

DEPARTMENT OF INTERIOR

1755-1850 MHz Comparable Band Analysis

Phase III – FINAL Report



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1. Introduction

The National Telecommunications and Information Administration (NTIA) ask all Federal agencies to internally study their radio systems utilizing frequencies in the 1755-1850 MHz band. The objective is to determine and report on the requirement(s) and all action(s) necessary to relocate all operations from the 1755-1850 MHz band to other comparable spectrum band(s) with the goal of completing relocation within 10 years. This candidate band required an electromagnetic interference analysis including detailed technical and radio frequency engineering studies on a system-by-system and site-by-site basis to meet the Commerce Secretary's recommendation to relocate all operations within 10 years. This analysis is the result of the Department of the Interior (DOI) working closely with the NTIA and other Federal agencies to assess the potential for repurposing the 1755-1850 MHz band and the potential for relocating DOI operations to comparable spectrum bands.

2. Executive Summary

The Department of Interior is committed to supporting the President's goal of making available 500 MHz of spectrum for use by commercial carriers for national wireless broadband systems. The DOI will continue to provide further resources to support the NTIA 10-Year Plan to meet the President's initiative. However, our resources and staffing are limited and further DOI work and analysis to meet the NTIA 10-Year Plan is dependent on availability of funds for continued research and RF engineering analysis moving forward with other candidate spectrum bands. Further, the going forward work is dependent on availability of funds to perform a more thorough up-front technical and engineering analysis. This means that the timing and progress of the other candidate spectrum bands comparable analysis effort by DOI, is dependent on availability of funds through the amendment of the current Commercial Spectrum Enhancement Act (CESA). Specifically, DOI and our bureau customers efforts will be importantly impacted by the availability of federal authority and funds to do further planning, evaluation, and project work for all total cost and time estimates for the relocation work; e.g., "technical/engineering analysis", "operational analysis" and "cost analysis". Also, if the DOI must vacate the entire 1755-1850 MHz band on an accelerated timeframe, as is stated in some current legislation before Congress, then relocation costs estimates could increase and will be incurred sooner. As such, the Department, in coordination with our customers having the major equities invested to support relocating all DOI operations out of the 1755-1850 MHz within 10 Years is dependent on availability of funds.

The Department conducted a thorough review of the proposed comparable bands and DOI operations in evaluating possible approaches to exiting the 1755-1850 MHz band. This Phase III Comparable Band Analysis is a Final Report for the 1755-1850 MHz band exit evaluation to the NTIA Policy and Plans Steering Group (PPSG).

DOI assessments and evaluations through spectrum management and RF engineering studies and technical analysis conclusion is an exit strategy that utilizes spectrum in comparable bands using more spectrally efficient digital technologies in a phased exit or complete exit approach. However, DOI would rather perform the complete exit with a onetime cost per detailed scope of work project plans vice having to revisit the effort in the future.

