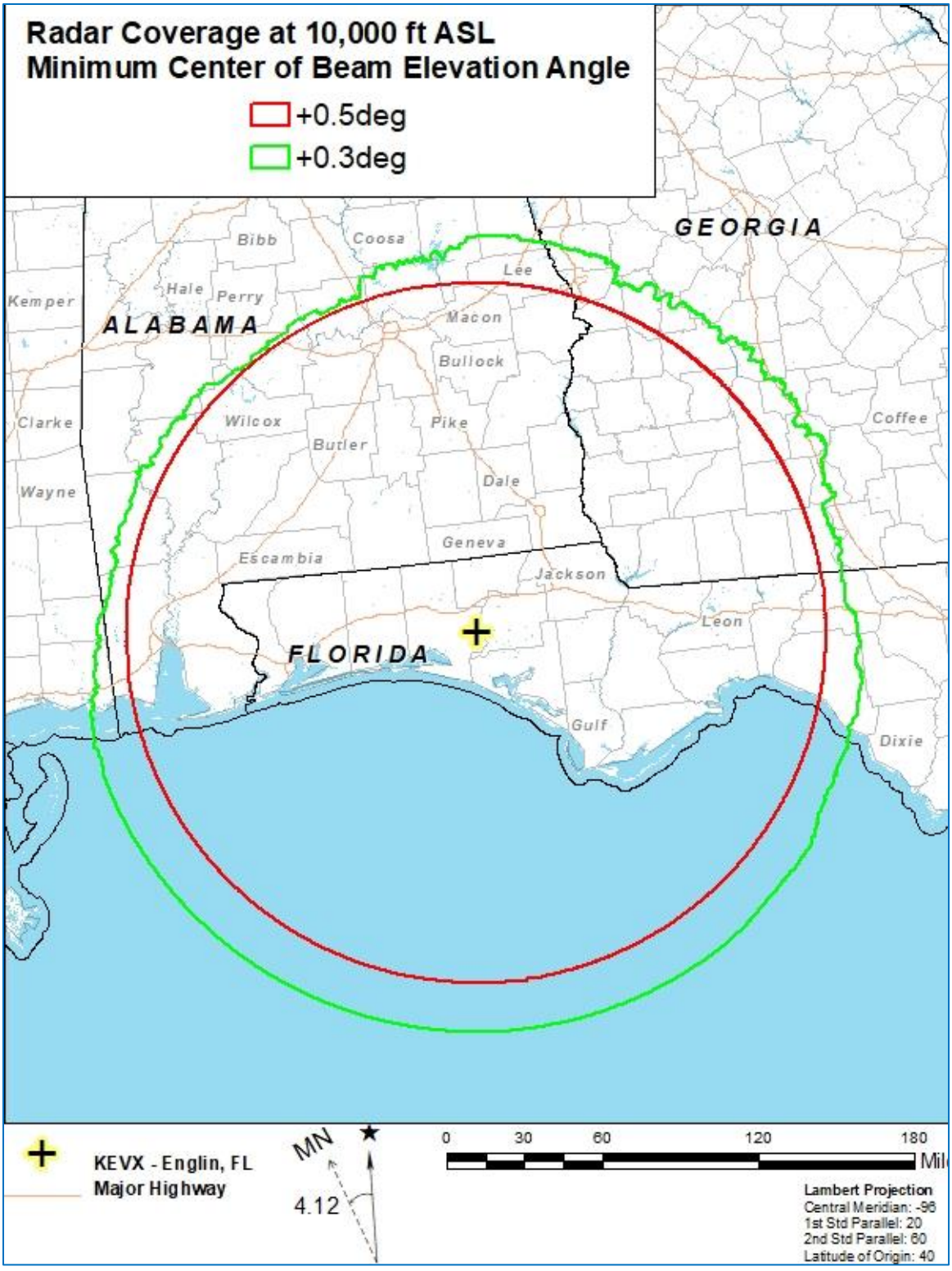

Figure 7: Existing and Proposed KEVX WSR-88D Coverage at 10,000 ft ASL

The existing WSR-88D transmitter and antenna are physically equipped to operate at the proposed minimum scan angle. The only change required to implement the proposed change would be modifications to the software that controls radar operations and processes data collected by the radar. No construction activities or ground disturbance would be required to implement the proposed action. The transmit power of the radar would also be unchanged.

3.2 ALTERNATIVES

NAO 216-6A requires analysis of the no-action alternative in EAs. For purposes of this EA report, the no-action alternative is defined as continuing to operate the KEVX WSR-88D serving the Eglin AFB, FL, area with the current minimum center of main beam scan angle of +0.5 deg. This is the same minimum scan angle used by most other WSR-88Ds in the nationwide network. The no-action alternative and alternative minimum scan angles between +0.4 and -0.0 deg are analyzed in Section 5 of this EA.

4 ENVIRONMENTAL SETTING, CONSEQUENCES, AND MITIGATION

4.1 EXPOSURE OF PERSONS TO RADIOFREQUENCY RADIATION

4.1.1 SAFETY STANDARDS

The electromagnetic environment at a specific location and time is composed of the all the electromagnetic fields from various sources (natural and manmade) that arrive there. The electromagnetic spectrum in an area is a continuously usable resource whose dimensions are amplitude, time, frequency, and space. In areas large enough to permit adequate spatial separation of users, the electromagnetic spectrum can simultaneously accommodate many users if they are sufficiently separated in frequency. The electromagnetic environment at any point can change nearly instantaneously and will vary spatially, even at locations in proximity; therefore, it is convenient to measure and characterize electromagnetic phenomena using averages over time and space.

Manmade contributions to the electromagnetic environment are both intentional and unintentional. Radio and television broadcasts, cellular telephone transmissions, and radar signals are examples of intentional contributions. Electromagnetic noise generated by power lines, fluorescent lights, and motors of all sorts are examples of unintentional human contributions. The KEVX WSR-88D transmits a radio signal at a frequency of 2,705 MHz, which is within the radiofrequency (RF) or microwave portion of the electromagnetic spectrum. Although microwaves can add heat to objects, they do not contain enough energy to remove electrons from biological tissue, and are a form of non-ionizing radiation. In this regard, microwaves are fundamentally different from ionizing radiations (e.g., X-rays, ultraviolet rays) which occur at higher frequency portions of the electromagnetic spectrum. Ionizing radiation occurs only at frequencies greater than 10^9 MHz. RF or microwave fields are non-ionizing radiation. Due to the fundamental differences between ionizing and non-ionizing radiation, safety standards and guidelines vary greatly for the two types of electromagnetic radiation. In this section only standards for non-ionizing radiation are addressed because KEVX WSR-88D RF emissions are non-ionizing.

The Institute of Electrical and Electronics Engineers (IEEE) developed safety guidelines for human exposure to RFR, and those standards have been adopted by the American National Standards Institute (ANSI) [ANSI/IEEE, 2019 and 2020]. The ANSI/IEEE safety standard is designed to protect all persons (including infants, elderly persons, and pregnant women) from adverse health effects from exposure to radiofrequency (RF), even if exposure should last over an entire lifetime. These guidelines set safety levels for maximum permissible exposure (MPE) to RF signals, which include a 10- to 50-fold safety margin and are intended to protect all members of the population.

MPEs are specified in power density of the radio signal in milliwatts per square centimeter (mW/cm^2) and vary with operating frequency. Separate MPEs have been established for

exposure of the general public and workers and for time-averaged exposure and peak exposure. Occupational safety standards are higher than those for the general public because workers are trained in RF safety practices and have greater ability to use that knowledge to protect themselves from potentially harmful RF exposure. The KEVX WSR-88D operating frequency is 2,705 MHz. The IEEE/ANSI safety standards for those frequencies are 1.0 mW/cm^2 for the general public (averaged over 30 minutes) and 5.0 mW/cm^2 for workers (averaged over 6 minutes). Federal Communications Commission (FCC) RF exposure standards for RF exposure of the general public and occupational exposure are the same as the ANSI/IEEE safety standards. The Occupational Health and Safety Administration (OSHA) regulates occupational exposure to RF emissions; the OSHA safety standard is 10.0 mW/cm^2 (averaged over 6 minutes) (OSHA, 2021).

4.1.2 RF Exposure Levels

The KEVX WSR-88D is mounted on a 20 m tall steel-lattice tower. Ground surface elevation is 140 ft MSL. The center of the antenna is at 222 ft MSL and the lower edge of the antenna is at 208 ft MSL or 68 ft above ground level (AGL). When operating at the current minimum scan angle of +0.5 deg, the lower edge of the beam is at 0.0 deg (i.e., horizontal) and the radar's main beam does not impinge on the ground surface within 3 miles of the radar (see Appendix C). Operating at the proposed minimum scan angle of +0.3 deg; the closest terrain illuminated by the main beam would 7,600 feet (1.44 miles) northwest (NW) of the WSR-88D. The closest structure within the main bean would be a cell phone tower located 11,250 ft (2.13 miles) NW. RF power density levels at the tower are shown in Table 3.

Compared to the existing minimum scan angle of +0.5 deg, lowering the minimum scan angle to +0.3 deg would result in a slight increase in RF exposure levels at air space in the vicinity of the radar. Appendix A includes calculations of the existing time-averaged RF exposure levels in the vicinity of the KEVX WSR-88D, and the RF exposure that would result if ROC lowers the minimum scan angle to +0.3 deg. Table 3 summarizes the results from Appendix A.

Table 3: RF Power Densities of KEVX WSR-88D Main Beam Compared to Safety Levels

Location / Distance from KEVX WSR-88D	Time-Averaged Power Density (mW/cm^2)	ANSI/IEEE General Public RF Safety Standard		ANSI/IEEE and FCC Occupational RF Safety Standard	
		Safety Standard (mW/cm^2)	Factor Below Std	Safety Standard (mW/cm^2)	Factor Below Std
Surface of Radome	0.603	1.0	1.66	5.0	7.9
Closest Structure: Cell Phone Tower 11,250 ft NW	0.000064	1.0	15,600	5.0	78,100
Closest Terrain: 7,600 ft NW	0.00014	1.0	7,100	5.0	35,700

During normal operation of the WSR-88D with a rotating antenna, RF exposure levels at all locations would comply with safety standards for exposure of both workers (i.e., occupational exposure) and the general public.

During infrequent stationary antenna operation, RF exposure levels within the WSR-88D main beam would exceed ANSI/IEEE and FCC safety levels for exposure of the general public within 1,740 ft of the WSR-88D antenna. FCC occupational safety levels would be exceeded within 777 ft. No structures or terrain are within those distances and no RF safety hazards would result.

4.1.3 RF ELECTRO-STIMULATION

The ANSI/IEEE safety guidelines also cover possible induction of currents within the bodies of persons and the potential for electro-stimulation of persons who make contact with conductive objects in the RFR field. The result is potentially harmful sensation of shock and/or burn. These effects only occur for RF fields at frequencies below 110 MHz (ANSI/IEEE, 2006). The KEVX WSR-88D would continue to operate at 2,705 MHz, outside the frequency range where induced currents or electro-simulation occur, and would not cause these effects.

4.1.4 CUMULATIVE RF EXPOSURE

As shown in Table 3, the power density of RF transmissions decreases exponentially with distance from the antenna. At all locations in the vicinity, RF emitted by the WSR-88D during normal operation would be at substantially below the safety standard for RF exposure of the general public. It is improbable that radio emissions from an external source would add to the WSR-88D RF emissions during normal operation to cause cumulative RF exposure levels exceeding safety standards.

4.2 RF EXPOSURE OF EQUIPMENT AND ACTIVITIES

4.2.1 TELEVISION, RADIO, CELLULAR TELEPHONE, AND PERSONAL COMMUNICATIONS DEVICES (PCDS)

High-power radar, such as the WSR-88D, can interfere with operation of radio, television, cellular telephone, and PCDs in close vicinity to the radar antenna. However, these devices operate at different frequencies from the WSR-88D, reducing the potential for radio interference. NTIA regulations reserve the 2,700 to 3,000 MHz band for government radiolocation users (e.g., meteorological and aircraft surveillance radars) [NTIA, 2009]. The WSR-88D operates outside the frequencies used by television and radio broadcasts, cellular telephones, and personal communication devices. Lowering the minimum scan angle to +0.3 deg would not result in the main beam impinging on the ground surface within 1.4 miles of the radar and the potential for radio interference would be low. No mitigation is necessary.

