Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
	)	
Amendment of Part 27 of the Commission's Rules to Govern the Operation of Wireless Communications Services in the 2.3 GHz Band	)	WT Docket No. 07-293
	)	
Establishment of Rules and Policies for the Digital Audio Radio Satellite Service in the 2410-2360 MHz Frequency Band	)	IB Docket No. 95-91 GEN Docket No. 90-357 RM No. 8610

To: The Commission

COMMENTS OF THE BOEING COMPANY

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SUMMARY

The Boeing Company ("Boeing") commends the Commission for its efforts to analyze the technical issues arising from the modification of the wireless communications service ("WCS") technical rules. Boeing has contributed to the submissions made by the Aerospace and Flight Test Coordination Council ("AFTRCC") in this proceeding, including its demonstration that the out-of-band emissions ("OOBE") limits proposed for WCS networks in the 2345-2360 MHz band are not adequate to protect flight test operations in the adjacent 2360-2390 MHz band and should be tightened. If the OOBE limits are not tightened, then the Commission's proposed WCS and Aeronautical Mobile Telemetry ("AMT") coordination regime is critical. The coordination requirements, however, should be improved to adequately protect current and future fixed and mobile AMT receive sites from harmful interference.

Boeing is a global leader in the design and manufacture of commercial and military aircraft and operates more non-federal AMT receive sites than any other entity. Therefore, it is perhaps uniquely situated to advise the Commission on the importance of flight testing safety. Flight testing is a critical safety-of-life service and, in the National Broadband Plan, the Commission specifically recognized the need to protect AMT sites in the context of modifying the WCS technical rules. During a flight test, telemetry room personnel rely on an uninterrupted stream of telemetry data to monitor airplane systems and ensure the safety of the flight crew and the general public.

The Commission has also recognized that the bandwidth requirements of the aircraft manufacturing community for AMT have significantly increased. These needs will only continue to increase at a more rapid pace as greater than ever amounts of data

and video must be collected to test increasingly complex aircraft during ever shorter development cycles. Any harmful interference from OOBE could put the flight crew and the general public at risk and would require the repetition of complex and costly flight tests.

The short development cycles for new aircraft mean that Boeing must be as flexible and efficient as possible in conducting its flight tests. Therefore, it must have geographic flexibility through the use of new fixed AMT sites and temporary mobile AMT facilities. For example, Boeing recently broke ground on a new manufacturing facility in North Charleston, South Carolina that will be used for aircraft final assembly. Boeing has secured the necessary licenses for possible flight testing of aircraft in North Charleston before delivery to customers. Boeing also owns seven mobile AMT receivers that are stationed throughout the United States. The flexibility afforded by these multiple fixed and mobile AMT receive antennas allows Boeing to seek optimum weather and other conditions to test and deliver its aircraft to customers as efficiently as possible.

As demonstrated by AFTRCC in this proceeding, the proposed OOBE limits on WCS transmissions into the 2360-2390 MHz flight test band are not adequate. Aggregation of raised OOBE levels from WCS devices would increase the adjacent channel interference into AMT receivers, resulting in harmful interference to the AMT operations in the 2360-2390 MHz band. Therefore, the OOBE limits should be tightened to reflect those limits proposed by AFTRCC. If the OOBE limits remain as proposed in the Public Notice, and if WCS licensees do not accept a guard band in the upper edge of the WCS spectrum, then the Commission's coordination requirements are essential. The coordination requirements should be strengthened, however, to require that WCS

licensees: 1) provide a list of WCS transmit sites and technical characteristics to AMT operators upon request; 2) modify operations or shut down if they cause harmful interference to AMT receive sites; and 3) protect future fixed and mobile AMT receive sites from harmful interference, even if that means that the WCS licensees have to modify their sites or transmissions.