3. Fixed operations: U.S. Geological Survey (USGS)
- a. Operations: Twenty six (26) fixed point-to-point microwave radio frequency assignments (RFAs) located on 15 sites throughout the Central California Coast ranges (18 radios) and in Southern CA (8 radios). DOI USGS microwave system radios carry continuous seismic data transmission from field equipment to data processing centers located in Menlo Park, CA (Northern California Seismic Network – “NCSN” system) and Pasadena, CA (Southern California Seismic Network – “SCSN” system). Near real-time seismic data are used for emergency response to significant earthquakes, tsunami warning, detection of volcanic unrest, and public information. Archived data are used for earthquake engineering and for seismological research. The NCSN system carries data from 436 channels utilizing a data rate of 1.6Mbps from 52% of NCSN regional seismic stations. The SCSN system carries 389 channels, which comprises ~40% of its total channels. The nature of the information transferred and the emergency response component require continuous operations. Operations are authorized for the NCSN from Geyser Peak north of Santa Rosa, CA south in the California Coast Ranges to Black Mountain east of San Luis Obispo, CA. The area encompasses major metropolitan areas including Santa Rosa, the Sonoma and Napa Valleys, Oakland, Berkeley, San Francisco, San Jose, Monterey, and Salinas Valley. For the SCSN operations are authorized from Edwards Air Force Base in the Mojave Desert south to Caltech campus in Pasadena, CA. The area encompasses the major metropolitan areas in the Los Angeles basin, including Anaheim, Pasadena, Glendora, Riverside, and San Bernardino. Operations are continuous for both systems (7X24X365).
 - b. Comparable band: Analysis shows the 7125-8500 MHz and 4400-4490 MHz radio propagation characteristics for these bands are adequate per the DOI Phase I Report, April 2011; and the preliminary results for the DOI Electromagnetic Compatibility (EMC) analysis and work per the DOI Phase II report in June, 2011; to include the final analysis for fixed operations (attachment), DOI does not expect operations in the 7125-8500 MHz or 4400-4490 MHz will cause any RFI to incumbent agency users. DOI foresees favorable consideration from NTIA to obtain radio frequency assignments for USGS NCSN and SCSN fixed point-to-point microwave system geographical area of operations.
 - c. Phasing Exit: DOI USGS experience gained from the previous AWS relocation and recent ARRA project. With the NCSN and SCSN relocation to 7125-8500 MHz or 4400-4490 MHz band(s) it is possible that DOI USGS can relinquish the 1755-1780 frequencies and consolidate their current operations in the 1780-1850 MHz band in less than 5 years. However, for DOI USGS to relocate in the 1780-1850 MHz band in less than 5 years, up-front funding is required immediately to perform further required technical and engineering analysis. The analysis themselves should only take a few months. However, delays in issuing contracts for the studies will delay the information needed.
 - d. Phasing Cost: DOI USGS estimates \$900K cost to relinquish the 1755-1780 frequencies and transition their current operations in the 1780-1850 MHz band in less than 5 years. \$350K is estimated for a contract to modify current Alcatel-Lucent radios to transmit on new frequencies and \$250K for site visits to migrate to new frequencies and \$300K for additional support staff as required.

- e. Complete Exit: Preliminary analysis for moving to 7125-8500 MHz or 4400-4490 MHz bands may require occupation of additional microwave sites. Competition for mountain top space in the aforementioned geographical area of operations is intense and environmental requirements for permits are becoming more restrictive. It is known that at existing sites, larger and heavier, high-performance dishes are required for operating in the 7125-8500 MHz or 4400-4490 MHz band. As such, all current towers will need further load test evaluations to determine if the added wind loading exceeds the safe design limit of the tower. In addition, identification of available infrastructure at any proposed new sites is unknown to mount larger dishes to support 7125-8500 MHz or 4400-4490 MHz system. Consequently, costs associated with site leasing, tower build out (as required) and maintenance will increase significantly.
- f. Complete Exit Cost: DOI USGS estimation for the total transition costs to be \$45M. This number reflects \$150K and 6 months to conduct further appropriate technical and engineering studies. USGS, NCSN and SCSN have full time employee (FTE) staff with technical and engineering expertise to manage the relocation however; they do not have all the required staff to conduct the relocation effort. As such, additional temporary support staff (i.e. contractors) must be hired to relocate and transition system to full operational functionality. In addition, the cost reflects replacement radio equipment, new towers, new dishes, R56 compliance, labor, installation, overhead, and required permitting. In addition, operational costs due to leases and maintenance could increase by \$750K or more annually, assuming \$30K/site lease costs for 15 projected new sites, increased site lease costs for existing sites due to larger dishes, and added maintenance costs. To include, addition of high performance solid state receiving dishes will increase lease costs at existing sites **if the dishes can be mounted at all.**