4.2.2 ELECTRO-EXPLOSIVE DEVICES (EEDS)

Electro-explosive devices are used to detonate explosives, separate missiles from aircraft, and propel ejection seats from aircraft. Under extreme circumstances, electromagnetic radiation can cause unintended firing of EEDs. Calculations based on a U.S. Air Force (USAF) standard

indicate that using electric blasting caps at distances beyond approximately 900 ft from the WSR-88D is a safe practice, even in the main beam of the radar, where the power density of the WSR-88D radio signal is greatest [USAF, 1982]. The U.S. Navy Hazards of Electromagnetic Radiation to Ordnance (HERO) regulations classify EEDs as safe, susceptible, or unsafe and unreliable, based on compliance with MIL-STD 664 (series). HERO safe EEDs are considered safe in all RFR environments. HERO susceptible EEDs may be detonated by RF energy under certain circumstances. HERO unsafe or unreliable EEDs have not been evaluated for compliance with MILSTD 664 or is being assembled, dissembled, or subject to unauthorized conditions, which can increase its sensitivity to RF emissions. Safe separation distances vary for susceptible and unsafe or unreliable ordnance [Naval Sea Systems Command, 2008]. For HERO susceptible ordnance, the safe separation distance (D) in ft is calculated as follows:

$$D = (781)\ (f)^{-1}(\text{average power x antenna gain})^{½}$$

Where f is operating frequency in MHz and average power = maximum transmitted power × duty cycle. Inserting these values gives:

$$D = (781)\ (2{,}705)^{-1}\ (475{,}000\ \text{W} \times 0.0021 \times 35{,}500)^{½}\ \text{ft}$$
$$D = 1{,}718\ \text{ft}$$

For HERO unsafe or unreliable EEDs, the safe separation distance (D) in ft is calculated as follows:

$$D = (2{,}873)\ (f)^{-1}(\text{average power x antenna gain})^{½}$$
$$D = (2{,}873)\ (2{,}705)^{-1}\ (475{,}000\ \text{W} \times 0.0021 \times 35{,}500)^{½}\ \text{ft}$$
$$D = 6{,}321\ \text{ft}$$

HERO concerns are only applicable in locations illuminated by the main beam of the radar. When operating at a minimum scan angle of +0.3 deg, the KEVX WSR-88D main beam would not illuminate the ground or structures within the safe setback distance for HERO safe or unsafe EEDs.

4.2.4 Fuel Handling

Electromagnetic fields can induce currents in conductive materials and those currents can generate sparks when contacts between conductive materials are made or broken. Sparks can ignite liquid fuels, such as gasoline. This phenomenon is rare, but can result in hazards to human health and property. This potential hazard arises during the transfer of fuel from container to another (e.g., fueling an automobile, boat, or airplane). The U.S. Navy developed a Technical Manual identifying the circumstances where this hazard may occur and providing direction on how to prevent it. The Technical Manual identifies a safe standoff distance based on radar operating characteristics [Naval Sea Systems Command, 2003]. Using formula contained in the Technical Manual, the distance from the WSR-88D at which RFR hazards to fuel may occur is 537 ft. This hazard only exists in areas directly illuminated by the main beam. The WSR-88D main beam operating at a minimum center of antenna scan angle of +0.3 deg would not

illuminate the ground or any occupied structures within 537 ft of the radar. The existing fuel tank for the standby generator at the base of the WSR-88D tower would not be illuminated by the WSR-88D main beam and hazards to fuel handling activities would not result. No mitigation is required.

4.2.5 Active Implantable Medical Devices

ANSI and the Association for Advancement of Medical Instrumentation (AAMI) developed the PC69:2007 standard to prevent external electromagnetic sources from causing electromagnetic interference with active implantable medical devices, including cardiac pacemakers and implantable cardiac defibrillators [ANSI/AAMI, 2007]. This standard specifies that cardiac pacemakers and ICDs must be tested by exposing them to a specified magnetic field and that the device must operate without malfunction or harm to the device. The specified field strength varies with frequency. For the WSR-88D operating frequency of 2,705 MHz, the field strength is 3 A/m. This is converted to power density (S) in units of W/m^2 by assuming free air impedance of 377 ohms:

$$S = 377\ |3|^2\ \ W/m^2$$
$$S = 3{,}393\ W/m^2$$

To convert to mW/cm^2, we multiply the numerator by 1,000 mW/W and the divisor by 10,000 $cm^2/\ m^2$ which gives a value of 339.3 mW/cm^2. The peak pulse power of the WSR-88D is given by the following formula (see Appendix A):

$$U_1 = 1.44\ X\ 10^9/R^2\ mW/cm^2$$

Inserting R = 2,060 ft gives a value of 339.3 mW/cm^2, which equals the threshold established by PC69:2007 standard. At distances of 2,060 ft or greater, the main beam of the WSR-88D would not adversely affect implantable medical devices. There would also be no hazards to implantable medical devices at locations outside the main beam. Operating at the minimum potential center of beam scan angle of +0.3 deg, the main beam of the KEVX WSR-88D would not illuminate the ground or structures within 2,060 ft of the radar.

Theoretically, persons in aircraft flying within 2,060 ft of the radar could be exposed to RF levels above the device susceptibility threshold set by ANSI/AAMI, but the likelihood of significant harm is extremely low. For persons in aircraft, the airframe would attenuate the RF level and the duration of exposure would be far less than the averaging time (6 to 30 minutes) specified in the RF safety standards, reducing the amount of RF exposure. Additionally, device susceptibility threshold in the PC69:2007 standard is based on coupling of the RFR directly into the device leads (which is the test protocol); the WSR-88D signal would be incident upon the surface of the body and would decrease considerably in strength at the location of the device leads within the body. Third, even in the unlikely event that the WSR-88D RFR couples into the device at levels above the susceptibility threshold, the device would revert to safe mode of operation that would prevent significant harm to the wearer or damage to the device [ANSI/AAMI, 2007].

FCC regulations at 47 CFR Part 95.1221 require that MedRadio medical implant devices and medical body-worn transmitters be able to withstand exposure to RF at the MPEs specified in FCC regulations at 47 CFR 1.1310 (FCC, 2017). As described in Section 4.1 above, RF exposure levels in the vicinity of the KEVX WSR-88D would comply with the FCC safety standards. Exposure of persons wearing implantable medical devices to the KEVX WSR-88D radio emissions would not result in adverse effects.

4.2.6 Astronomical Observatories

The WSR-88D can cause harmful electromagnetic interference (EMI) with charge-couple devices (CCDs) which electronically record data collected by astronomical telescopes (NEXRAD JSPO 1993). The potential for harmful EMI would arise if the WSR-88D's main beam would directly impinge on an astronomical observatory during low angle scanning. Two observatories are within 150 miles of the KEVX WSR-88D but lowering the minimum scan angle of KEVX WSR-88D main beam to +0.3 deg would not result in the main beam impinging on any of the observatories (see Appendix C). No adverse effects on astronomical observatories would result.

4.2.7 Summary of RF Exposure Effects

Table 5 summarizes impacts to potentially RF-sensitive equipment and activities. The potential for the proposed action to cause radio interference with other radio users would be very low.

Table 4: Potential Effects of KEVX WSR-88D on Equipment and Activities

Equipment / Activity	Applicable Standard	Setback Distance	Would Main Beam Impinge Within Setback Distance?	Potential for Significant Effects
TV, Radio, Cellular Telephone, and Personal Communications Devices (PCDs)	NTIA Frequency Allocations	n/a	n/a	Very low
EEDs	U.S. Navy HERO Safe/Unsafe	1,718 ft / 6,321 ft	No	None
Fuel Handling	U.S. Navy Hazards to Personnel, Fuel, and Other Flammable Material	537 ft	No	None
Active Implantable Medical Devices	AAMI PC69:2007, FCC 47 CFR Part 95.1221	2,060 ft	No	Very Low
Astronomical Observatories	Direct Exposure to WSR-88D Main Beam	n/a	n/a	None

4.3 LAND USE AND COASTAL ZONE MANAGEMENT

Florida is a coastal state and has a Coastal Management Program (CMP) consisting of "a network of agencies implementing 24 statutes that protect and enhance the state's natural cultural, and economic coastal resource." Walton County is a coastal county within the designated coastal zone. Federal activities are required to be fully consistent with Florida's approved CMP unless full consistency is prohibited by Federal law. (Florida CMP, 2023)

The KEVX WSR-88D is about 20 miles NNE of the Gulf of Mexico shoreline and within the designated coastal zone, which includes all of Walton County. Operating the KEVX WSR-88D at a lower scan angle would not result in ground disturbance or emissions of air or water pollutants. No impacts to land or water resources of the coastal zone would result. Similarly, no impacts to habitats for sensitive species would result. The proposed action would be consistent with policies to protect and conserve natural resources of the coastal zone. Similar to current operations, RF emissions from the proposed lower scan angle operations would conform with RF safety standards for exposure of persons and potentially RF sensitive activities. No visual or acoustic noise impacts would result. The increased radar data collected by KEVX WSR-88D could benefit residents, businesses, and visitors to the coastal zone by improving the quality of weather forecasts and warnings of severe weather. Improved forecasts and warnings would assist in reducing the threats to life and safety and property from coastal storms and severe weather events.

Federal agencies comply with these Florida's Coastal Zone Management policies by submitting a statement of consistency to the Florida Office of Resilience and Coastal Protection which oversees the Coastal Zone Management Program. The state must concur or object to the Federal consistency determination within 30 days. The proposed action is fully consistent with Florida's CMP and ROC will submit a consistency determination to the State.

The KEVX WSR-88D is located in a rural area and nearby uses include woodlands, rural residences and agriculture. The nearest residence is located about 350 ft E. The proposed action would not change land uses at the KEVX WSR-88D site or vicinity and would not affect nearby land uses.

4.4 GEOLOGY, SOILS, AND SEISMIC HAZARDS

The WSR-88D site is underlain by Pleistocene-age (<1.8 million years old) flat-lying marine terrace sedimentary layers, consisting of interlayered sandstone, shale, and calcareous marl clay (American Association of Petroleum Geologists 1975). Soil is Lakeland sand on 0 to 5% slope. Lakeland sand is deep and excessively drained. The water table is more than 80 inches below the ground surface and this soil is not hydric. Lakeland sand soil is not considered prime farmland. The frequency or flooding or ponding is "none" (Natural Resources Conservation Service, 2023).

U.S. Geological Survey (USGS) considers Walton County to have a low risk of seismic hazards (USGS, 2014). The proposed action would not affect the WSR-88D tower structure or change its seismic risk level.

Lowering the minimum scan angle of the KEVX WSR-88D would not require physical changes to the radar or result in ground disturbance. The proposed action would have no effect on geology, soils, or seismicity. No mitigation measures are required.

4.5 DRAINAGE AND WATER QUALITY

The KEVX WSR-88D site drains via overland flow to an unnamed branch of Seven Runs, a tributary of the Choctawhatchee River which flows southward and discharges to Choctawhatchee Bay, an inlet on the Gulf of Mexico (USGS, 2021). Lowering the minimum scan angle of the KEVX WSR-88D would not result in ground disturbance. The proposed action would not affect the amount of impervious surface area at the radar site, the rate of storm runoff flowing from the site during or after precipitation events, or generate water pollutants. The proposed action would have no effect on drainage or water quality. No mitigation measures are required.

