

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of)
)
Petition To Adopt Service Rules for the Aeronautical) RM –
Mobile Airport Communication System (AeroMACS))
)
)

**WIMAX FORUM PETITION FOR RULEMAKING
TO ADOPT AEROMACS SERVICE RULES**

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TABLE OF CONTENTS

EXECUTIVE SUMMARY	i
I. INTRODUCTION	2
II. THE DEMAND FOR AEROMACS	3
III. THE FCC ACTIONS THAT LAID THE GROUNDWORK FOR AEROMACS.....	11
IV. THE PROPOSED PART 87 TECHNICAL RULES ARE BASED ON ALREADY- ADOPTED INTERNATIONAL STANDARDS	13
V. FEDERAL AND NON-FEDERAL SHARING	14
VI. AUTHORIZATION OF NON-FEDERAL USERS	15
VII. ELIGIBILITY FOR NON-FEDERAL AEROMACS LICENSES	18
VIII. THE FCC SHOULD PROPOSE DESIGNATING A SINGLE, NATIONWIDE CHANNEL MANAGER FOR NON-FEDERAL AEROMACS USERS.....	19
IX. SUMMARY AND CONCLUSION	24
APPENDIX A.....	1-A

EXECUTIVE SUMMARY

The WiMAX Forum submits this petition for rulemaking (Petition) to initiate the process of promulgating service rules for the Aeronautical Mobile Airport Communication System, better known as AeroMACS. AeroMACS is a standardized airport surface communications system for high capacity aeronautical mobile and fixed broadband communications relating to safety and regularity of flight. In 2015 the FCC allocated the 5091-5150 MHz band to AeroMACS and in 2017 also allocated the 5000-5030 MHz band to AeroMACS. Although numerous tests of AeroMACS technology are ongoing in the U.S. and around the world, implementation of AeroMACS in the U.S. is not widespread because the FCC has not yet adopted service rules for AeroMACS.

AeroMACS spectrum will be shared between Federal and non-Federal users. The Petition proposes that sharing take place between Federal and non-Federal users in accordance with a Memorandum of Agreement to be negotiated: 1) on behalf of Federal users by the National Telecommunications and Information Administration; and 2) on behalf of non-Federal users by a single Channel Manager to be designated by the Commission.

The potential services and applications provided by AeroMACS are all related to safety and regularity of flight, and can be grouped into three major categories: 1) Air Traffic Control and Air Traffic Management and infrastructure; 2) airline operations; and 3) airport and/or port authority operations. While the first is a Federal Government initiative, the latter two will take place under the FCC's jurisdiction.

The Petition proposes that non-Federal AeroMACS operations be authorized as a Part 95 licensed-by-rule service, with technical rules codified in Part 87 (Aviation Services). The proposed technical rules are based on already-adopted international technical standards. The proposed licensing approach would authorize non-Federal entities to operate AeroMACS stations without an individual license issued by the FCC: a) upon required registration in a centralized database administered by a single, non-profit, impartial, non-governmental entity (the Channel Manager) appointed by the Commission; and b) the assignment of channels by the Channel Manager.

A single Channel Manager will ensure coordination among eligible non-Federal users of the AeroMACS band, ensure nationwide consistency in the allocation and use of the available channels, and provide a single point of contact to facilitate sharing of the AeroMACS bands with Federal AeroMACS users and Aeronautical Mobile Telemetry users in a manner that will avoid interference. The proposed Channel Manager would process requests by non-Federal users for access to AeroMACS channels in a fair and equitable manner to ensure efficient use of AeroMACS spectrum and to prevent either hoarding or warehousing of spectrum by any one entity. The proposed licensing rules are intended to provide the Channel Manager flexibility to manage the AeroMACS spectrum so as to maximize efficient usage.

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The Aeronautical Mobile Airport Communication System, better known as AeroMACS, is a standardized airport surface communications system for high capacity aeronautical mobile and fixed broadband communications relating to safety and regularity of flight. AeroMACS is the airport surface communications solution recommended by the International Civil Aviation Organization (ICAO) for coping with increased volumes of data exchange at busy airport surfaces.¹ AeroMACS represents one of the core technologies outlined in the Future Communication Infrastructure framework, which combines the vision of the Federal Aviation Administration's (FAA's) Next Generation Air Transportation System in the U.S. and the Single European Sky ATM Research (SESAR) in Europe.² AeroMACS is also included in the ICAO's Global Air Navigation Plan (GANP), which outlines recommendations to deploy this communications system at large- and medium-sized hub airports worldwide.³

AeroMACS operates in the globally harmonized 5091-5150 MHz band allocated to the aeronautical mobile (Route) service (AM(R)S) by the International Telecommunication Union

¹ See EUROCONTROL, Airport Surface Data Link (AeroMACS), <http://www.eurocontrol.int/articles/airport-surface-data-link-aeromacs> (last visited Mar. 16, 2017).

² See Worldwide AeroMACS Implementations Prove Their Tremendous Potential, WiMAX Forum (Nov. 19, 2015), http://www.wimaxforum.org/Page/News/PR/20151119_Worldwide_AeroMACS_Implementations_Prove_Their_Tremendous_Potential.