4. Video Surveillance: National Park Service (NPS)

- a. Operations: DOI NPS U.S. Park Police (USPP) utilizes aeronautical mobile video surveillance down link transmitters on two rotor blade aircraft. Both aeronautical platforms currently operate on one radio frequency assignment (RFA) in the 1755-1850 MHz band. As such, with only one channel, only one video surveillance platform may be operating while in flight. However, both aeronautical platforms provide real-time video surveillance downlink capabilities to DOI NPS USPP Command Post for mission management, Law Enforcement, Homeland Security, Search and Rescue and Medical Evacuation operations. To include, video surveillance support is provided to other Federal Agencies Command Posts through secured cloud computing per service level agreements (SLA) for cooperative Law Enforcement, Homeland Security, and other operations as required. Operations are within a 40km radius of Washington D.C. National Capitol Region (NCR), on a weekly basis (potentially 2-3 times within the week), and “On-Call” as requested by other Federal Agencies or as DOI NPS USPP situational awareness requires. Operational missions times (TME) on the current RFA are “TME-3 – For occasional use and not limited to the work week”, and missions are up to two hours duration however longer operations have occurred depending upon the mission requirement. In addition, this aviation asset has been deployed to support National Emergency Response situations (e.g., U.S. Park Police deployed the asset to Louisiana to provide emergency response support during Hurricane Katrina relief operations)
- b. Comparable Band: The 2200 -2290 MHz band presents similar or better propagation characteristics to the 1755-1850 MHz band whereas signal strength losses in higher bands are

not a viable option for DOI. The 2200-2290 MHz band is allocated for aeronautical mobile operations to meet DOI requirements. DOI has discussed other comparable bands (1435-1525, 1675-1695 MHz) with NTIA. The 1435-1525 MHz band is not a consideration due to the incumbent operations in this band is very congested for military tactical radio relay, air combat training systems, and precision guided munitions. As such, successful coordination in sharing of the band for DOI operations is a major factor and concern. Also, DOI has concerns with any potential to relocate any operations in to the 1675-1695 MHz band for sharing of operations with incumbent services, (i.e., meteorological aids (radiosonde) and meteorological satellite (space-to-earth) services. In addition, regulatory policy change would have to be effected to the 1675-1695 MHz band to ensure co-primary status be granted to effectively access and share the band with these incumbent operations. As such, with the reduction of available spectrum, and the potential to cause RFI to or from systems currently occupying the 1675-1695 MHz band, DOI is not a considering this band. Other comparable bands will require significant investments in R&D through specific vendor outsourcing thus it would take a very long lead-time to design, develop, test, and deploy aeronautical mobile video surveillance down link transmitters required by DOI users. As such, DOI mission requirements for aeronautical mobile video surveillance into other bands depend on the availability of funding and manufacture of equipment to support this function.

- c. Phasing Exit: DOI NPS can relinquish the 1755-1780 MHz assigned frequency to bring their current operations in to the 1780-1850 MHz band in less than one year. However, DOI preference is to take advantage of integration of new system/technology upgrade and modernization that will produce increased spectral efficiencies in our video surveillance operations now with a one-time cost for the relocation effort. DOI believes it is our due diligence and good business practice to conduct one transition vice two separate transitions without unnecessary increased expenses. In addition, DOI NPS intentions within the 1755-1850 MHz band is to continue operations and maintenance of the current legacy operations with the eventual integration of new system/technology upgrade and modernization that will produce increased spectral efficiencies in our video surveillance operational capabilities when transitioning to the 2200-2290 MHz band. DOI has already approached incumbent users within the NCR local environment (Justice, NASA and DOD). DOI will continue with the coordination of the incumbent users to discuss further feasibility of sharing arrangements based on incumbent's assignment operational times and planed operations to identify clear channels for our increased spectral efficiencies so all operational use can coexist within the NCR local environment with negotiated arrangements.
- d. Phasing Cost: DOI NPS estimates \$350k total cost to relinquish the 1755-1780 frequencies and transition their current operations in the 1780-1850 MHz bands. This cost is for a contract to modify current radios to transmit on two new frequencies (two channels). DOI NPS USPP regional support requirements have increased to have both aeronautical video surveillance platforms to operate simultaneously thus two RFA(s) are required for the DOI NPS USPP as a force multiplier to support the increasingly operational situational awareness.
- e. Complete Exit: DOI NPS could transition within one year. The vendor has visited with the NPS USPP to assess the scope of work however due to lack of availability of funds for relocation a request for proposal (RFP)/quote cannot go forward to begin the work. DOI NPS relocation out of the 1755-1850 MHz band will consists of investments with integration of new system technology upgrade and modernization from its current legacy wideband analog operations.