4.6 TRANSPORTATION

The KEVX WSR-88D is in a rural area. Vehicle access is via State Route 81, a two-lane paved public road with low traffic volumes. The proposed action requires modification of the software used by the WSR-88D to support scan at angles below +0.5 deg. To implement the change in scan angle, ROC technicians and engineers would travel to the KEVX WSR-88D site to perform initial testing and ensure that the modified software is operating properly. Travel to the site would be minimal and would not result in significant congestion on local roads. Transportation effects would not be significant. No mitigation measures are required.

4.7 AIR QUALITY

The KEVX WSR-88D is equipped with a standby generator that is used if primary power is interrupted and periodically for testing. The proposed action would not change the power consumption of the WSR-88D or affect the hours of operation of the standby generator, and no change in air emissions would result. A Clean Air Act Federal Conformity Determination is not required. No mitigation measures are required.

4.8 FLOOD HAZARDS

Executive Order (E.O.) 11988, *Floodplain Management*, requires the Federal Government to avoid adverse impacts to the 100-year or base floodplain (that is, the area subject to a 1 percent annual chance of flooding), unless there is no practicable alternative [President, 1977a]. The KEVX WSR-88D site is within Zone X, an area outside the 100-year and 500-year floodplains (FEMA, 2005). The proposed action of lowering the minimum would not affect floodplains or flood hazards. No mitigation measures are required.

4.9 WETLANDS

E.O. 11990, *Protection of Wetlands*, requires the Federal Government avoid funding or implementing projects which would adversely impact wetlands unless there is no practicable alternative [President, 1977b]. Based on National Wetland Inventory maps prepared by the U.S. Fish and Wildlife Service (USFWS), the WSR-88D site does not contain federal jurisdictional wetlands. The nearest wetland is a palustrine scrub-shrub broad-leaved evergreen seasonally saturated wetland, (PSS3B), located 900 ft W (USFWS, 2023L). The proposed action would not result in ground disturbance or changes to drainage and would not affect federal jurisdictional wetlands; no mitigation is required.

4.10 BIOLOGICAL RESOURCES / PROTECTED SPECIES

The USFWS administers the Endangered Species Act (ESA) and Migratory Bird Treaty Act. The KEVX WSR-88D is located within the area served by the USFWS Florida Ecological Services Field Office in Vero Beach, FL. The EA preparers obtained a protected species list from that office (see Appendix B). Table 5 list threatened, endangered, and candidate species that may occur in the vicinity of the WSR-88D site:

Table 5: Threatened, Endangered, and Candidate Species that may Occur in the Vicinity of the KEVX WSR-88D

Species	Scientific Name	Type	Status	Critical Habitat at Site?
Eastern black rail	*Laterallus jamaicensis ssp. jaimaicensis*	Bird	Threatened	None designated for this species
Eastern indigo snake	*Drymarchon couperi*	Reptile	Threatened	None designated for this species
Alligator snapping turtle	*Machrochelys temminckii*	Reptile	Proposed Threatened	None designated for this species
Gulf sturgeon	*Acipenser oxyrinchus*	Fish	Threatened	None at site
Choctaw bean	*Obovaria choctawensis*	Clam	Endangered	No
Fuzzy pigtoe	*Pleurobema strodeanum*	Clam	Threatened	No
Southern kidneyshell	*Ptychobranchus jonesi*	Clam	Endangered	No
Southern sandshell	*Hamiota australis*	Clam	Threatened	No
Tapered pigtoe	*Fusconaia burkei*	Clam	Threatened	No

Species	Scientific Name	Type	Status	Critical Habitat at Site?
Monarch butterfly	*Danaus plexippus*	Insect	Candidate	None designated for this species
Cooley's meadowrue	*Thaklictrum cooleyi*	Plant	Endangered	None designated for this species

Eastern black rail (*Laterallus jamaicensis ssp. Jaimaicensis*) is a wetland-dependent bird that occurs in the southeastern U.S. during breeding months. It inhabits wetlands with dense overhead cover and moist to saturated soil near very shallow water (< 3cm deep) used for foraging. Dense vegetation is required near foraging areas for protection from predators because adult birds have a tendency to walk and run rather than fly and juvenile birds are incapable of flight. The proposed action would not result in ground disturbance or otherwise impact suitable habitat for Eastern black rails (USFWS, 2023A). No impacts would result

Eastern indigo snakes (*Drymarchon couperi)* are large (up to 9 ft in length), thick-bodied glossy black snakes with white to orangish chins and bellies that inhabit longleaf pine forest in the southeastern U.S. The species has declined in population due to habitat destruction overcollection for pet trade, and vehicle strikes (USFWS, 2023B). The proposed action would not impact suitable habitat and would not impact this species.

Alligator snapping turtles, Gulf sturgeons, and the five listed clam species depend on aquatic habitat (USFWS, 2023 C, D, E, F, G, H, and I). The proposed action would not disturb water bodies or impact water quality and would not impact these species.

One candidate species for listing as threatened or endangered could potentially occur in the local area: Monarch Butterfly (*Danaus plexippus*). The KEVX WSR-88D is not located within designated monarch butterfly critical habitat. Monarch butterflies are brightly colored and lay eggs on milkweed host plants, and larvae emerge in two to five days and feed on milkweed. Adults live two to five weeks, except when overwintering when they enter suspended reproduction and may live up to nine months. In temperate climates, monarchs seasonally migrate up to 1,800 miles (USFWS, 2023J). The proposed action would not result in ground disturbance or removal of vegetation and would not impact monarch butterfly habitat.

Cooley's meadowrue is a rhizomatous perennial herb that is endemic to the southeastern coastal plain and occurs in Walton County. It grows in moist to wet bogs and savanna and depends on some disturbance (e.g., wildfires or land clearing) to open up habitat. Fire suppression, silviculture, and agriculture are believed to have caused the plant's declining population. The proposed action would not result in ground disturbance or removal of vegetation and would not impact Cooley's meadowrue.

In addition to threatened, endangered, and candidate species USFWS is responsible for protecting migratory birds under the Migratory Bird Treaty Act and Executive Order 13186

Responsibilities of Federal Agencies to Protect Migratory Birds and bald and golden eagles under the *Bald and golden Eagle Protection Act*. Birds of particular concern in vicinity of the proposed action include Chimney swift (*Chaetura pelagica*), Prothonotary warbler (*Protonotaria citrea*), and swallow-tailed kite (*Elanoides forficatus)* (see Appendix B).

Lowering the minimum scan angle to +0.3 deg from the current +0.5 deg would result in a thin sliver of the atmosphere, which is currently below the main beam overage area, being exposed to the main beam of the WSR-88D (see Figure 4). The portion of this atmosphere above the newly exposed sliver of atmosphere is currently within the main beam and RF exposure levels would not change. The sliver of the atmosphere where new main beam coverage would result in increased RF exposure levels would be very small near the WSR-88D - 5 ft thick at 900 ft from the WSR-88D and increasing in thickness with distance from the radar. At 1 mile it would be 20 ft thick and at five miles it would be 92 ft thick. Birds, bats, or insects flying within the newly covered sliver of the atmosphere would be exposed to RF emissions from the WSR-88D. The RF levels in the sliver of airspace would be no greater than in RF levels in the existing covered airspace, which occurs just above the newly exposed air space. At distances of several miles or greater where the volume of newly covered airspace would be substantial, RF levels would be very low. At 900 ft, RF exposure levels would be 100 times less than safety standards for human exposure. Based on the extremely low RF levels at distance from the WSR-88D, RF exposure of birds or insects flying within the newly covered airspace would not be harmful.

Increased RF exposure could result if a bird or butterfly flies in a path that keeps it within the WSR-88D main beam for extended periods of time. However, during normal operation the WSR-88D main beam is continuously moving. At 1,000 ft the WSR-88D main beam is moving at an effective speed of about 89 miles per hour and it is very unlikely that a bird or insect could remain within the WSR-88D main beam for any length of time.

No impacts would result to threatened or endangered species, designated monarch butterfly critical habitat, migratory birds, or bald and golden eagles. No mitigation measures are required.

4.11 CULTURAL AND HISTORIC RESOURCES

Section 106 of the National Historic Preservation Act of 1966 (as amended) requires that federal agencies consider the effects of their actions on historic places and, if effects may result, provide the State Historic Preservation Officer (SHPO) with an opportunity to comment on their actions. Section 106 regulations are set forth in 36 CFR Part 800, *Protection of Historic Properties* (Advisory Council on Historic Preservation, 2010).

Because the proposed action would not involve ground disturbance, no impacts to archaeological or paleontological resources would result. The proposed action's area of potential effect (APE) is defined as area within 1,740 ft of the KEVX WSR-88Ds where RF exposure of persons within the WSR-88D main beam could potentially exceed safety levels (see Appendix A). The National Register of Historic Places database was searched to identify places listed or eligible for listing on within the APE. No listings were found (National Park Service, 2023). Additionally, a search

was conducted of the Florida Historic Sites Master File. The search covered sections 22 and 23 of Township 2 north, Range 17 west, which includes the entire APE. No historic or cultural sites are present in sections 22 or 23 (Frederick, 2023). No places listed or eligible for listing on NRHP are located within the APE and the proposed action would not affect historic properties. Under Section 106 Regulations 36 CFR Section 800.4 (d)(1), *No Historic Properties Affected,* if the proposed action does not have the potential to affect historic properties, the ROC shall provide notification of this determination to the SHPO. If the SHPO does not object to the determination within 30 days, ROC's section 106 responsibilities are fulfilled. [ecfr, 2023).

4.12 ENVIRONMENTAL JUSTICE AND SOCIOECONOMIC IMPACTS

E.O. 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations,* requires federal agencies to identify and address, as appropriate, disproportionately high and adverse environmental or human health effects on minority populations and low income populations (President, 1994).

The KEVX WSR-88D is in a rural/agricultural area in Walton County, FL. Nearby land uses are agriculture and widely spaced rural residences. The proposed action would not generate air or water pollutants or hazardous waste. The project would modify the operation of the KEVX WSR-88D by reducing the minimum scan angle from +0.5 deg to +0.3 deg. The WSR-88D main beam would not impinge on the ground in proximity to the radar and would comply with safety standards for human exposure to RF energy and setbacks for activities (e.g., fuel handling and EED use) that are potentially sensitive to RF exposure. No disproportionately high and adverse effects would result to any persons, including minority or low income populations. No mitigation is required.

4.13 FARMLANDS

The Farmland Protection Policy Act sets forth federal policies to prevent the unnecessary conversion of agricultural land to non-agricultural use. NRCS regulations at 7 CFR Part 658, *Farmland Protection Policy Act*, are designed to implement those policies. Completion of Form AD-1006 and submission to the U.S. Department of Agriculture (DoA) is required if a federal agency proposes to convert land designated as prime farmland, farmland of statewide importance, or unique farmland to non-agricultural use. Soil at the KEVX WSR-88D site is not classified as prime farmland (NRCS, 2023). Additionally, the WSR-88D site is committed to non-agricultural government use. The proposed action would not convert farmland to non-farm use. No mitigation is necessary.

4.14 ENERGY CONSUMPTION

The proposed action would not change electric use by the WSR-88D and would have no effect on energy consumption. No mitigation is necessary.

4.15 VISUAL QUALITY/ LIGHT EMISSIONS

The proposed action would not change the appearance of the KEVX WSR-88D or result in new emissions of visible light. The proposed action would have no effect on visual quality. No mitigation is necessary.

4.16 SOLID AND HAZARDOUS WASTE

The proposed action would result in no changes to solid or hazardous waste generation. No mitigation is necessary.

4.17 WILD AND SCENIC RIVERS

The Wild and Scenic Rivers Act of 1968 protects free-flowing rivers of the U.S. These rivers are protected under the Act by prohibiting water resource projects from adversely impacting values of the river: protecting outstanding scenic, geologic, fish and wildlife, historic, cultural, or recreational values; maintaining water quality; and implementing river management plans for these specific rivers. The wild and scenic rivers closest to the KEVX WSR-88D is Black Creek in southern Mississippi, about 190 miles W of the WSR-88D. (National Park Service, 2023). The proposed action would not affect that wild and scenic river. No mitigation is necessary.