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COMMENTS OF THE BOEING COMPANY

The Boeing Company ("Boeing"), by its attorneys and pursuant to Section 1.415 of the Commission's Rules, 47 C.F.R. § 1.415, hereby submits the following comments in response to the Public Notice in the above referenced proceeding.[1] The Commission should tighten the proposed out-of-band emission ("OOBE") restrictions on wireless communications service ("WCS") operations in the 2345-2360 MHz band, which are not adequate to protect safety-of-life Aeronautical Mobile Telemetry ("AMT") flight test operations in the adjacent 2360-2390 MHz band. Alternatively, the Commission should modify and improve the proposed coordination requirements between WCS base stations and AMT receive sites as described herein.

[1] *See Commission Staff Requests That Interested Parties Supplement the Record on Draft Interference Rules for Wireless Communications Service and Satellite Digital Audio Radio Service*, IB Docket No. 95-91 et al., Public Notice, DA 10-592 (rel. Apr. 2, 2010) ("Public Notice").

Boeing supports, and has contributed to, the submissions made by the Aerospace and Flight Test Coordination Council ("AFTRCC") in this proceeding.[2] The rules proposed in the Public Notice, however, raise specific concerns for Boeing as the operator of more non-federal AMT sites than any other entity in the country. AFTRCC's submissions in this proceeding demonstrate that the OOBE restrictions proposed for WCS networks are not adequate to protect flight test operations in the adjacent band. Therefore, if the OOBE limits are not tightened in a manner that is consistent with AFTRCC's request, the Commission's proposed coordination regime becomes critically important. The proposed coordination requirements, however, should not only protect existing fixed AMT receive sites, but also future AMT receive sites as well as mobile AMT base vehicles to be used on a temporary and periodic basis. These protections are essential to the safety of flight test personnel and the general public, and the growth of the vital U.S. aerospace industry. Therefore, such coordination rules should be imposed even though, in some cases, they may require future modification to, or the relocation of, WCS sites or operations.

I. INTRODUCTION

Boeing is participating in this proceeding as a global leader in the design and manufacture of commercial and military aircraft, as one of the world's largest aerospace and defense contractors, and as a leader in the manufacture and launch of commercial and government satellites. The U.S. aerospace industry exported $83 billion in products last year and contributed the largest positive balance to U.S. trade of any manufacturing

[2] Boeing also contributed to and supports the comments filed by the Satellite Industry Association on the Public Notice.

sector. The aerospace and defense sectors directly employed 818,000 people in the United States last year. Headquartered in Chicago, Boeing itself employs more than 158,000 people across the United States and in seventy countries, with almost 96 percent based in the United States. Boeing is one of the leading U.S. exporters with total revenue in 2009 of $68.3 billion. Boeing operates two major divisions, Boeing Commercial Airplanes ("BCA") and Boeing Defense, Space & Security ("BDS"). Both business units benefit from routinely conducted flight test operations as a critical element of their businesses.

Boeing's AMT flight test operations in the 2360-2390 MHz band are conducted to develop and refine design concepts; to demonstrate compliance with internal design criteria and government regulatory requirements; to evaluate product improvements; to demonstrate operational effectiveness; and to ensure compliance with the certification requirements of the Federal Aviation Administration ("FAA"), international and foreign aeronautical regulatory agencies and U.S. government customers.

Boeing appreciates the Commission's efforts to explore the technical issues involved with the possible modification of technical rules for WCS in the 2345-2360 MHz band and the Commission's recognition of the important public safety concerns that require the protection of adjacent flight test spectrum.

Boeing was an active contributor to the AFTRCC filings in this proceeding, including with respect to the technical analyses that were undertaken, and Boeing fully supports the comments submitted by AFTRCC on the Public Notice. The Public Notice, however, raises special concerns for Boeing. The Commission has proposed a compromise between WCS licensees and the flight test community in the rules as

drafted.[3] As detailed in the various AFTRCC comments that have been filed in this proceeding, the compromise OOBE limits are not adequate to protect safety-of-life flight test AMT receivers in the 2360-2390 MHz band. Seemingly recognizing this, the Commission proposed in its draft rules a detailed coordination regime for placement of WCS base stations. The WCS Coalition appears to oppose coordination because it might be administratively burdensome, but if WCS wants to share spectrum adjacent to the flight test band using the proposed OOBE limits and without the use of a guard band at the upper edge of the WCS spectrum band, then coordination requirements are unavoidable.