As such, this will produce increased spectral efficiencies in the 2200-2290 MHz band for our video surveillance operations. Conversely, DOI believes other Federal agencies eventual integration of additional capability with investments and R&D identified during the review of their systems during the 1755-1850 MHz relocation effort, will also include system technology upgrade(s) and modernization opportunities' that will produce increased spectral efficiencies by replacing the current incumbent legacy wideband analog operations in the 2200-2290 MHz band. DOI Electromagnetic Compatibility (EMC) analysis for the NPS USPP ops in this band (attached), to include, per the DOI Phase II report June, 2011, DOI does not expect operations in the 2200-2290 MHz band will cause any RFI to incumbent agency users. DOI has already approached incumbent users within the NCR environment (Justice, NASA and DOD) and DOI will continue with the coordination of the incumbent users to discuss further feasibility of sharing arrangements based on incumbent's assignment operational times and planned operations to identify clear channels. DOI believes with our increased spectral efficiencies and with negotiated and appropriate arrangements made our operational use can coexist within the NCR local EME.

- f. Complete Exit Cost: \$1M; the estimated cost is for replacement radio equipment, antennas, labor, installation, overhead, training, and compliance for aircraft certification as required. NPS USPP rotary blade airframes are not conducive to additional antennas that would take up additional space or would require significant modifications to the outside airframe. To include, the inside airframe space is also limited and any additional space requirements will insert challenges for existing radio assemblages. DOI, NPS and USPP have approached the vendor of its current system operating within the 1755-1850 MHz band; we are leveraging off the vendors current radio assemblage rack specifications to eliminate major modification due to limited space within the airframes with specific vendor development of modernize radio modules with increased spectral efficiencies. To include leveraging off the current antenna mount locations with a 'hole-for-hole' matched antenna base configuration and alignment on the outside of the airframe for operations in the new frequency band.

5. Video Surveillance: U.S. Fish & Wildlife Service (FWS)

- a. Operations: Mobile video surveillance supporting the DOI FWS Office of Law Enforcement Services (OLES), operations throughout United States and Possession (US&P). The video surveillance system is comprised of portable and mobile video devices for the collection of evidence and information during law enforcement operations in support of criminal investigations and Secretary, Executive staff and other VIP protection details. There are six systems currently operating in the 1755-1850 MHz band. These systems support body worn (body wire) transmitters/receiver kits. Receivers are normally located in a surveillance van. However, Kits can also support temporary fixed operations in hotel, office, or street with pole or rooftop operations. Operations are in rural areas on DOI managed lands and in small to major metropolitan areas as required for investigations or protection details. A typical operational duration may be on a weekly basis at any time of the day or night for two to five hours, when in operation; however, duration of use is dependent upon the mission requirement. As such, use is schedule on an as needed basis for special operations on U.S. FWS Wildlife Refuges and other DOI managed lands or in metropolitan areas throughout US&P. In addition, use is as requested for other special operations by other DOI Law Enforcement offices to include other Federal agencies during Law Enforcement Joint Task Force operations.