5 ALTERNATIVES TO THE PROPOSED ACTION

5.1 MINIMUM SCAN ANGLES BETWEEN +0.4 AND 0.0 DEG

ROC evaluated the benefits and potential impacts of lowering the minimum center of beam scan angle of the KEVX WSR-88D to each angle between +0.4 and 0.0 deg in 0.1 degree increments (see Appendix C). That analysis found that the proposed action of lowering the minimum scan angle to +0.3 deg would result in the significant improvement in radar coverage.

A minimum scan angle of +0.4 deg would increase the radar's coverage area, but by less than the proposed action (i.e., minimum scan angle of +0.3) deg. A minimum scan angle lower than +0.3 deg would not increase coverage area and would have the drawback of increasing ground clutter returns.

Because a minimum scan angle of +0.3 deg would result in significant improvement in radar coverage area while avoiding significant environmental impacts, ROC selected +0.3 deg as the proposed minimum scan angle for the KEVX WSR-88D.

5.2 NO ACTION

The no action alternative consists of continued operation of the KEVX WSR-88D at the existing minimum scan angle of +0.5 deg. The improvements in radar coverage summarized in Section 3 would not be achieved and the project objectives would not be met.

The proposed action would result in increased RF exposure compared to existing WSR-88D operations as described in section 4.1; the no-action alternative would not change RF exposure levels from existing. Under both the proposed action and the no action alternative, RF exposure during normal WSR-88D operations would conform to safety standards established by ANSI/IEEE, OSHA, and FCC.

Similar to the proposed action, the no-action alternative would not result in adverse effects in the following topic areas:

- Land Use and Coastal Zone Management
- Geology, Soils, and Seismic Hazards
- Drainage and Water Quality
- Transportation
- Air Quality
- Flood Hazards
- Wetlands
- Biological Resources / Protected Species
- Cultural and Historic Resources
- Environmental Justice and Socioeconomic Impacts
- Farmlands

- Energy Consumption
- Visual Quality/ Light Emissions
- Solid and Hazardous Waste
- Wild and Scenic Rivers

6 FINDING

The proposed action of lowering the scan angle of the KEVX WSR-88D from the current minimum of +0.5 deg to +0.3 deg would not result in significant changes in the quality of the human environment. Lowering the minimum scan angle would also not add to the environmental effects of past, present, and reasonably foreseeable future actions to cause cumulatively significant effects

The proposed action would improve the quality of meteorological radar data available to ROC forecasters and others users of the data. This may indirectly benefit the residents and businesses of the Eglin AFB, FL area, improving the accuracy of forecast and severe weather alerts, which could result in environmental benefits if weather dependent economic or government activities (e.g., agriculture, construction, outdoor recreation, transportation, military operations, water management) become more efficient or safer as a result of improved weather services. The resulting environmental benefits are difficult to quantify, but are unlikely to be significant.

Implementation of the proposed action would not have the potential to cause significant changes in the environmental. A Finding of No Significant Impact is warranted for the proposed action.

7 DOCUMENT PREPARERS

This Draft EA was prepared by Sensor Environmental LLC under contract to Centuria Corporation. Centuria Corporation provides support to the ROC Radar Operations Center (ROC) in Norman, OK.

Mr. James Manitakos, CEO, served as Sensor's Project Manager. Huntington Ingalls Industries (HII)/Alion Science and Technology Corporation prepared radar coverage maps and calculated coverage areas under subcontract to Sensor. Mr. Andre Tarpinian, Radio Frequency Engineer, served as HII Alion's Project Manager. Ms. Jessica Schultz, Deputy Director of the ROC, and Mr. Ryan Groce, Centuria Corporation Program Manager, from the ROC assisted in preparation of this EA.

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Environmental Assessment Report

ENVIRONMENTAL ASSESSMENT (EA)

LOWERING THE MINIMUM SCAN ANGLE OF THE WEATHER SURVEILLANCE RADAR - MODEL 1988, DOPPLER (WSR-88D) SERVING THE EGLIN AIR FORCE BASE, FL, AREA

APPENDICES

APPENDIX A

RADIOFREQUENCY RADIATION POWER DENSITY CALCULATIONS

1. OBJECTIVE

This appendix quantifies the power densities of the radiofrequency radiation (RFR) emitted by the Weather Surveillance Radar, Model 1988 Doppler (WSR-88D) during operations that include minimum scan angles lower than +0.5 degrees (deg). The calculated power densities will be used to analyze the potential for effects to result from exposure of humans, equipment, and activities to the WSR-88D radio signal, and the significance of any identified potential effects.

2. METHODOLOGY

This memorandum builds upon the analysis included in the 1993 *Supplemental Environmental Assessment (SEA) of the Effects of Electromagnetic Radiation from the WSR-88D Radar* [NEXRAD Joint System program Office, 1993]. The 1993 analysis analyzed the potential electromagnetic effects of the WSR-88D signal when the radar operates at a minimum center of beam scan angle of +0.5 deg. This memorandum builds on that analysis by considering operation at a lower minimum scan angle of -0.2 deg. The parameters of the WSR-88D are shown in Table A-1 and are not changed from the 1993 analysis:

TABLE A-1: Operating Characteristics of WSR-88D Serving the Eglin AFB, FL, Area (KEVX)

Parameter	**Value**
Operating Frequency	2,705 megahertz (MHz)
Wavelength at 2,705 MHz)	0.364 ft, 11.1 cm
Maximum pulse power	475 kiloWatts (kW)
Maximum duty cycle	0.21%
Antenna diameter	28 ft, 853 cm
Antenna gain	35,500:1, 45.5 dB
Beam width to half-power points	1.0 deg
First sidelobe relative power density, maximum	0.00325, -25 dB
Other sidelobe maximum power density, relative to main beam	0.0004, -34 dB

The ROC proposes to modify the minimum center of beam scan angle used during operation of the KEVX WSR-88D below the +0.5 angle currently used. This would not require changes to the antenna, other hardware which composes the WSR-88D, or the radiated pulse power of the WSR-88D. However, incorporating scans at angles below +0.5 deg could affect the amount of RFR exposure experienced by persons, equipment, and activities at or near ground level in the vicinity of the radar. This memorandum quantifies that change.

3. MODIFIED VOLUME SCAN PATTERN 31

The WSR-88D uses a number of complex volume scan patterns to maximize the quality and usefulness of the meteorological data it collects. The 1993 report analyzed volume scan pattern 31, which results in the highest levels of ground-level RFR exposure. Volume Scan Pattern

(VCP) 31 consists of eight 360 deg rotations of the antenna at various scan angles. ROC proposed to add two additional antenna rotations at a scan angle between +0.5 and 0.0 deg to this scan pattern to increase the range at which the radar can detect and track meteorological phenomena, especially at low elevations within the atmosphere. This memorandum assumes that the two added scans would be at +0.3 deg (i.e., lower half power point of -0.3 deg), the lowest scan angles under consideration by ROC. Adding two +0.3 degree scans would result in the greatest possible increase in ground level RFR exposure. The modified VCP 31 would be as follows:

- Two complete rotations at +0.3 deg
- Two complete rotations at +0.5 deg
- Two complete rotations at +1.5 deg
- Two complete rotations at +2.5 deg
- One complete rotation at +3.5 deg
- One complete rotation at +4.5 deg

The complete pattern would include 10 rotations of the antenna at a speed of 0.8 revolutions per minute (rpm), the pattern would take about 12 minutes and 22 seconds to complete [Turner, 2011].

4. CALCULATION OF RF POWER DENSITIES

Appendix A of the 1993 SEA includes detailed calculations of the RFR power density and exposure levels resulting from volume scan pattern 31. The proposed scan change would not affect the distance of the transition from the near field to the far field, calculated at 640 to 800 ft in section A.3 of the 1993 Appendix A.

4.1 Far Field

For VCP 31 operation of the WSR-88D, the values of U_1, U_2, U_3, U_4 and U_5 are unchanged from the values derived in 1993 Appendix A. The RF human exposure standards are based on time-averaged RF exposure for six minutes (occupational exposure) or 30 minutes (general public exposure) [American National Standards Institute/Institute of Electrical and Electronic Engineers, 2019]and 2020. We use six minutes as the averaging time as a worst-case analysis. The time-averaged power density for VCP 31, considering the contributions from both the main beam and the first five sidelobes is given by U_5, below:

$$U_{5,\ VCP\ 31} = 5{,}804 / R^2\ mW/cm^2$$

At this point the analysis must consider the proposed modifications to VCP 31, which will change the values of U_4 and U_5. The modified VCP 31 would have two additional +0.3 deg scans. Within our six minute averaging time, these two added scans would replace the RFR contribution from one +1.5 deg and one +2.5 deg scan. As described in the 1993 appendix, U_4 sums the RFR contributions at center of antenna level from each of the scans performed during the six minute period of interest. The coefficients for the +0.3 deg scans are 2.4/6 reflecting the proportion of the 6 minutes and 1.0 because the center of beam will essentially be at antenna level (i.e., +0.2 deg which equates to 2.8 ft, or one-tenth of the beam width at the far field

transition distance of 800 ft). The corresponding coefficients for the two +0.5 deg scans within the six minutes are 2.4/6 and 0.5, and for the one +1.5 deg scan within the six minutes are 1.2/6 and 0.012. The modified U_4 calculation is given below

$$U_{4,\,mod} = [(2.4/6)\,(1.0) + (2.4/6)\,(0.5) + (1.2/6)\,(0.012)]\,U_3$$

$$U_{4,\,mod} = (0.602)\,U_3$$

Inserting the U_3 value of $1.35 \times 10^4/R^2$ milliwatts/cm^2 (mw/ cm^2), yields:

$$U_{4,\,mod} = 8{,}130 / R^2 \ \ mW/cm^2$$

U_4 is the 6-minute time-averaged power density at locations in the far field directly illuminated by the main beam and at the same elevation as the WSR-88D antenna, considering the RFR contributed from the main beam and the first five sidelobes. According to the WSR-88D specification, sidelobes of higher order than the first five will contain less than 5% of the eradiated energy. The 1993 SEA calculated the average power density of these higher order sidelobes at $4/R^2$ mW/cm^2. We add this to U_4 to obtain U_5, the total time-averaged power density at an elevation even with the center of antenna elevation and distances greater than 800 ft from the antenna:

$$U_{5,\,mod} = 8{,}130 \times 10^3/R^2 + 4/R^2 = 8{,}134/R^2 \quad mW/cm^2$$

4.2 Near Field

Appendix A of the 1993 SEA contains the following formula for power density in the WSR-88D main beam during VCP 31 operation:

$$U_{6,\,VCP\,31} = 9800/\,(R^2 + 800R)\ mW/cm^2$$

Which is based on calculation of the height Y of the mathematical cylinder illuminated by all scans during the six-minute period using the formula Y = 28 + R Tan (2 deg) + 0.035R. Since the modified scan pattern of interest includes scans of +0.3. +0.5, and +1.5 degs, the angular range is 1.2 deg, and we recalculate Y as follows:

$$Y = 28 + R \times \text{Tan}\,(1.2\ \text{deg}) = 28 + 0.021R$$

The circumference of the illumination cylinder is $2\pi RY$ and the total area A is

$$A = 2\pi RY = 176R + 0.13R^2$$

The average power radiated is less than or equal to 1 kW, and the average power over the cylindrical surface cannot exceed this value divided by the area. At the mid-height of the cylinder, the local power density will exceed the average value by a factor of 2 (unchanged from the 1993 analysis). We introduce this factor, multiply by 10^6 to convert from kW to mW, and divide by 929 to convert from sq ft to square centimeters (sq cm):

$$U_{6,\,mod} = 2 \times 10^6 / (929)\,(176R + 0.13R^2) = 16{,}556 / (R^2 + 1{,}353\,R)\ mW/cm^2$$

$U_{6,\,mod}$ is the time-averaged RFR exposure within the area illuminated by the WSR-88D main beam up to distances of 640 ft where the beam begins to spread.

