Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
Amendment of Parts 1, 2, 15, 25, 27, 74, 78, 80, 87, 90, 97, and 101 of the Commission's Rules Regarding Implementation of the Final Acts of the World Radiocommunication Conference (Geneva, 2007) (WRC-07), Other Allocated Issues, and Related Rule Updates	)	ET Docket No. 12-338 (Proceeding Terminated)
Amendment of Parts 2, 15, 80, 90, 97, and 101 of the Commission's Rules Regarding Implementation of the Final Acts of the World Radiocommunication Conference (Geneva, 2012) (WRC-12), Other Allocation Issues, and Related Rule Updates	)	ET Docket No. 15-99
Petition for Rulemaking of Xanadoo Company and Spectrum Five LLC to Establish Rules Permitting Blanket Licensing of Two-Way Earth Stations With End-User Uplinks in the 24.75-25.05 GHz Band	)	IB Docket 06-123
Petition for Rulemaking of James E. Whedbee to Amend Parts 2 and 97 of the Commission's Rules to Create a Low Frequency Allocation for the Amateur Radio Service	)	
Petition for Rulemaking of ARRL to Amend Parts 2 and 97 of the Commission's Rules to Create a New Medium-Frequency Allocation for the Amateur Radio Service	)	

To: The Commission

COMMENTS OF THE AEROSPACE AND FLIGHT TEST RADIO COORDINATING COUNCIL, INC.

Aerospace and Flight Test Radio Coordinating Council, Inc. ("AFTRCC"), by its counsel, hereby submits its Comments on the Notice of Proposed Rulemaking, FCC 15-50 (hereinafter, the "Notice") in the above-captioned proceeding. In particular, AFTRCC supports the proposed allocation of the bands 4400-4940 and 5925-6700 MHz for Aeronautical Mobile Telemetry ("AMT") use.

INTRODUCTION

AFTRCC is an association of the nation's principal aerospace manufacturers (see Attachment). AFTRCC was founded in 1954 to serve as an advocate for the aerospace industry on matters affecting spectrum policy, and it serves as the recognized non-Federal Government coordinator for the shared, Government/Non-Government spectrum allocated for flight testing. AFTRCC is the FCC-designated AMT coordinator for secondary medical body area network use of the flight test spectrum at 2360-2390 MHz, and is responsible for coordination with Wireless Communications Services licensees in the adjacent, 2345-2360 MHz band. Most recently, AFTRCC was designated to coordinate wireless microphone use on a secondary, licensed basis in the 1435-1525 MHz AMT band. AFTRCC works closely with Government Area Frequency Coordinators, who are responsible for Federal Government use of the spectrum, in an effort to ensure that interference-free flight test operations are protected, and flight safety is maximized.

DISCUSSION

As the Notice observes, the 2007 World Radiocommunication Conference allocated the 4400-4940 and 5925-6700 MHz bands for AMT use subject to conditions specified in Resolution 416 (WRC-07). The allocation was made based on proposals advocated strongly by the United States. Those proposals had been developed through the Commission's WRC Advisory Committee process, and were the result of extensive collaboration between and among representatives of the AMT community, and the Fixed Service ("FS") and Fixed Satellite Service ("FSS") communities, respectively.

As the Notice explains, additional spectrum for AMT is necessary in order to cope with the extraordinary growth in the amount of data collected during the course of flight test operations. This growth stems from the increasing complexity of modern aircraft and the pressure to shorten the product development cycle. *See id.* at para. 207.

Over the last 30 years, the number of measurements collected during flight testing have dramatically increased.[1] In the early days, aircraft used mechanical control rods to translate inputs from the pilot to the control surfaces. As aircraft evolved, control rods were supplemented with hydraulic lines, and later both were replaced by sensors and actuators connected by wire (*i.e.,* fly-by-wire). In addition, the number and complexity of critical flight systems have increased significantly. When coupled with advances in aerodynamics, fuels, and other technologies, aerospace manufacturers face ever more challenging test environments. Tests in these environments require greater amounts of measurement data transmitted to ground support operations in real-time in order to determine if the system can do what it is supposed to do, to modify test flights in progress, and to decide, as the test develops, whether to even continue the flight.

For instance, digital video cameras now represent an increasingly important source of data. Cameras complement traditional sensors, offering "pictures" that other sensors cannot capture. Video can be synchronized with other instrumentation to record the movements of "tufts," or "strings" glued to the aircraft skin, visibly indicating the direction of air flow over the surface of the aircraft at every instant during maneuvers, thereby providing insight for design changes to increase performance and efficiency. Video also provides other benefits, such as the ability to closely observe the interaction of water and tires during wet runway testing, monitoring

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[1] *See, e.g.,* Draft New Report ITU-R M.[AMT], Operational Description of Aeronautical Mobile Telemetry (AMT), Document 8B/58, submitted to the ITU-R by the United States, August 19, 2004, pages 9 *et seq*.

ice build-up on control surfaces during icing tests, and determining the time lag on cockpit avionics displays.