- b. **Comparable Band:** The 2200-2290 MHz band presents similar or better propagation characteristics to the 1755-1850 MHz band and DOI has discussed other comparable bands with NTIA; DOI's preliminary analysis for the current electromagnetic environment per the DOI Phase II report June, 2011, demonstrates no increased potential RFI in rural areas on DOI managed lands or in metropolitan areas. This is due to DOI practice of coordinating locally with competent spectrum management authorities/offices prior to any FWS OLES regional support requirements to arrange for operational times and frequency band sharing with any incumbent users. Moreover, DOI FWS has one RFA in the 2200-2290 MHz band to support the operation. As such, DOI concerns are to replace the current equipment that operates in the 1755-1850 MHz band, as it will be rendered obsolete due to not being able to be retrofitted to operate within the 2200-2290 MHz band.
 - c. **Complete Exit:** DOI, FWS and OLES have approached the vendor of its current systems operating within the 1755-1850 MHz band. DOI FWS OLES is satisfied that current technologies are available to support our video surveillance operations for the relocation efforts and DOI NPS could transition within one year. However, due to lack of availability of funds for relocation a request for proposal (RFP) cannot go forward to begin the required project work for the relocation effort. Delays in issuing contracts for the studies will delay the complete exit due to the delay in obligation of funds for letting of contracts to complete the project work. In addition, DOI FWS OLES relocation out of the 1755-1850 MHz band will consist of investments with integration of new system technology upgrade and modernization thus also minimizing any potential RFI with any current legacy wideband operations. As such, this will produce increased spectral efficiencies in the 2200-2290 MHz band for our video surveillance operations. Conversely, DOI believes other Federal agencies eventual integration of additional capability with investments and R&D identified during the review of their systems for the 1755-1850 MHz relocation effort, will also include system technology upgrade(s) and modernization opportunities' that will produce increased spectral efficiencies by replacing the current incumbent legacy wideband analog operations in the 2200-2290 MHz band.
 - d. **Complete Exit Cost:** \$400K relocation cost for the transition to the 2200-2290 MHz band. This estimated cost is for replacement radio equipment, antennas, labor, installation, overhead, and training as required.
6. **Small Unmanned Aircraft System (sUAS/UAV):** Department of the Interior
- a. **Operations:** The DOI have acquired 176 sUAS at no cost from Department of Defense (DOD). The sUAS consist of: 19 Raven A systems @ 3 UAV per systems (57); 25 Dragon Eye systems @ 3 UAV per system (75); 22 T-Hawk III systems @ 2 UAV per system (44). The Department is researching the UAV capabilities for our natural resource core mission areas. Those missions involve numerous scientific and conservation applications to manage and protect the United States natural resources. Those natural resource missions involve but may not be limited to: **Environmental Mission:** Ecosystem monitoring, Pollution monitoring, Wildlife monitoring, Fishery control, Water resource observation and forecasting, Oil spill detection & control, Glacier / ice cap monitoring, Aerial Mineral exploitation, Terrain mapping, Natural disaster impact and relief, Contamination measurements, Volcanic observation, Climate change research; **Law Enforcement:** Information gathering for investigative / evidence, Aerial crime scene inspection, Counter drug operations, Anti-terrorism operations, Persistent LE surveillance, Traffic observation / law enforcement, Critical infrastructure protection, SAR

operations / monitoring; **Fire Fighting:** Fire monitoring, Fire investigation, Early warning systems. Also, as an example, rangelands are remote and our Bureau of Land Management (BLM) is required to monitor millions of acres of rangeland; use of UAVs will provide fast and repeated deployment for managing rangeland health and ecosystem change assessment and mapping vegetation/soils at very high resolution.

- b. Comparable Band and Exit Strategy. The DOI has coordinated with DOD and we will leverage from their studies, analysis and conclusion to relocate to the same comparable band as DOD. In addition, DOI will also proceed with our exit strategy as DOD time line determines as we will be utilizing DOD sUAS Program Office developer's maintenance contracts to retrofit the UAVs. The alternative is, once a determination is made with the proof of concept test that DOI may not use a specific make/model of sUAS we accrued, they will be returned to DOD for a final disposition through DRMO processes. At present, DOI have not completed our studies and research required to make a determination through proof of concept. As such, DOI have not made a determination on the sUAS number and type required to be maintained; DOI intentions are to retrofit of all current sUAS in our inventory.

- c. Complete Exit Cost: \$88M (.5M per UAV)

2 enclosures

DOI_7125_8500_MHz_Comparable Band Analysis.pdf

DOI_2200_2290_MHz_Comparable Band Analysis.pdf