4.3 RF Exposure Levels near KEVX WSR-88D

Table A-2 shows the time-averaged RF power densities that would result at locations directly illuminated by the main beam of the KEVX WSR-88D when operating in modified VCP 31. The near field is within 640 ft of the radar and the U_6 formula is used to calculate these near field values. At greater distances, the far field formula for U_5 is used. For comparison purposes, corresponding values for the original VCP 31 are also shown. As can be seen from Table A-1, use of modified scan pattern 31 would lower the elevation at which the main beam occurs and would also slightly increase the time-averaged power densities in both the near and far fields.

Table A-2: Comparison of RF Power Densities within the WSR-88D Directly Illuminated Area Using VCP 31 and Modified VCP 31

Place	Distance (ft)	Original VCP 31 Lowest Elev (ft MSL)	Original VCP 31 Time-Avg Power Density (mW/cm2)	Modified VCP 31 Lowest Elev (ft MSL)	Modified VCP 31 Time-Avg Power Density (mW/cm^2)
Surface of Radome	20	208*	0.598	n/a	0.603
Closest Structure: Cell Phone Tower	11,250	208	0.000046	169	0.000064
Closest Illuminated Ground	7,600	208	0.00010	181	0.00014

*****Elevation of bottom edge of KEVX WSR-88D antenna

ROC may infrequently operate the KEVX WSR-88D with a stationary antenna, resulting in the main beam being continuously pointed at the same location for a period of time. The RF exposure level within the main beam can be calculated using equation U_1 multiplied by the radar duty cycle

$$U_7 = (1.44 \times 10^9/R^2)\ 0.0021 = 3.024 \times 10^6/R^2 \qquad (mW/cm^2)$$

When operating in stationary antenna mode, the KAH WSR-88D would exceed the American National Standards Institute / Institute of Electrical and Electronic Engineers (ANSI/IEEE) safety levels within the following distances:

- ANSI/IEEE and FCC General Public Safety Level (1.0 mW/cm^2): 1,740 ft

- Federal communications commission (FCC) and ANSI Occupational Safety Level (5.0 mW/cm^2): 777 ft

5. REFERENCES

ANSI/IEEE. *IEEE Standard for Safety Levels with Respect to Human Exposure to Electric, Magnetic, and Electromagnetic Fields, 3 kHz to 300 GHz*. IEEE Std C95.1-2019 (February 8, 2019).

ANSI/IEEE. *IEEE Standard for Safety Levels with Respect to Human Exposure to Electric, Magnetic, and Electromagnetic Fields, 3 kHz to 300 GHz, Corrigenda 2*. IEEE Std C95.1-2019 (September 24, 2020).

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APPENDIX B

PROTECTED SPECIES LIST

United States Department of the Interior

FISH AND WILDLIFE SERVICE
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Phone: (772) 562-3909 Fax: (772) 562-4288
Email Address: fw4flesregs@fws.gov
https://www.fws.gov/office/florida-ecological-services

In Reply Refer To: July 22, 2023
Project Code: 2023-0107804
Project Name: KEVX WSR-88D Lower Scan Angle

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. **Please include your Project Code, listed at the top of this letter, in all subsequent correspondence regarding this project.** Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Migratory Birds: In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts see https://www.fws.gov/birds/policies-and-regulations.php.

The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. It is the responsibility of the project proponent to comply with these Acts by identifying potential impacts to migratory birds and eagles within applicable NEPA documents (when there is a federal nexus) or a Bird/Eagle Conservation Plan (when there is no federal nexus). Proponents should implement conservation measures to avoid or minimize the production of project-related stressors or minimize the exposure of birds and their resources to the project-related stressors. For more information on avian stressors and recommended conservation measures see https://www.fws.gov/birds/bird-enthusiasts/threats-to-birds.php.

In addition to MBTA and BGEPA, Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Birds*, obligates all Federal agencies that engage in or authorize activities that might affect migratory birds, to minimize those effects and encourage conservation measures that will improve bird populations. Executive Order 13186 provides for the protection of both migratory birds and migratory bird habitat. For information regarding the implementation of Executive Order 13186, please visit https://www.fws.gov/birds/policies-and-regulations/executive-orders/e0-13186.php.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Code in the header of

this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List
- USFWS National Wildlife Refuges and Fish Hatcheries
- Migratory Birds
- Wetlands

OFFICIAL SPECIES LIST

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Florida Ecological Services Field Office
1339 20th Street
Vero Beach, FL 32960-3559
(772) 562-3909

PROJECT SUMMARY

Project Code: 2023-0107804
Project Name: KEVX WSR-88D Lower Scan Angle
Project Type: Maintenance/Modification Meteorological Tower
Project Description: Lowering the minimum scan angle of the KEVX WSR-88D
Project Location:

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@30.5650255,-85.9215679570067,14z

Counties: Walton County, Florida

ENDANGERED SPECIES ACT SPECIES

There is a total of 11 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

BIRDS

NAME	STATUS
Eastern Black Rail *Laterallus jamaicensis ssp. jamaicensis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/10477	Threatened

REPTILES

NAME	STATUS
Alligator Snapping Turtle *Macrochelys temminckii* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/4658	Proposed Threatened
Eastern Indigo Snake *Drymarchon couperi* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/646	Threatened

FISHES

NAME	STATUS
Gulf Sturgeon *Acipenser oxyrinchus (=oxyrhynchus) desotoi* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/651	Threatened

CLAMS

NAME	STATUS
Choctaw Bean *Obovaria choctawensis* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/5038	Endangered
Fuzzy Pigtoe *Pleurobema strodeanum* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/3417	Threatened
Southern Kidneyshell *Ptychobranchus jonesi* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/7539	Endangered
Southern Sandshell *Hamiota australis* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/2551	Threatened
Tapered Pigtoe *Fusconaia burkei* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/5046	Threatened

INSECTS

NAME	STATUS
Monarch Butterfly *Danaus plexippus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9743	Candidate

FLOWERING PLANTS

NAME	STATUS
Cooley's Meadowrue *Thalictrum cooleyi* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/3281	Endangered

CRITICAL HABITATS

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

YOU ARE STILL REQUIRED TO DETERMINE IF YOUR PROJECT(S) MAY HAVE EFFECTS ON ALL ABOVE LISTED SPECIES.

USFWS NATIONAL WILDLIFE REFUGE LANDS AND FISH HATCHERIES

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS OR FISH HATCHERIES WITHIN YOUR PROJECT AREA.

MIGRATORY BIRDS

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

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1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Chimney Swift *Chaetura pelagica* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Mar 15 to Aug 25
Prothonotary Warbler *Protonotaria citrea* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Apr 1 to Jul 31
Swallow-tailed Kite *Elanoides forficatus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/8938	Breeds Mar 10 to Jun 30

PROBABILITY OF PRESENCE SUMMARY

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

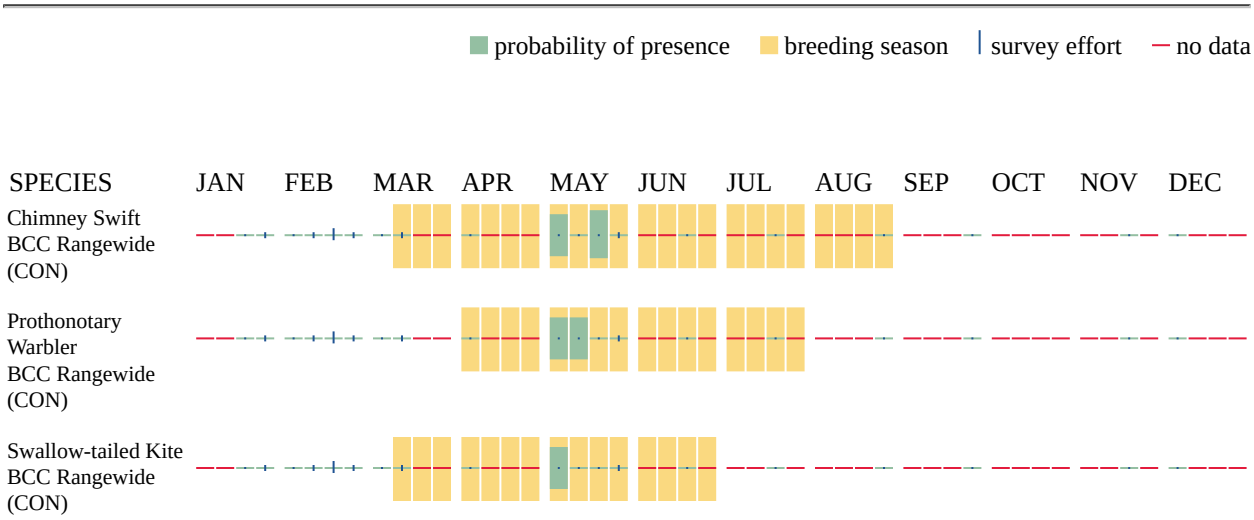
Breeding Season (■)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe

Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



Additional information can be found using the following links:

- Birds of Conservation Concern https://www.fws.gov/program/migratory-birds/species
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf

MIGRATORY BIRDS FAQ

Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?
The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets.

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering or migrating in my area?
To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may query your location using the RAIL Tool and look at the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?
Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects
For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?
If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report
The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

WETLANDS

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

THERE ARE NO WETLANDS WITHIN YOUR PROJECT AREA.

IPAC USER CONTACT INFORMATION

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APPENDIX C

TECHNICAL MEMORANDUM AND TRIP REPORT

SENSOR ENVIRONMENTAL LLC
www.sensorenvirollc.com

TECHNICAL MEMORANDUM

TO: Ryan Groce, Program Manager, Centuria Corporation	**FROM:** James Manitakos, CEO, Sensor Environmental LLC
CC: Jessica Schultz, Deputy Director, National Weather Service Radar Operations center Andre Tarpinian, Senior RF Engineer, Huntington Ingalls Industries Mission Technologies (formerly Alion Science and Technology Corp.)	**SUBJECT:** Analysis of Lower Scan Angles for Weather Surveillance Radar, Model 1988 Doppler (WSR-88D) Serving Eglin Air Force Base, FL, Area
DATE: July 7, 2023	

1. BACKGROUND AND NEED

The National Weather Service (NWS) proposes to reduce the minimum vertical scan angles used during normal operation of the WSR-88D serving Eglin Air Force Base (AFB), area. Information on this radar is shown in Table 1. This WSR-88D was commissioned on August 24, 1992 and has been in operation at its current location since then.

TABLE 1: Information on WSR-88D Serving the Eglin AFB, FL, Area

Location	36 miles east-northeast (ENE) of Eglin AFB and 13 mi northeast (NE) of Freeport, Walton County, FL
Commissioning Date	August 24, 1992
International Civil Aviation Organization Designator	KEVX
Elevation, ground surface at tower base (mean sea level, MSL)	140 feet (ft)
Elevation, center of antenna (MSL)	222 ft
Tower Height (m)	20 m (66 ft)
Latitude (WGS84)	30˚33’52” N
Longitude (WGS84)	85˚55’17” W
Operating Frequency	2,705 megaHertz (MHz)
Spot Blanking or Sector Blanking used	No

The U.S. Air Force (USAF) currently operates the KEVX WSR-88D at a minimum center-of-beam scan angle of + 0.5 degree (deg). The WSR-88D main beam has a width of 1 deg to the half power points. Half of the beam (i.e., 0.5 deg) is below the axis, resulting in an essentially horizontal floor for existing radar coverage. As a result, the WSR-88D cannot provide radar coverage of the atmosphere below the elevation of the WSR-88D antenna. At considerable distance from the radar, earth curvature increases the height above the ground surface of the uncovered area. To increase the amount of radar coverage provided by the KEVX WSR-88D, The WSR-88D Radar Operations Center (ROC) proposes to operate the radar with a lower center-of-beam minimum scan angle and is considering angles between +0.4 and 0.0 deg. This would result in the lower half power point of the main beam at -0.1 to -0.5 deg, depending on the minimum scan angle selected.