Any coordination regime that is adopted must take into account the evolving nature of the flight test process. The spectrum requirements of Boeing and other aircraft manufacturers continue to increase at a significant pace, both with respect to geographic reach and bandwidth requirements. For these reasons, Boeing will need to add new fixed and mobile AMT sites in the near and long term. The flexible use of mobile AMT sites is an essential part of effective and efficient flight testing for Boeing. Therefore, provisions must be included in the coordination rules to allow AMT operators to quickly add new sites and identify mobile sites for temporary or periodic operations. WCS licensees should also be required to modify or shut down offending transmitters if they interfere with an existing AMT receive site, and alter their WCS sites or transmissions to accommodate new fixed and mobile AMT sites.

As the operator of more non-federal AMT receive sites than any other entity, Boeing assures the Commission that it will cooperate and actively participate in the

[3] *See* Public Notice at 2.

coordination process. To facilitate coordination, the Commission requested from AFTRCC a list of non-federal AMT sites, which AFTRCC has provided. The draft rules also require AFTRCC to provide an updated list of sites to WCS operators upon request.[4] Boeing will make every effort to consider the locations and operations of WCS towers when making decisions about logistics of flight test operations and new AMT site locations. To that end, however, and in the spirit of *quid pro quo*, the rules should also require that WCS licensees provide a list of WCS base station sites and their technical characteristics upon request by any AMT site operator.

II. AERONAUTICAL FLIGHT TESTING IS A CRITICAL SAFETY-OF-LIFE SERVICE THE PROTECTION OF WHICH PROMOTES THE PUBLIC INTEREST AND PUBLIC SAFETY

Aeronautical flight tests push each aircraft to its operational and safety limits, subjecting flight crews to substantial, yet controlled risk when adequately monitored in real-time through AMT communications. Safety hazards of certain flight tests are high, particularly those that exercise airplane systems and structures at or near their design envelope. These tests are conducted in FAA-approved airspace, have minimum crew on board (generally only a test pilot and co-pilot), and are accompanied by one or more chase airplanes with crew that visually monitor the exterior of the test airplane while maintaining radio contact with the pilot and co-pilot.

During testing, flight test design engineers monitor the airplane's status from a telemetry room on the ground, often hundreds of miles from the aircraft. Data providing the current status of airplane systems and structures is delivered to the telemetry room via the AMT data link as rapidly as it is acquired from the instrumentation installed on the

[4] *See* Public Notice at 12.

airplane. A Test Director in the telemetry room provides test operational instructions and continuous feedback about the airplane's status to the pilot and co-pilot.

The safety of the flight crew depends upon the real-time data received from the aircraft using AMT spectrum. For example, during initial airworthiness tests, the analysts and engineers rely on the real-time data received via the AMT data link to determine the aircraft's current status and whether the aircraft should continue the flight and initiate a subsequent test. If the AMT signal is interfered with by in-band or out-of-band emissions, the ground crew may not be able to identify a problem or alert the flight crew in time to avoid or correct a dangerous situation that could result in significant aircraft structural damage to the hull, wing, tail or other critical components. To illustrate the potential risks involved, the picture below shows tail damage that an E-6 test plane sustained during an airworthiness test.

Airplane Damaged During Airworthiness Test Lands Safely at Boeing Field

When such incidents occur, telemetry room personnel rely on an uninterrupted stream of real time telemetry data to monitor airplane systems for direct and collateral damage. Based on this data, they provide instructions to the pilot and co-pilot to avoid further damage to the airworthiness of the aircraft. As with the E-6 incident, the telemetry data was needed to bring the flight crew and airplane to a safe landing with no further incident or risk to the public on the ground.

