Alion Comments for the NTIA National Spectrum Strategy: The Alion Comments Are in Response to Questions 2 and 4

The NTIA requested comments from interested parties with regard to development of a comprehensive long-term national spectrum strategy. NTIA sought broad input from interested stakeholders, including private industry, academia, civil society, and other experts. The NTIA request for comments (RFC) included an invitation to comment on any or all of the range of national broadband strategy issues addressed in seven specific questions presented in the second part of the notice. Alion decided to provide responses to RFC questions 2 and 4, as presented below.

Docket No. 181130999-8999-01

To: spectrum-strategy-comments@ntia.doc.gov

NTIA RFC Question 2:

To what extent would the introduction of automation facilitate assessments of spectrum use and expedite the coordination of shared access, especially among Federal and non-Federal spectrum stake holders

ALION RESPONSE COMMENT:

Automation is a prerequisite for spectrum-sharing based on dynamic coordination[1]. Dynamic coordination, or dynamic spectrum access, will require automation in order to achieve 'real-time' or 'near real-time' dynamic channel allocation based on frequency, time, location, and the regulatory rules for the frequency range. This kind of coordination will permit more efficient use of the spectrum and maximize the utility of a given band. However this spectrum coordination cannot be achieved by simply upgrading or automating existing databases, models, and regulatory processes. To establish dynamic coordination and allow real-time dynamic channel allocation, automation must replace the traditional committee-based processes and their static assignment databases. Dynamic coordination will require a new information processing environment based upon the accumulated experience of the spectrum users and regulators. This new automated information processing environment will need a much larger range of data inputs and will dispense with the current deliberative administrative processes and their associated fixed frequency assignment databases.

The new automated processing environment will need to apply complicated rules and regulations while obtaining RF equipment laydowns, calculating propagation losses, and determining link budgets and interference margins in real-time. The automation effort should be conducted on a band by band basis due to the range and complexity of the equipment, interactions, and environments that must be considered for dynamic spectrum access.

[1] Spectrum sharing based on sense-and-avoid technologies may not be as dependent on automation processes. However, as seen in the FCC rulemaking for the Citizens Broadband Radio Service (CBRS), automated processes can take sensing data and apply it to dynamic coordination.

The importance of automation in facilitating spectrum sharing can be illustrated by examining the fundamental prerequisites for RF equipment operation. Each RF equipment needs a specific amount of bandwidth, an interference-free time slot, and a location in which to operate. Determination of the equipment bandwidth requirement involves automation of network equipment laydowns and information regarding data flow, channel widths, and pulse types. The equipment time slot requirement would necessitate automation of the RF equipment environment data and the computational capability to identify the available periods of time in which environmental noise and interference levels would not exceed interference threshold criteria for the system of interest. Finally, in addition to the automation of the bandwidth, time, and geographic location parameters necessary for successful RF equipment operation, there is also the need to automate the spectrum management rules that foster compatibility with the other RF equipment that comprise the electromagnetic environment. The automation of all the rules and regulations that have been instituted for each frequency band and radio service represents a significant challenge to the successful automation of spectrum sharing capabilities.

A single automated spectrum sharing capability could not efficiently coordinate the bandwidth, time, location, and regulatory requirements, for each RF equipment, across the entire frequency spectrum. Instead automated spectrum coordination capabilities must be tailored to each frequency band. Candidate automation solutions should be tested in frequency bands where there is a real need for coordination between government and non-government spectrum users. The automated spectrum coordination programs should eventually permit Federal and non-Federal spectrum users to execute dynamic channel allocation in 'real-time' in those frequency bands where the spectrum sharing issues are complex.

Automation should also be used to facilitate the application of Federal and non-Federal regulations and policies. If the key government regulations and policies for each slice of the spectrum were converted into algorithms it would speed the evaluation of new requests and make application of the rules more objective. The various radio service and frequency band regulations are extensive and in some cases require interpretation. Therefore, automation should move forward for the bands under current discussion for sharing and should be used to facilitate sharing on a band by band basis.

Automation will improve the ability to assess spectrum user performance. This is due partly to the fact that automation allows the collection and logging of vast amounts of RF signal traffic. If this data logging capability is combined with 'big data' analysis techniques it may be possible to spot patterns and relationships in the RF signal traffic that indicate when a frequency is available for sharing. In fact, automated logging and 'big data' analysis may identify available frequencies for spectrum-sharing which previously were assumed not feasible.

NTIA RFC Question 4

How might investment in RDT&E improve spectrum-utilization methods, and spectrum-sharing tools and techniques?

ALION RESPONSE COMMENT:

Research Development Test and Evaluation (RDT&E) funds are essential to foster collaboration between Federal and non-Federal spectrum users to incentivize the development of tools and methods to implement spectrum-sharing. RDT&E funds are necessary to move sharing concepts and technologies forward in a cooperative manner as Federal and non-Federal entities might not take the funds from existing projects or business lines. The RDT&E funds could be used efficiently and effectively at large Federal sites such as test ranges where development and testing could proceed in an environment already structured for testing and where the potential for impact to operational systems is low. RDT&E funds should be used to improve the key tools required for Dynamic Spectrum Access (DSA); such as sensors, software defined radios (SDRs), spectrum-sharing coordination and management software, and T&E performance monitoring systems.

As stated in the 2012 PCAST Report[2] and the Department of Defense Electromagnetic Spectrum Strategy[3], sharing is a matter of national interest to meet the growing requirements of Federal and non-Federal radio users. Spectrum is critical for the national security and economic security of the nation. Yet as the government develops new systems and the wireless industry moves toward 5G, the call for exclusive spectrum remains strong. Therefore, a neutral funding source, such as RDT&E funds, is critical to pulling the sides together in a cooperative and collaborative approach to developing sharing methods. Even where one group works earnestly to identify sharing opportunities, the other group may be unlikely to accept outcomes in which they were not involved. A cooperative and collaborative approach must be facilitated.

A large geographic area is needed to study Federal and commercial systems in a scaled implementation. Test ranges should be chosen with sufficient space for the deployment of systems, sensors and networks yet they should also have facilities for the laboratory testing of individual components and systems. Laboratories at the test range could be used to bench test interference protection criteria, verify threshold values used in the spectrum-sharing software, and enable continued sensor improvements.

RDT&E funds are needed to study non-Federal sharing with Federal incumbents and to study Federal users sharing in bands where the incumbents are non-Federal operations. Because sharing solutions will vary band by band based on the type of operations, the RDT&E funds used in this sharing study effort would produce the greatest benefit when applied to frequency bands that hold the greatest interest and potential for sharing. Government and industry should work together to recommend which bands should be considered for the RDT&E study.

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[2] President's Council of Advisors on Science and Technology (PCAST), "*Realizing the Full Potential of Government-Held Spectrum to Spur Economic Growth*", July 20, 2012.

[3] Department of Defense, *Electromagnetic Spectrum Strategy, 2013*, distributed under Deputy Secretary of Defense letter, September 11, 2013.