2. INVESTIGATIONS PERFORMED

To analyze the benefits and potential impacts of lowering the minimum scan angle of the KEVX WSR-88D, Sensor Environmental LLC and our subcontractor Huntington Ingalls Industries Mission Technologies Group (formerly Alion Science and Technology Corporation) performed the following tasks:

1. Visited the KEVX WSR-88D to ascertain site conditions and activities in the vicinity (see Attachment A, Trip Report).
2. Obtained 360-degree calibrated panoramic photograph taken at 15-m level of the KEVX WSR-88D tower, which is about 30 ft lower than the center of antenna height.
3. Prepared maps showing the extent of WSR-88D coverage at 2,000 ft above site level for each (center of beam) scan angle from the current minimum of +0.5 degree to 0.0 degree (See Attachment B).
4. Identified areas of terrain and activities that are potentially sensitive to radiofrequency (RF) radiation exposure in proximity to the WSR-88D that would be directly illuminated by the main beam at each lower scan angle under consideration (see Attachment C).
5. Identified astronomical observatories within 150 miles and analyzed the potential for a lowered WSR-88D main beam to directly impinge on each observatory.
6. Identified wind turbines within 50 miles and analyzed the potential for a lowered WSR-88D main beam to directly impinge on each observatory.

3. WSR-88D COVERAGE

KEVX WSR-88D is located on modestly hilly ground in a rural portion of Walton County, Florida about 36 miles east-northeast (ENE) of Eglin AFB. The Project team used Alion

Integrated Target Acquisition System (ITAS) terrain-based computer model with GIS-based interface to project the terrain-dependent radar coverage for the KEVX WSR-88D at 2,000 ft above site level (ASL). The radar coverages shown in Attachment B are based on Digital Terrain Elevation Data (DTED) Level 2 topographic data and 4/3 earth radius to account for atmospheric refraction of the WSR-88D main beam. The lower half-power point of the unobstructed WSR-88D main beam is considered the minimum elevation (i.e., floor) of WSR-88D coverage. Table 2 shows KEVX WSR-88D coverage areas at 2,000 ft above site level (ASL) for the range of minimum scan angles under consideration by NWS.

TABLE 2: KEVX WSR-88D Radar Coverage Areas for Minimum Scan Angles

Coverage Altitude (ft ASL)	Minimum Center of Beam Scan Angle (deg)	Lower Half-power Point (deg)	Area in Lambert Projection (sq. mi.)	Change from Existing Minimum Scan Angle
2,000	+0.5 (existing)	0.0	10,977	n/a
2,000	+0.4	-0.1	14,255	+29.9%
2,000	+0.3	-0.2	16,615	+51.4%
2,000	+0.2, +0.1, 0.0	-0.3, -0.4, -0.5	16,677	+51.9%

When operating at the current minimum center of beam minimum scan angle of +0.5 deg, the KEVX WSR-88D is subject to very minor terrain blockage (see Attachment B). At a lower scan angle of +0.4, radar coverage would improve in all directions, although coverage improvements to the northwest (NW) and east (E) would be limited by terrain blockage. At a lower scan angle of +0.3, additional coverage improvements would be achieved in most directions, except to the NW and E. Negligible additional coverage would result at minimum scan angles below +0.3 deg.

Low altitude radar coverage over the Gulf of Mexico is a concern. Under current operations, 2,000-ft radar coverage extends a maximum of 40 miles from the Gulf shoreline. Lowering the WSR-88D minimum scan angle to +0.3 would extend the area of 2,000 ft coverage to up to 60 miles from the Gulf shoreline (see Attachment B).

4. HUMAN EXPOSURE AND POTENTIALLY RF-SENSITIVE ACTIVITIES

Exposure to radiofrequency (RF) radiation can potentially be harmful to humans and RF-sensitive activities. Table 3 presents the safe setback distances from the WSR-88D for human exposure, implantable medical devices, fuel handling, and EEDs (Sensor Environmental LLC,

2011). Safety standards for implantable medical devices, fuel handling, and EEDs are based on instantaneous exposure. Safety standards for human exposure are based on time-averaged exposure; therefore, exposure during both rotating antenna and stationary antenna operations are considered.

TABLE 3: Safe Setback Distances for Human Exposure and Potentially RF-Sensitive Activities Directly Illuminated by the WSR-88D Main Beam

Activity	Safe Setback Distance (ft)		Source
Human Exposure	Rotating Antenna	20	American National Standards Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE)
	Stationary Antenna	1,740	
Implantable Medical devices	2,060		ANSI/Association for the Advancement of Medical Instrumentation (AAMI)
EEDs (Safe/Unsafe)	1,718 / 6,321		Naval Sea Systems Command
Fuel Handling	537		Naval Sea Systems Command

The safe setback distances from the WSR-88D for human exposure, implantable medical devices, fuel handling, and electro-explosive devices (EEDs), are given in section 4 of this memorandum. The greatest safe setback distance for human exposure or any of these activities for exposure of EEDs, which include blasting caps, some types of ordnance, and equipment used in aviation systems (e.g., ejection seats and separation systems for air-launched missiles). Hazard of Radiation to Ordnance (HERO) regulations characterize EEDs as either unsafe or safe with differing setback distances. HERO unsafe or unreliable EEDs have not been evaluated for compliance with MILSTD 664 or are being assembled, dissembled, or subject to unauthorized conditions, which can increase its sensitivity to RF emissions. HERO safe EEDs have been evaluated for compliance with MILSTD 664 and are not being assembled or dissembled (Naval Sea Systems command, 2008). Based on the U.S. Navy HERO regulations, the safety setback distances for HERO unsafe and safe EED, respectively are 6,321 ft and 1,718 ft respectively. U.S. Air Force safety regulations consider a 900 ft setback distance from radars such as the WSR-88D safe for all types of blasting caps (U.S. Air Force, 1982).

5. DIRECTLY ILLUMINATED TERRAIN AND STRUCTURES

Photographs 3A through 3D in Attachment A Trip Report are panoramic photographs taken from the 15-m level of the KEVX WSR-88D tower and show a 360 deg view of the horizon. As shown in these figures, no nearby structures rise above WSR-88D antenna elevation.

A search of the Federal Communications Commission (FCC) Antenna Structure Registration site identified four listings within 3 miles of the KEVX WSR-88D. Table 5 provides additional information. The existing/planned towers in the listings are 2.1 to 3.0 miles from the WSR-88D. One listing (file number 1301565) was cancelled and the tower not bult. Two listings (File numbers 1262424 and 1304036) are for towers built in 2006 and 2018; the tops of both towers are higher in elevation than the WSR-88D. The WSR-88D main beam currently impinges on the upper portions of both towers and the portions of the towers within the main beam would increase if the minimum scan angle is lowered. The fourth listing (file number 1304036) was approved by the FCC but has not yet been constructed. The top of the planned tower will be higher in elevation than the WSR-88D; therefore, the WSR-88D main beam at either the existing +0.5 deg minimum scan angle or a lower future scan angle will impinge on the upper part of the planned tower. The two existing and one planned tower in the FCC listings are farther from the WSR-88D than all safe setback distances. No RF hazards will result to personnel or RF-sensitive activities at those towers.

TABLE 4: FCC Antenna Structure Registrations within 3 miles of KEVX WSR-88D

File Number	Distance and Direction from WSR-88D	Top of Tower Elevation (ft MSL)	Registrant	Status	Would WSR-88D main beam impinge at scan angle of +0.5 deg / +0.3 deg?
1301565	n/a	n/a	T-Mobile South LLC	Cancelled, tower not constructed	n/a
1262424	2.1 mi (11,250 ft) NW	327	Affiniti LLC	Constructed 2006	Yes/Yes
1304036	3.0 mi (15,700 ft) NW	443	Branch Towers LLC	Constructed 2018	Yes/Yes

TABLE 4: FCC Antenna Structure Registrations within 3 miles of KEVX WSR-88D					
1315602	2.2 miles (11,600 ft) NW	488	New Cingular Wireless PCS LLC	Approved by FCC, not yet constructed	Yes/ Yes

Attachment C contains maps showing terrain directly illuminated by the KEVX WSR-88D main beam at minimum center of beam scan angles of +0.5 seg (current operation) through 0.0 deg. At the current minimum scan angle of +0.5 deg or a minimum scan angle of +0.4 deg, the main beam does not impinge on the ground within 3 miles. At minimum scan angle of +0.3 deg, the main beam would not impinge on small areas of elevated terrain about 1.4 miles (7,600) ft to the NW of the radar. At scan angle of +0.2 deg, the main beam would impinge on the ground about 1.1 miles (5,900 ft) to the NW. At scan angles lower than +0.2 deg, the main beam would impinge on larger areas of terrain to the NW and additionally on high terrain to the south and southwest. At a lower scan angle of +0.3 deg, the impinged ground is farther from the WSR-88D than all safe setback distances

6. ASTRONOMICAL OBSERVATORIES

The WSR-88D can potentially cause adverse electromagnetic interference (EMI) with charge-couple devices (CCDs) which electronically record data collected by astronomical telescopes (NEXRAD JSPO), 1993). Due to the sensitivity of astronomical equipment which is designed to detect very faint signals from space, this equipment is vulnerable to EMI. The potential for harmful EMI would arise if the WSR-88D main beam would directly impinge on an astronomical observatory during low angle scanning. The area of potential impact to observatories is within 150 miles of the WSR-88D. Portions of the states of Florida, Georgia, Alabama, and Mississippi are within 150 miles of the KEVX WSR-88D and were evaluated to identify observatories. Two observatories are within 150 miles (www.go-astronomy.com, 2023). Table 45list these observatories and whether the WSR-88D beam at a scan angle of 0.3 deg would impinge on them. Lowering the minimum scan angle of KEVX WSR-88D main beam to +0.3 deg would not result in the main beam impinging on any of the observatories.

TABLE 5: Astronomical Observatories within 150 miles of KEVX WSR-88D				
Observatory	**Location**	**Distance and Direction**	**Elevation (ft MSL)**	**Would WSR-88D main beam impinge at lower scan angle of +0.3 deg?**

TABLE 5: Astronomical Observatories within 150 miles of KEVX WSR-88D				
Westbrook	Columbus, GA	140 mi NNE	290	No, earth curvature places beam 7,100 ft above observatory
Red Barn	TyTy, GA	148 mi NE	340	No, earth curvature places beam 8,100 ft above observatory

7. WIND TURBINES

Wind turbines are a special concern because they produce Doppler radar returns that can mask meteorological returns. The U.S. Wind turbine Database (USGS, 2023) was searched for wind turbines within 50 miles of the KEVX WSR-88D. The search did not identify any wind turbines within 50 miles.

The U.S. Department of Interior Bureau of Ocean Energy Management (BOEM) is responsible for leasing offshore waters within U.S Exclusive Economic Zone for renewable energy projects, including wind turbines, and environmental review of proposed leases and projects. BOEM's list of existing leases and applications was searched and identified no active proposed wind turbine projects near the Florida coastline.

8. SUMMARY AND RECOMMENDATION

Compared to the current minimum scan angle of +0.5 deg, lowering the minimum scan angle of the KEVX WSR-88D to +0.3 deg would increase coverage area at 2,000 ft above site level by 51.4%. The range of 2,000 ft coverage would increase from 40 to 60 miles from the Gulf of Mexico shoreline. Lowering the minimum scan angle to +0.2 deg or lower would result in would negligible additional coverage.

A minimum scan angle of +0.3 deg would not result in the main bean impinging on any terrain or structures within the safe setback distances for human exposure, implantable medical devices, safe EEDs, or fuel handling. Lowering the WSR-88D minimum scan angle would also not result in adverse effects to astronomical observatories. No wind turbines are present within 50 miles of the KEVX WSR-88D and lowering the minimum scan angle would not result in new or more intense doppler returns from wind turbines. Therefore, a minimum center of beam scan angle of +0.3 deg is recommended for the KEVX WSR-88D.