The Commission has repeatedly recognized flight testing as a safety-of-life service. Almost twenty years ago, the Commission stated that "[w]e have previously determined that aeronautical flight test and telemetry operations should not share spectrum with unlicensed devices because of the threat to safety of life."[5] The Commission cited to its decision the previous year to prohibit the operation of Part 15 intentional radiators on frequencies used by certain sensitive radio services.[6] In that decision, the Commission described the sensitive radio services as those "involving safety-of-life."[7] The restricted bands used by safety-of-life services included the 2310-2390 MHz band used by aeronautical flight test telemetry.[8]

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[5] *Inquiry Relating to Preparation for the International Telecommunication Union World Administrative Radio Conference for Dealing with Frequency Allocations in Certain Parts of the Spectrum*, Gen Docket No. 89-554, Second Notice of Inquiry, 5 FCC Rcd 6046, 6061, ¶ 102 (1990) (*citing Revision of Part 15 of the Rules Regarding the Operation of Radio Frequency Devices Without an Individual License*, Gen Docket No. 87-389, RM-5193, RM-5250, RM-5575, First Report and Order, 4 FCC Rcd 3493, 3502, ¶61 (1989)).

[6] *Id*. at 3502, ¶ 61.

[7] *Id*.

[8] *Id.* at 3504, ¶ 66.

The Commission has also restricted secondary use of flight test spectrum for other services, such as air show communications, because of the harmful interference that could occur to aircraft being tested "at high altitudes hundreds of miles from their base."[9] The Commission determined that the resulting interference could "directly affect the safe operation of such aircraft" and concluded that secondary use of the frequencies "would impair the efficiency and safety of the flight test industry."[10] The Commission's recognition of flight testing as a safety-of-life service is often in the context of in-band interference, but is no less true with respect to interference from immediately adjacent bands if the OOBE restrictions are not adequate. In fact, in the National Broadband Plan, the Commission recognized the need to protect AMT operations from WCS networks.[11]

The recognized risks of interference from in-band and out-of-band transmissions to the efficient and safe operation of flight testing have heightened in recent years. Flight test maneuvers have become more sophisticated and far greater amounts of data must be collected in real time to protect the safety of the flight crew and efficiently bring aircraft to market. Further, test aircraft are generally flown at significant speeds and require more maneuvering room, necessitating large and varied geographic areas for flight test operations.

The Commission's proposed WCS rules are a compromise that, according to the Commission's Public Notice, only provide "reasonable protection against harmful

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[9] *Petition to Amend Part 87 of the Commission's Rules to Allot VHF Aeronautical Frequencies for the Coordination of Air Show Events*, RM-7164, Order, 5 FCC Rcd 4641, 4642, ¶ 7 (1990).

[10] *Id*.

[11] Connecting America: The National Broadband Plan, Recommendation 5.8.1, p.85, *available at* http://www.broadband.gov/.

interference to incumbent services."[12] Therefore, as discussed in greater detail below, the Commission's proposed coordination requirements are essential, and must be strengthened in order to provide truly adequate protection from harmful WCS OOBE interference.

III. AIRCRAFT MANUFACTURERS REQUIRE INCREASING AMOUNTS OF SPECTRUM TO CONDUCT FLIGHT TEST OPERATIONS SAFELY AND TO COMPLY WITH REGULATORY REQUIREMENTS

The Commission has recognized that "aeronautical telemetry bandwidth requirements have significantly increased in recent years as aircraft manufacturers collect increasing amounts of data and video concerning the performance of prototype aircraft."[13] This increase in bandwidth use by aerospace manufacturers in recent decades is due to increased system complexity, greater use of high definition video, larger testing footprints, and shorter aircraft development cycles.

Modern aircraft are increasingly using complex technology, which requires more testing, and therefore, increased demand for spectrum. The flight testing required in 1995 to complete the FAA certification process for Boeing's 777 aircraft included the electronic monitoring of approximately 64,000 individual data channels. The flight testing required to certify Boeing's new 787 aircraft has included the electronic monitoring of 200,000 (and continually increasing) individual data channels. In contrast,

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[12] Public Notice at 2.

