CSMAC

Report of the Spectrum Management Improvements Working Group

November 10, 2011

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I. INTRODUCTION

The Spectrum Management Improvements Working Group (Working Group) of the Commerce Spectrum Management Advisory Committee (CSMAC) was formed to examine ways to improve the quality of the data used in National Telecommunications and Information Administration (NTIA) spectrum management systems, particularly in light of the April 2011 Government Accountability Office (GAO) Spectrum Management Report.[1] The GAO Report found that "NTIA's data management system is antiquated and lacks internal controls to ensure the accuracy of agency-reported data, making it unclear if decisions about Federal spectrum use are based on reliable data."[2] This initial report considers techniques used to ensure spectrum data accuracy and how those techniques can be improved based on commercial and governmental experiences.

II. QUESTION EXAMINED

The Working Group examined the following question: What techniques are used to ensure the accuracy of spectrum data, and how can those techniques be improved, simplified and streamlined to (i) validate new data when collected, (ii) identify and correct erroneous data once stored, (iii) maintain the accuracy of data over time, and (iv) ensure compliance? In particular, what lessons and techniques can be drawn from commercial and governmental experiences to inform NTIA's efforts along these vectors?

III. APPROACH

To support its recommendations, the Working Group reviewed licensing and data management systems of the Federal Communications Commission (FCC); industry spectrum data management systems; other similar data management systems, including the Domain Name System (DNS) and "Whois" database;[3] and applicable government Information Technology (IT) directives, including the Office of Management and Budget's 25 Point Implementation Plan to Reform Federal IT Management.[4] The Working group also interviewed NTIA staff concerning

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[1] United States Government Accountability Office, Report to Congressional Committees, Spectrum Management: NTIA Planning and Processes Need Strengthening to Promote the Efficient Use of Spectrum by Federal Agencies, GAO-11-352 (April 2011), *available at* http://www.gao.gov/new.items/d11352.pdf.

[2] *Id.* (Highlights of GAO-11-352).

[3] The DNS is a hierarchical, distributed database that contains mappings of DNS domain names to various types of data, such as Internet Protocol (IP) addresses. Whois is a query and response protocol used to find information on domain names, IP Addresses, domain hosts and networks.

[4] Vivek Kundra, U.S. Chief Information Officer, 25-Point Implementation Plan to Reform Federal Information Technology Management (Dec. 9, 2010), *available at* http://cio.gov/documents/25-Point-Implementation-Plan-to-Reform-Federal%20IT.pdf.

current and planned spectrum data management approaches. This review, coupled with interviews with NTIA staff, informed the findings and recommendations presented below.

IV.   FINDINGS

The Working Group makes the following findings with respect to the spectrum data management approaches and accuracy techniques of the FCC, industry, and NTIA.

A.   FCC Approach

Current Process. To support its non-Federal spectrum management functions and objectives, the FCC maintains a database of over two million license records consisting of both licensee administrative information and technical data which provides a general description of the wireless systems authorized by the agency to utilize spectrum under its jurisdiction. While this database contains critical information necessary to provide spectrum utilization information, it is not designed to determine the availability of spectrum on a geographic or disaggregated basis in order to promote greater shared or exclusive spectrum use. In addition, the FCC database is not designed to determine the appropriate applications of new technologies. In other words, it has been designed and is maintained as a license database, not a spectrum management database.[5] Complicating its use as a spectrum management evaluation asset, the current FCC database is also segregated into several components.[6]

The FCC database is used as the primary source of national non-Federal spectrum utilization, and provides the base information necessary for frequency and spectrum engineering activities performed by spectrum engineers and licensees. Further, there are many industry databases that duplicate portions of the FCC licensing database for their own analytical purposes.

The Future: CLS – the FCC's Strategic Database Objective. In order to improve its spectrum management capabilities and develop a transparent, easily accessible, data driven, efficient, cost-effective and green licensing system, the FCC continues to devote agency resources towards the development of its Consolidated Licensing System (CLS). It is expected to take at least four years to implement the CLS. Its key features will include: single sign-on; consolidated forms; streamlined application filing; reduced application processing time; courtesy electronic reminders and notifications; easy search and output generation; centralized customer support; and a paperless process.

Data Accuracy Techniques. There are several administrative, financial, enforcement and regulatory techniques that support the accuracy of the information contained within the FCC's license database. As a threshold matter, licensees are responsible for maintaining the accuracy of their administrative contact information reported on their FCC issued authorizations. In addition,

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[5] To achieve the latter, the database would need to host a significant amount of additional system information, *i.e.*, antenna patterns, equipment specifications, *etc*., and have a variety of spectrum analytical and system engineering program capabilities to support evolving spectrum management policies.