9. MEMORANDUM AUTHORS

This memorandum was prepared by Sensor Environmental LLC under contract to Centuria Corporation, which is a support contractor to the National Weather Radar Operations Center. Mr. James Manitakos, CEO, served as Sensor's Project Manager. Huntington Ingalls Industries Mission Technologies Group prepared radar coverage maps and calculated coverage areas under subcontract to Sensor. Mr. Andre Tarpinian, Radio Frequency Engineer, served as Huntington's Project Manager.

10. REFERENCES

ANSI/IEEE. *IEEE Standard for Safety Levels with Respect to Human Exposure to Electric, Magnetic, and Electromagnetic Fields, 3 kHz to 300 GHz*. IEEE Std C95.1-2019 (February 8, 2019).

ANSI/IEEE. *IEEE Standard for Safety Levels with Respect to Human Exposure to Electric, Magnetic, and Electromagnetic Fields, 3 kHz to 300 GHz, Corrigenda 2*. IEEE Std C95.1-2019 (September 24, 2020).

ANSI/AAMI. *American National Standard, Active Implantable Medical Devices – Electromagnetic compatibility – EMC test protocols for cardiac pacemakers and implantable cardioverter defibrillators*, ANSI/AAMI PC69:2007 (2007).

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ATTACHMENT A

TRIP REPORT, KEVX WSR-88D

TRIP REPORT

Traveler: James Manitakos, Sensor Environmental LLC

Destination: KEVX Weather Surveillance Radar, Model 1988 Doppler (WSR-88D) serving the Eglin Air Force Base (AFB), FL, area

Dates: June 27 - 29, 2023

Purpose: Field Inspection of radar and vicinity and obtaining 360-degree panoramic photographs from of KEVX WSR-88D tower.

Summary: June 27: Mr. Manitakos flew from Washington D.C. to Tallahassee, FL.

June 28: Weather: 93° F, overcast. Mr. Manitakos took pictures of the KEVX WSR-88D (photographs 1 and 2) and investigated land uses in the vicinity of the radar. Mr. Manitakos took panoramic photographs (Photograph 3) from the 15-m level of the KEVX WSR-88D, which is about 30 ft below the center of the WSR-88D antenna.

June 29: Mr. Manitakos flew from Tallahassee, FL to San Francisco, CA

Photograph 1: KEVX WSR-88D serving Eglin AFB, FL, area viewed from E.

Photograph 2: Sign at KEVX WSR-88D serving Eglin AFB, FL, area.

Photograph 3A: Panoramic photograph from KEVX WSR-88D tower [— 0 deg]

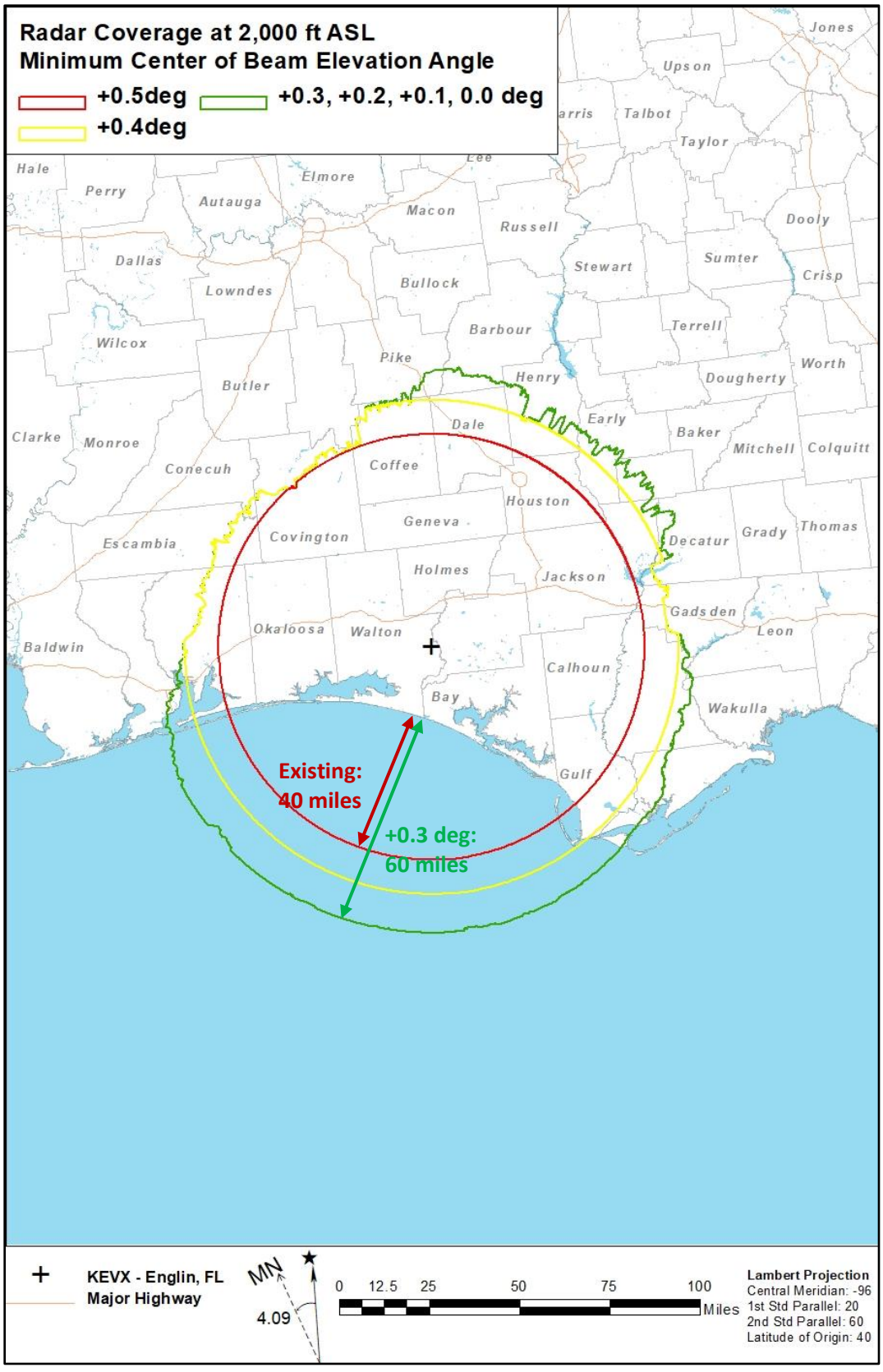
Photograph 3B: Panoramic photograph from KEVX WSR-88D tower [— 0 deg]

Photograph 3C: Panoramic photograph from KEVX WSR-88D tower [— 0 deg]

Photograph 3D: Panoramic photograph from KEVX WSR-88D tower [— 0 deg]

ATTACHMENT B

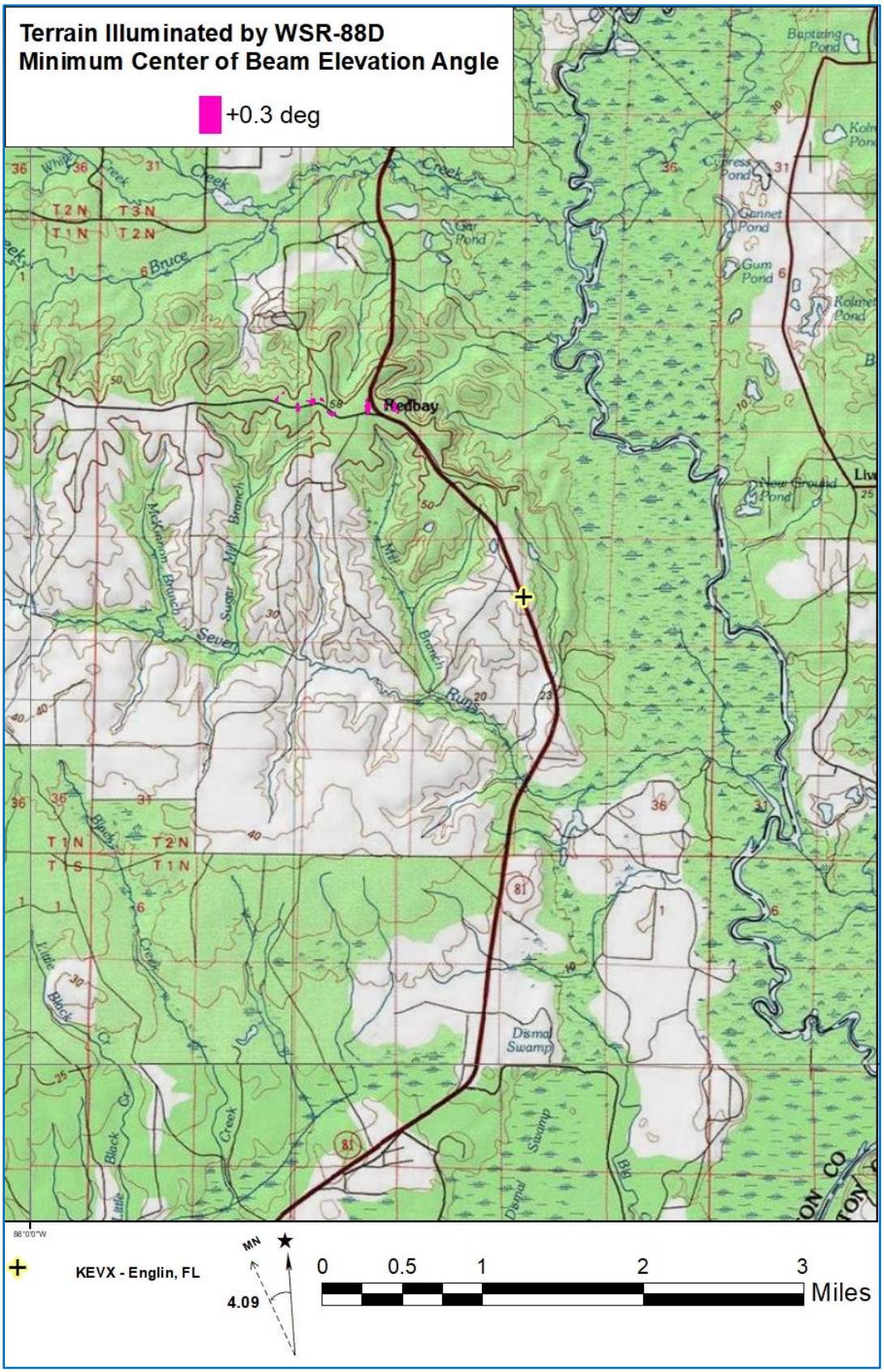
KEVX WSR-88D COVERAGE MAP
MINIMUM SCAN ANGLES +0.5 deg to 0.0 deg