[13] *Amendment of Part 2 of the Commission's Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services to Support the Introduction of New Advanced Wireless Services, Including Third Generation Wireless Systems*, ET Docket No. 00-258; *Amendments to Parts 1, 2, 27 and 90 of the Commission's Rules to License Services in the 216-220 MHz, 1390-1395 MHz, 1427-1429 MHz, 1429-1432 MHz, 1432-1435 MHz, 1670-1675 MHz, and 2385-2390 MHz Government Transfer Bands*, WT Docket No. 02-8, Fourth Notice of Proposed Rulemaking, 18 FCC Rcd 13235, 13260, ¶ 52 (2003).

the certification process required in 1954 for Boeing's 707 aircraft included the monitoring of only about 300 data channels.

Not only has the total number of measurements vastly increased, but these measurements must also be undertaken with much greater frequency and precision. Boeing currently requires up to 400 test samples per second for each electronic monitoring device. As a consequence, the sample rates required by each individual sensor have increased several fold, often requiring digital outputs of 12, 16 and sometimes 32 bits per sample.[14]

The onboard instrumentation requirements on each test aircraft greatly exceed the amount of available bandwidth for AMT. Test aircraft are now collecting data in gigabits per second, but can only transmit 5-15 Mbits per second of data through AMT spectrum due to bandwidth limitations. Therefore, Boeing is forced to transmit only the most critical aircraft safety data being collected, typically 5-15 Mbits per second of the 400-plus Mbits per second of data being recorded onboard the aircraft. This problem is exacerbated in military and small commercial aircraft that do not have the space onboard to store the data that cannot be transmitted.

High definition video is likely to be used in the coming years to monitor airframe components, cockpit instrumentation, and personnel condition and actions.[15] This will cause an order-of-magnitude increase in data capacity demand in the next ten years.[16] In

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[14] *See Spectrum Requirement for Aeronautical Mobile Telemetry*, United States of America, Document 8B/143-E at 2 (31 March 2005) ("Document 8B/143-E").

[15] *See* Darrell Ernst, Carolyn Kahn, and David Portigal, "The Economic Importance of Adequate Aeronautical Telemetry Spectrum," The MITRE Corporation, MTR 060202, 4-1, February 2007.

[16] *Id*.

addition, aircraft testing footprints are increasing in size due to the higher altitudes and faster speeds of new aircraft, which requires testing at greater distances.[17] Increased footprints reduce the ability to geographically reuse spectrum (a spectrum efficiency technique), which requires more spectrum as well as lower take off elevations for the ground station antenna to track the test aircraft.[18] Finally, global market forces demand reduced development, production, and testing cycles to reduce the time it takes to bring new aircraft to market.[19] One way to reduce the airplane development cycle is to do more real-time testing, for which AMT is essential.[20]

These trends in the aerospace manufacturing and testing industry have driven exponential growth in the demand for spectrum and have resulted in heavy use of the 2360-2390 MHz band. The growing congestion of AMT operations in the band should not be exacerbated by the introduction of an adjacent spectrum use that would result in harmful out-of-band interference that could endanger flight crews and the public, and necessitate repetition of complex and costly flight tests using limited AMT spectrum resources. The OOBE restrictions proposed in the Public Notice are not adequate to protect flight test spectrum and therefore should be tightened as provided in the AFTRCC proposal. Otherwise, the coordination regime proposed by the Commission becomes crucial and should be strengthened as discussed further below.

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[17] *Id*. at 4-1 – 4-2.

[18] *Id*. at 4-2.

[19] *Id*.

[20] *Id*.