[6] These include: Antenna Structure Registration System (ASR), Cable Operations and Licensing System (COALS), Commission Registration System (CORES), Consolidated Database System (CDBS), Equipment Authorization System (EAS), Experimental Licensing System (ELS), International Bureau Filing System (IBFS), and Universal Licensing System (ULS).

systems that are licensed on a site-specific basis are obligated to amend their licenses to report new or revised system use parameters that change previously authorized spectrum use patterns. In several bands, licenses and construction permits are subject to automatic cancellation and removal from ULS for failure to comply with buildout and construction reporting requirements or maintain operations for a specified period of time. Through the FCC's Enforcement Bureau, licensees are held accountable for operating systems that are inconsistent with data reported within the FCC's license database. Penalties for non-compliance may include citations, violation notices, admonishments, forfeitures and license revocations. Licenses are generally granted for five to ten year periods as a means to maintain license data accuracy, under the premise that licensees will review and amend license information as necessary, or at least at time of renewal. It is worth noting, however, that data accuracy is not as relevant for many license classes – *i.e.*, geographic-area licensed Commercial Mobile Radio Service (CMRS) or satellite services – which do not require data-intensive site-by-site licensing.

In the past, the FCC has instituted certain audit initiatives to verify the accuracy of several of its license databases, which provided meaningful information on spectrum use and even non-use. These efforts have included PLMRS and BRS databases. The FCC may also procedurally conduct rudimentary verification of specific license data, *i.e.*, county names, proper frequency listings, FAA compliance, etc. to identify data irregularities. The opportunity to allow for bulk data uploads is also encouraged to support the maintenance of data accuracy.

B. Industry Approach

The accuracy of spectrum data across the private sector is addressed in several ways. Below is a list of general practices used by licensees and spectrum managers:

- System-wide data accuracy and clean-up procedures are regularly performed to establish a data baseline and address existing errors.

- Best practices are employed to ensure consistency, avoid errors and catch and correct bad or missing data. These include taking steps to limit who can enter and manipulate data; using pick lists and drop downs to pre-populate where possible; implementing procedures to check and verify data both at the point-of-entry and over time; allocating appropriate resources for data entry, review and maintenance; and performing regular system-wide data accuracy checks as mentioned above.

- Spectrum data managers are held accountable for data accuracy. This is done by requiring individual and transparent accountability for maintaining database accuracy and/or establishing milestones and rewards for data accuracy. Moreover, failure to perform may result in lower compensation, disciplinary action or even dismissal.

- Spectrum data is confirmed through cross-check verification, whereby data from one source is compared to data from another source.

- Calculations are automated where applicable (for example, antenna height AMSL can be calculated automatically by adding the antenna height AGL and ground elevation).

- Spectrum data collected is limited to what is necessary to achieve the specific task(s) or goal(s) underlying its collection in the first instance; the collection of superfluous data merely increases the opportunity for error and expands unnecessary the data that must be maintained and verified over time, straining resources.

- Spectrum management systems use distributed databases to normalize and compartmentalize similar classes of data elements. For example, databases for radio equipment specifications, antenna specifications, site and location information, station record ownership information, etc. are separately maintained to ensure a single- reference data source.

C.   NTIA Approach

Current Process. NTIA is responsible for assigning radio licenses for Federal users; no Federal agency can transmit using radio spectrum within the United States without NTIA approval. In turn, Federal agencies are responsible for verifying the need for radio assignments and ensuring that the data they provide is correct. As a result, NTIA depends on the agencies to verify and ensure that the spectrum data submitted to NTIA is correct. Agencies are currently required to review frequency assignment data every five years to ensure that frequency assignments are in current use and are correctly reflected in the Government Master File (GMF).[7]

Improvements related to the GAO Report. The twenty-one agencies that make up the Frequency Assignment Subcommittee (FAS) of the Interdepartment Radio Advisory Committee (IRAC)[8] are providing suggestions to improve and strengthen NTIA's spectrum data management process and to address concerns identified by the GAO Report. The final list of improvements will be sent to the IRAC and then to NTIA for implementation in concert with NTIA-planned improvements.

Several recommendations are being examined to improve data accuracy. For example, FAS is expected to recommend that agencies verify the spectrum data they submit at the data entry level, and certify the need for a spectrum assignment at the headquarters level. Each will require an individual to be identified in the assignment record as having performed the assigned function correctly (presently, this is merely assumed). Other options include requiring the use of terrain data to check agency data for correctness and using new computer programs to verify coordinates, power, radius and number of units. The FAS is also discussing whether to request more information about assignments and, if so, what information can be collected and what will provide the best results.