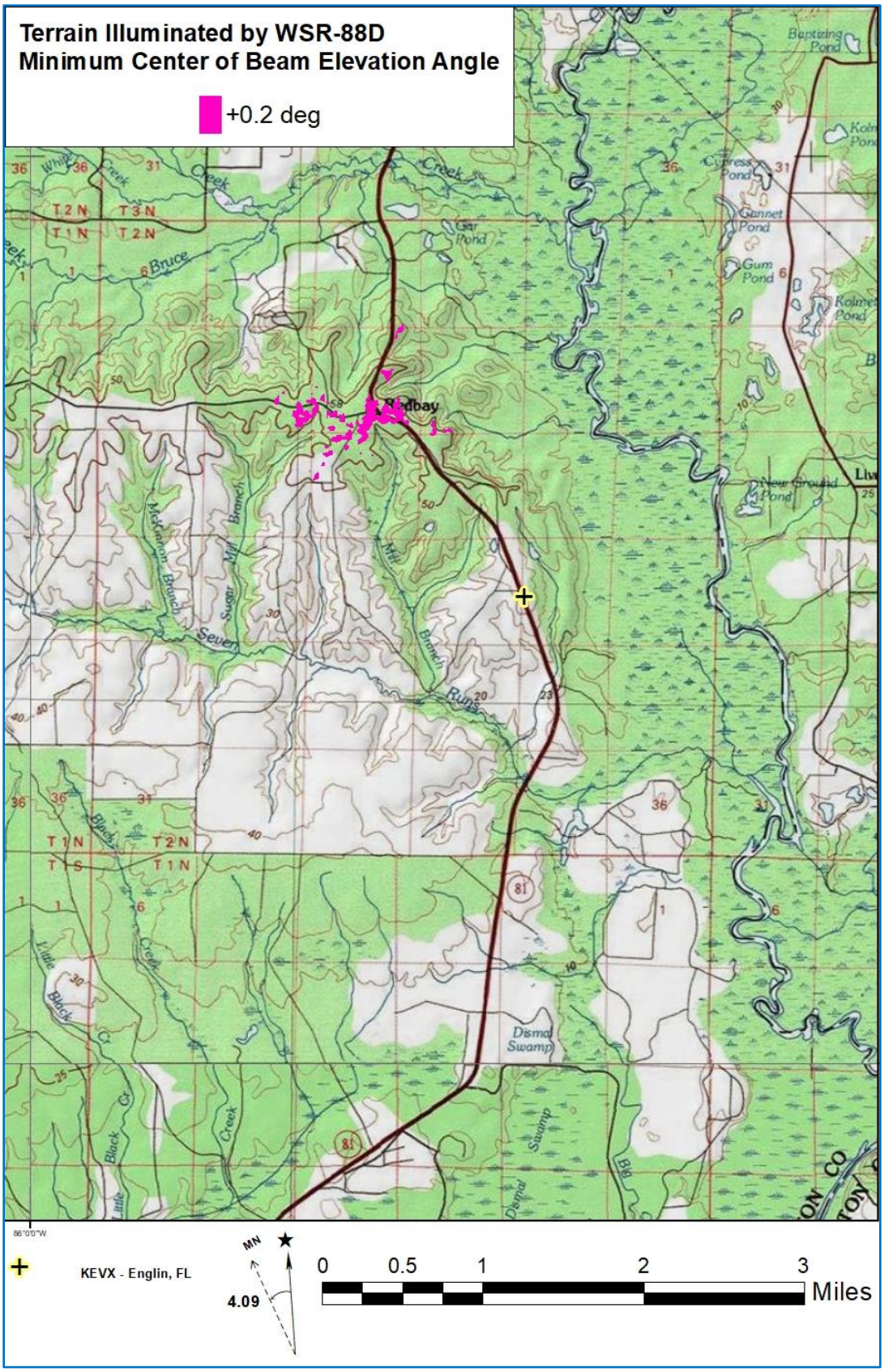

Radar Coverage at 2,000 ft ASL
Minimum Center of Beam Elevation Angle
+0.5deg
+0.3, +0.2, +0.1, 0.0 deg
+0.4deg
Existing:
40 miles
+0.3 deg:
60 miles
KEVX - Englin, FL
Major Highway
MN
4.09
0 12.5 25 50 75 100
Miles
Lambert Projection
Central Meridian: -96
1st Std Parallel: 20
2nd Std Parallel: 60
Latitude of Origin: 40

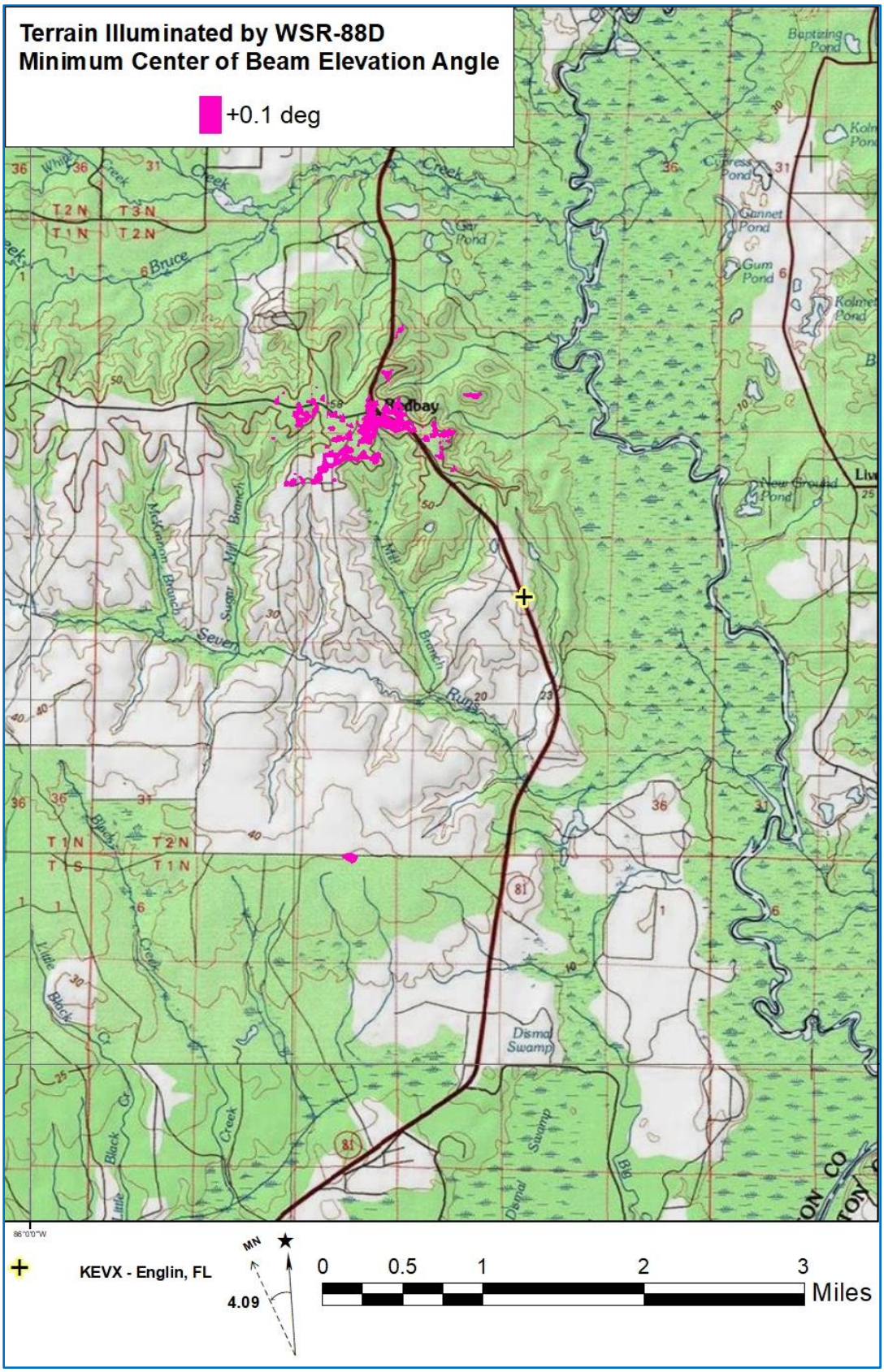
ATTACHMENT C

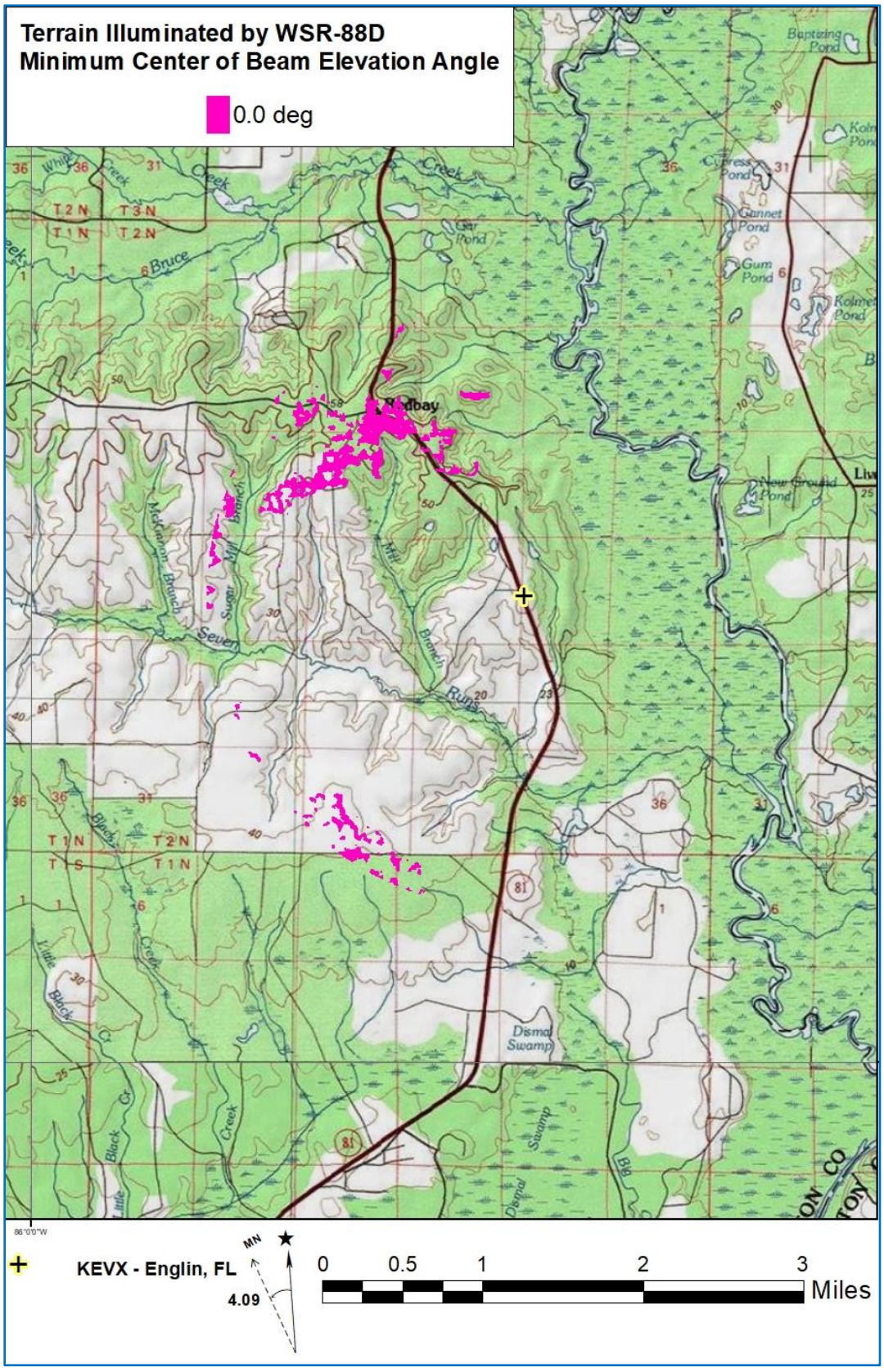
KEVX WSR-88D NEARBY DIRECTLY ILLUMINATED TERRAIN
AT SCAN ANGLES OF +0.3 to 0.-0 deg

NOTE: No terrain within 3 miles is directly illuminated by the WSR-88D main beam at scan angles of +0.5 or +0.4 deg.


Terrain Illuminated by WSR-88D
Minimum Center of Beam Elevation Angle
+0.3 deg
Redbay
KEVX - Englin, FL
MN
4.09
0
0.5
1
2
3
Miles


Terrain Illuminated by WSR-88D
Minimum Center of Beam Elevation Angle
+0.2 deg
KEVX - Englin, FL
MN
4.09
0
0.5
1
2
3
Miles


Terrain Illuminated by WSR-88D
Minimum Center of Beam Elevation Angle
+0.1 deg
KEVX - Englin, FL
4.09
0
0.5
1
2
3
Miles


Terrain Illuminated by WSR-88D
Minimum Center of Beam Elevation Angle
0.0 deg
KEVX - Englin, FL
4.09
MN
0
0.5
1
2
3
Miles