IV. AIRCRAFT MANUFACTURERS REQUIRE EXPANDING GEOGRAPHIC REACH AND FLEXIBILITY TO COMPLY WITH THE TIMING AND OPERATIONAL REQUIREMENTS OF MULTIPLE AND DIVERSE FLIGHT TEST OPERATIONS

Flight testing is designed to be, and must be, as efficient as possible. This is because flight testing is conducted at the end of the lengthy and critical certification path that culminates with the delivery of an aircraft. Every day of delay in a flight test program can potentially cost millions of dollars. The WCS and AMT coordination regime must therefore account for the need for future fixed and mobile AMT sites to be operational at any existing or new location on relatively short notice.

The Commission has specifically recognized the need for AMT flexibility and the costs of delays in flight testing, observing that the "schedules of telemetry flight tests are unpredictable and delays costly."[21] Costs of flight testing delays start at approximately $50,000 per hour and increase exponentially depending on the size and length of the test. Each additional day of delay to complete and secure type certification for an aircraft can cost millions of dollars in inventory costs, labor expenses and delivery penalties. Such increased costs are eventually borne by taxpayers (with respect to government aircraft), the flying public, and the nation's overall economy and detract from the global competitiveness of U.S. aerospace manufacturers in the international marketplace. Therefore, the Commission should ensure that aircraft manufacturers such as Boeing are not prevented from continuing to employ flexible measures, such as the use of mobile AMT base vehicles, to conduct flight test operations on a safe and efficient basis.

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[21] *Amendment of the Frequency Allocation and Aviation Services Rules (Parts 2 and 87) to Provide Frequencies for Use by Commercial Space Launch Vehicles*, Gen. Docket No. 89-89-16, RM-6423, Report and Order, 5 FCC Rcd 493, 495 (1990).

To optimize efficiency, aircraft manufacturers must have flexibility with regard to the locations used to perform flight test operations, and Boeing has designed its AMT operations to be capable of testing anywhere in the United States. For example, during a current flight test program concerns have been raised about program overlap with another competing flight test program. As a result, testing will be conducted simultaneously in two separate locations to enable both programs to receive required U.S. Government certification as quickly as possible. In another example, Boeing abruptly moved the AMT base of operations from the central United States to the west coast to address program concerns.

In order to enhance the flexibility and responsiveness of Boeing's flight test operations, Boeing maintains fixed AMT receive stations that operate in the 2360-2390 MHz band at sites throughout the United States.[22] In November of last year Boeing broke ground on a second 787 manufacturing line in North Charleston, South Carolina.[23] Boeing's Charleston facilities are already used to assemble and install systems for the aft fuselage sections and to join and integrate center fuselage sections, and the new facilities

[22] Boeing currently conducts flight tests using AMT antennas at Seattle, Washington; Naval Air Station Patuxent River, Maryland; Roswell, New Mexico; Palmdale, California; Moses Lake, Washington; Glasgow, Montana; Naval Air Station China Lake, California; Yuma, Arizona; Mesa, Arizona; Philadelphia, Pennsylvania; St. Louis, Missouri; Edwards Air Force Base, California; Eglin Air Force Base, Florida; St. Charles, Missouri; Flagstaff, Arizona; Phoenix, Arizona; Tucson, Arizona; Big Bear, California; Bishop, California; Blythe, California; Carlsbad, California; Crows Landing, California; LeMoore NAS, California; Long Beach, California; San Diego, California; Santa Ynez, California; Thermal 1, California; Wrightwood, California; Wichita, Kansas; and Eugene, Oregon. Many of the initial flight tests conducted by Boeing's BDS division occur at Boeing's production sites in areas such as St. Louis, Philadelphia and Mesa, Arizona. Depending on the customer and the type of tests involved, such aircraft then are often tested further at military bases and government test ranges across the United States.