Many of these changes may be implemented within three to six months, but some may take longer if additional software is required. NTIA expects that many of the changes can be

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[7] Geostationary satellite and aeronautical band spectrum assignments are exceptions and are reviewed every ten years.

[8] IRAC assists NTIA in assigning frequencies to U.S. Government radio stations and in developing and executing policies, programs, procedures, and technical criteria pertaining to the allocation, management, and use of the spectrum. The FAS focuses on frequency assignment issues.

effectuated by existing NTIA IT staff and by changing the Manual of Regulations and Procedures for Federal Radio Frequency Management (Red Book)[9] to require agencies to provide more information in their submissions.

More Improvements Expected from FSMS. NTIA is developing a new spectrum data management system, the Federal Spectrum Management System (FSMS), which will eventually replace the GMF. The new system is intended to modernize and improve spectrum management processes, and will require more data for each record; cross-reference and verify data with other files; and incorporate engineering models to provide better interference predictions and spectrum utilization. As a result of funding and other delays, FSMS is approximately four to five years away from being fully operational and used by all the Federal agencies.

V. RECOMMENDATIONS

The Working Group provides the following recommendations to improve spectrum data accuracy and reliability. These recommendations comprise a combination of a one-time data clean-up effort and the implementation of best practices. Accordingly, NTIA should:

1. ***Perform a one-time, system-wide data accuracy and clean-up effort***. A soon as practicable, NTIA should perform a one-time, system-wide data accuracy and clean-up effort. This effort is needed to establish a data baseline and address existing errors. All Federal government spectrum assignments should be reviewed. NTIA could lead this effort with a mandate for Federal agency cooperation. The goals of this effort should be to assure that assignments in the GMF accurately reflect the systems deployed and in operation and capture any missing assignments.

2. ***Establish goals and metrics for data accuracy and milestones for achieving***. Recognizing that implementation of the first recommendation may take time, NTIA should consider a phased approach with established interim phase milestones. NTIA could apportion this effort by band, Federal agency, station class, etc. In addition, the effort could be separated into a system-wide review of all data records to determine whether errors may be concentrated to a particular band, Federal agency, station class, etc., then focus the data accuracy and clean-up effort on the areas with the highest concentration of errors or on errors that have the greatest impact on accurate spectrum assignment (e.g., coordinates, ground elevations, antenna centerlines, etc.).

3. ***Increase agency accountability for data accuracy by strengthening enforcement***. NTIA should increase Federal agency accountability for data accuracy by strengthening enforcement in three ways. First, NTIA should adopt more rapid and clear escalation procedures. Specifically, higher ranking government officials should be responsible and accountable for ensuring prompt review of data and ongoing data accuracy. Second, NTIA should strengthen the process of requiring responsible individuals to certify the accuracy of spectrum data. Third, NTIA should shorten the five-year review cycle. A

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[9] NTIA, Manual of Regulations and Procedures for Federal Radio Frequency Management (May 2011 Rev. of Jan. 2008 Ed.) (Redbook), *available at* http://www.ntia.doc.gov/page/2011/manual-regulations-and-procedures-federal-radio-frequency-management-redbook .

two- or three-year cycle is more appropriate to identify and correct data errors in a sufficient time frame to support more accurate spectrum assignment activities.

4. ***Investigate the use of distributed databases to improve access, accuracy***. NTIA should investigate the use of distributed databases to improve data access and accuracy. Distributed databases link together multiple sources of unique data with flow through, which improves data access and transparency while minimizing data errors. Also called normalization, this process organizes data to minimize redundancy. Distributed databases also localize the responsibility for data collection and maintenance, which limits control of data to improve accuracy and efficiency.

5. ***Consider requirements to support data accuracy as FSMS is developed***. As development proceeds on the FSMS, NTIA should consider implementing methodologies described in Sections IV.A and IV.B to support data accuracy. The full range of such methodologies should be examined and considered for implementation in the FSMS.

6. ***Recommend that Congress allocate funding to support these initiatives***. NTIA should request that Congress fund these initiatives within NTIA and across all involved Federal agencies. The Working Group estimates an appropriate funding level to fully perform the data accuracy review and clean-up recommended in the first bullet may run between $2.0M to $4.0M, depending upon how the scope is defined, when the project would start, the period of performance, etc. This estimate is based upon assuming a percentage of data errors across all Federal spectrum assignments combined with an estimated level of effort required to correct any given error.[10] Funding could come from several sources, including possibly spectrum auction proceeds.

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[10] The Working Group assumed a total of 244,000 Federal assignments.