Video is also used for monitoring pilot workload; i.e. an over-the-shoulder view of the instrument panel as seen by the pilot. High-definition video can show flight test engineers on the ground what the pilot sees, and how he or she is reacting to the various gauges, warning lights, and other visual and auditory inputs. The foregoing types of video inputs are merged with the rest of the telemetry stream, improving the efficiency and efficacy of the ground operations, but also adding to the spectrum requirement.

Manned and unmanned aircraft are also increasingly designed to operate closer to the point of maximum efficiency. For example, winglet and non-circular engine nacelles are more efficient, but more precision is required to ensure that the design is correct; likewise, use of layered composites in wings greatly increases the number of parameters that must be tested. Thus, more data must be captured, transmitted, and analyzed in order to validate the engineering and for certification of aircraft. This is especially true for extended range, single-engine operation on overwater routes, which requires a higher level of test fidelity.

In addition to the increasing use of video, the number of measurement points as well as the frequency and accuracy of measurement, have increased over the years, such that the flight-test community has been increasingly hampered by the lack of adequate AMT spectrum. In the 1950s, flight testing of a typical new commercial airliner could be completed with a few hundred measurements. In recent years, flight testing of one new commercial aircraft generated approximately 100,000 different types of measurements. Not only has the number of measurement types vastly increased, but they are taken with much greater frequency and precision. With these demands, data rates have increased significantly, which requires more radio frequency spectrum. In general, the amount of instantaneous data collected today requires a much higher data rate than in years past.

The proposed allocations will help significantly in mitigating the spectrum constraint, and thus enhance the efficiency of the aerospace industry and its numerous test programs supporting civil aviation, national defense, and aerospace exports.

The Notice discusses the incumbent services currently occupying the two bands with which AMT would share. With respect to 5925-6700 MHz, it observes that the band is populated by numerous FS and FSS stations, which would need to be protected. The Notice inquires whether AMT sharing with these incumbents is "feasible." Id. at paras. 216-217.

Based on the studies performed by the AMT community during the U.S. preparatory process for WRC-07 in collaboration with FSS and FS industry representatives, the answer to that question is affirmative: Sharing is definitely feasible. As NTIA observed in its comments, the techniques spelled out in Res. 416 (*see* Notice, para. 208) and described in studies conducted in the ITU-R, for example a combination of co-channel avoidance and spatial separation, "would initially be the primary mean to achieve compatible operations . . . ." *Id.* at note 447. Thus, spectrum in these bands, particularly 5925-6700 MHz, is useable today for AMT to complement existing allocations.

However, in order to make the most effective use of vacant spectrum between and among the many FS and FSS stations referenced in the Notice (the "interstitial" channels), new technology will also need to be developed. Work has begun towards developing that technology although, to be sure, it is at a very early stage. For example, a proposal is being evaluated currently for development of a software-defined radio capable of operating in the 5925-6700 MHz band either by assembling unused pieces of spectrum into a composite channel (similar to

LTE-A carrier aggregation), or by sensing occupied spectrum and hopping to a vacant channel (a Dynamic Spectrum Access technique). It is too early to say whether this technology, or other proposals, would prove effective and efficient in the demanding environment associated with flight testing, but the issue is being actively worked.

In the meantime, the AMT community is also studying the sub-band 6425-6525 MHz. As the chart in paragraph 213 of the Notice makes clear, this band does not have the Fixed Service allocation applicable to the surrounding bands; rather, the band is allocated for the Mobile Service and comparatively few satellite earth stations. The band is used predominantly for broadcast auxiliary purposes, in particular electronic newsgathering ("ENG"). Due to the characteristics of flight test telemetry, it is AFTRCC's view that a compatible sharing regime with the broadcast and FSS communities in this band may also be quite feasible. For instance, AMT parameters are characterized by weak signals subject to deep fades generated by distant aircraft during maneuvers. In order to even detect, much less decipher, intelligence from the telemetry stream, AMT ground stations require the use of large, parabolic antennas with gains typically exceeding 30 dBi, and as much as 41 dBi. This factor, among others (such as the fact that, per Res. 416, the spectrum would not be used for safety-related telemetry), facilitates AMT compatibility with the incumbent systems. AFTRCC intends to explore these issues further with the broadcast community.

CONCLUSION

AFTRCC appreciates the Commission's adoption of the Notice and the referenced proposals. Allocation of the spectrum as proposed will help maintain the primacy of the U.S. aerospace industry in the global marketplace as flight testing needs grow, and contribute to maintaining the U.S. aerospace advantage for national security.

Respectfully submitted,

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