[23] *See* Jim Albaugh Welcomes South Carolina to Boeing Family, Press Release, Nov. 20, 2009, *available at* http://boeing.mediaroom.com/index.php?s=43&item=953.

can be used for final assembly as well.[24] Boeing has secured the necessary FCC licenses for the possible expansion of flight test operations into North Charleston in order to support final assembly operations.[25]

Although Boeing uses its fixed sites on a regular basis, it has become increasingly evident that these sites are inadequate and Boeing must regularly supplement its fixed receivers with mobile AMT base vehicles and antennas that can be used to establish temporary AMT test sites anywhere in the United States.[26]

Boeing therefore owns seven mobile AMT base vehicles that are stationed throughout the United States and additionally employs mobile AMT base vehicles owned by the U.S. government. For example, the mobile trailer and antenna shown below has been utilized by BDS's St. Louis, Missouri Test Data Operations team in Palmdale, California to support the test program for the F-15 Singapore aircraft.[27] The St. Louis Test Data Operations team's mobile trailer also supports the F-18 and other proprietary projects and is scheduled for future use at various locations throughout the country.

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[24] *See* Boeing 787 Final Assembly and Delivery, Charleston Facility Taking Shape, Press Release, April 5, 2010, *available at* http://boeing.mediaroom.com/index.php?s=43&item=1145 and Joseph C. Anselmo, *Deal with Alenia Cements Boeing Control of 787 Fuselage Factory*, Aviation Daily, Dec. 23, 2009.

[25] *See* Sean Mead, *Boeing's Final Assembly Plant Will Build 787-8s*, Aviation Daily, Nov. 23, 2009, at 3.

[26] Both BCA and BDS utilize mobile AMT vehicles to support flight testing operations. Boeing's BDS business unit maintains a Mobile Telemetry Trailer and Portable Antenna that comprises its Mobile Telemetry System. The Mobile Telemetry System can support a single flying aircraft with a separate communication, video and display system. It receives telemetry transmissions, converts them to scaled data and displays them using the SYMVIONICS IADS display software for both classified and unclassified aircraft data systems.

[27] *See* News Release, Boeing Rolls Out 1st F-15SG to Singapore, Nov. 3, 2008, *available at* http://www.boeing.com/news/releases/2008/q4/081103b_nr.html.

Mobile Telemetry Trailer

Portable Antenna

BCA also has mobile vans that are used to act as stand-alone AMT flight test systems and to supplement existing AMT test ranges, pictured below.

Mobile Station for Telemetry Communications

For example, when BCA was testing the 757-300, the flight test plan, or "critical path," indicated that flight testing would be conducted in Seattle, but the location had to be changed to address ongoing weather problems in the Pacific Northwest. Calm air was needed for a flutter test. Appropriate weather conditions existed in Roswell, New Mexico, so a mobile telemetry van was used in Roswell to conduct the telemetry testing. The late shift in test location helped to maintain the development schedule for the aircraft at significant cost savings.

In addition, some of the AMT testing of the 747-8 Freighter is taking place at a new flight test site in Othello, Washington because of flight test range availability issues stemming from the simultaneous flight testing of the 747-8, the 787 Dreamliner, and the P-8A Poseidon. Boeing recently applied for the authorizations necessary to conduct

these flight tests, which again emphasizes the complex nature of scheduling and conducting flight testing.

The flexibility afforded by mobile AMT trailers allows Boeing to test its aircraft in optimal weather conditions and over different terrain and elevations. This flexibility and mobility is necessary for adequate and efficient flight test operations in varied situations and is required for certification. The growing demands of increased and more extensive flight test operations necessitate that aircraft manufacturers not be confined to the *status quo*. Rather, they must be able to employ flight test spectrum in increasing geographic locations to comply efficiently with the production demands of the aviation industry and the regulatory requirements of global aviation authorities. It is critical that any coordination regime between WCS towers and AMT flight test sites account for the need for new and mobile AMT sites to be operational quickly and be located almost anywhere.

V. THE COMMISSION'S PROPOSED WCS AND AMT COORDINATION REQUIREMENTS ARE ESSENTIAL AND SHOULD BE IMPROVED TO PROTECT SAFETY-OF-LIFE FLIGHT TEST OPERATIONS FROM HARMFUL OUT-OF-BAND INTERFERENCE

The OOBE limits proposed in the Public Notice are less stringent than those that AFTRCC demonstrated in this proceeding as being necessary to protect AMT flight test operations. The OOBE limits for WCS should therefore be tightened accordingly. If the adopted OOBE limits remain inadequate, the Commission's proposed coordination regime between WCS base stations and AMT sites is indispensable. There are important provisions, however, that should be added to the coordination requirements to strengthen them and adequately protect flight test operations from harmful interference.

First, WCS licensees should be required to provide a list of WCS transmit sites to AMT site operators upon request. Boeing is committed to active participation in the coordination process and will cooperate with WCS licensees as required by the Commission's proposed rules. Effective coordination, however, will require that WCS licensees and AMT site operators know where each other's sites are located. The Commission has already required AFTRCC to provide a list of AMT receiver sites, which it has done.[28] The proposed rules further require AFTRCC to provide a current list to any requesting WCS licensee.[29] The rules therefore should also require WCS licensees to provide a list of WCS transmit sites and their technical characteristics upon request by any AMT site operator. Boeing will consider the locations of WCS sites to the fullest extent possible when planning for future fixed or mobile AMT receive sites to meet its flight test needs.

Further, Boeing envisions the need to work with the Commission and WCS licensees on the specifics for coordination. For example, AMT licenses are generally secured for AMT transmitters rather than the associated receivers and therefore WCS licensees will have to take in to account the fact that AMT receivers may not always be located in the center of the licensed area.

In addition, to avoid the need for a guard band within WCS spectrum, WCS licensees should be required to shut down if they cause harmful interference to AMT receive signals and should be required to protect future fixed and mobile AMT sites. At the very least, WCS licensees must protect existing AMT receive sites within the 45

[28] *See* Letter from William K. Keane to Marlene Dortch, WT Docket No. 07-293 et al, Apr. 9, 2010.

[29] *See* Public Notice at 12.

kilometers or radio line of site distance, whichever is larger, as proposed in the draft rules. The coordination requirements should be improved, however, by imposing a specific requirement that WCS licensees shut down if they interfere with existing AMT receive sites. Only through the adoption of such a requirement can the Commission adequately protect AMT operators from the loss of in-flight telemetry data. Such data losses can require retesting at great expense or risk the safety of the flight crew and public. WCS licensees should also be required to protect future fixed and mobile AMT sites, even if that means modifications to WCS sites or transmissions. Without provision for these additional coordination requirements, a guard band within the WCS spectrum would be necessary to adequately protect safety-of-life flight test operations.

Finally, WCS licensees may wish to seek more time to meet the proposed build-out requirements in order to allow sufficient time for coordination with AMT receive site operations. The Commission recently proposed ambitious substantial service performance requirements for WCS licensees, which will add to the coordination burden.[30] Boeing commits to working with WCS licensees on such coordination efforts, however, meeting the performance requirements may be challenging when accounting for the time necessary to accomplish proper coordination.

VI. CONCLUSION

Boeing appreciates the Commission's efforts over many years to evaluate the technical proposals and tests submitted in the course of this proceeding, as well as the Commission's recognition of the safety-of-life realities of flight test operations. As

[30] *See Federal Communications Commission Requests Comment on Revision of Performance Requirements for 2.3 GHz Wireless Communications Service*, WT Docket No. 07-293, Public Notice, FCC 10-46 (rel. Mar. 29, 2010).

demonstrated by AFTRCC, however, the OOBE restrictions proposed in the Public Notice would not be adequate to protect AMT receive sites in the 2360-2390 MHz band and should be tightened.

Without adequate OOBE limits or a guard band in the WCS spectrum, the Commission's proposed WCS and AMT coordination requirements are critical. Boeing applauds the coordination requirements proposed, but strongly urges the Commission to strengthen them by requiring that WCS licensees provide AMT operators with a list of WCS transmit sites upon request, cease transmissions if they cause harmful interference to an AMT receive site, and modify WCS transmissions to accommodate new fixed and mobile AMT receive sites.

Respectfully submitted,

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