³ See ICAO Doc 9750-AN/963 Fourth Edition – 2013.

(ITU) at the World Radiocommunication Conference 2007 (WRC-07). In 2015, the FCC allocated the 5091-5150 MHz band to AM(R)S systems, limited to surface applications at airports that operate in accordance with international aeronautical standards, that is, AeroMACS.⁴ In the same proceeding, the FCC also proposed allocating the 5000-5030 MHz band to AM(R)S to support AeroMACS.⁵ On March 29, 2017 the FCC adopted its proposal to allocate the 5000-5030 MHz band to AeroMACS.⁶

Widespread implementation of AeroMACS in the U.S., however, has not been feasible because the FCC has not yet adopted service rules for AeroMACS. This petition for rulemaking (Petition) is submitted pursuant to Section 1.401(a) of the Commission's Rules⁷ by the WiMAX Forum[®] to propose AeroMACS service rules that, if adopted, will facilitate the wide-spread deployment of AeroMACS technology at airports within the United States to promote the safety and regularity of flight.

I. INTRODUCTION

The WiMAX Forum is a not-for-profit industry association that certifies and promotes the compatibility and interoperability of broadband wireless products based upon the IEEE Standard 802.16. Over the past several years the WiMAX Forum's Aviation Working Group (AWG) has been proactively engaged with equipment vendors and representatives from the

⁴ 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 Allocation Issues, and Related Rule Updates, *Report and Order, Order, and Notice of Proposed Rulemaking*, 30 FCC Rcd 4183, 4209 (2015) ("*FCC 2015 Actions*"). The FCC also allocated the 5091-5150 MHz band to aeronautical mobile telemetry (AMT) at 52 flight test areas, but with AeroMACS having a priority over AMT systems. *Id.*

⁵ *Id.* at 4264. Hereinafter the 5091-5150 MHz band sometimes will be characterized as the "AeroMACS Upper Band," and the 5000-5030 MHz band will be characterized as the "AeroMACS Lower Band."

⁶ 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 Allocation Issues, and Related Rule Updates, *Report and Order*, FCC 17-33 (2017) ("*FCC 2017 Report and Order*").

⁷ 47 C.F.R. § 1.401(a).

avionics, airframe, and airline operator communities, as well as the various civil aviation authorities, to advance the development of WiMAX system profiles to meet the requirements for AeroMACS.⁸ As part of that effort, on September 28, 2015 the WiMAX Forum submitted reply comments in ET Docket Nos. 15-99 and 12-338 supporting the Commission’s proposal to implement the recommendations of WRC-07 with respect to the 5000-5030 MHz and 5091-5150 MHz bands designated for AeroMACS.⁹ In those reply comments, we noted the need for further activity with respect to service rules for AeroMACS and the importance of considering the need for channel coordination in the frequencies allocated for AeroMACS.¹⁰ In acknowledging our requests in its recent decision, the FCC stated that issues relating to service rules and frequency coordination will be addressed in due course in a separate proceeding.¹¹ With this Petition, the WiMAX Forum responds to the FCC’s decision and proposes specific Part 87 and Part 95 service rules that reflect the globally harmonized consensus on AeroMACS technical requirements.

II. THE DEMAND FOR AEROMACS

The adoption of AeroMACS by the global aviation community reflects a need to establish a new framework for airport surface communications designed to advance the safety and regularity of flight. As described below, the most pressing demands for AeroMACS technology involve mobile communications at airports, where, among other things, AeroMACS technology could help offload VHF Data Link – Mode 2 (VDLM2) and Aircraft

⁸ The AWG acts as a focal point for worldwide aviation industry interests in AeroMACS technology by defining requirements and technology profiles that drive the network, air interface specifications, certification, and products. The WiMAX Forum has also been partnering with aviation industry and regulatory organizations to establish study groups to help advance the development, standardization, and testing of AeroMACS.

⁹ Reply Comments of the WiMAX Forum, ET Docket Nos. 15-99 & 12-338 (Sept. 28, 2015).

¹⁰ *Id.* at 4 (cited in *FCC 2017 Report and Order* ¶ 40).

¹¹ *FCC 2017 Report and Order* ¶ 40 n.96.

Communications Addressing and Reporting System (ACARS), and improve deicing efficiency. In addition, AeroMACS fixed links could be used to connect gate and ground operations, tracking and control devices, and other services supporting safety and regularity of flight.

The existing ground safety communications infrastructure at airports has a number of limitations that AeroMACS can help overcome. First, underground cabling not only lacks mobility but is expensive to deploy, lacks flexibility when new areas need coverage, and is not available at all airport locations. Second, the existing wireless infrastructure relies on a combination of narrowband spectrum allocations and narrowband wireless technologies, with bandwidth limitations that force the use of lower throughput data applications. For instance, the most commonly used aircraft datalink technologies on the airport surface are ACARS and VDLM2. As a solution that uses dedicated spectrum and is optimized for the aviation industry, these VHF datalinks provide very robust, reliable and secure connections. VDLM2, however, is limited to 31.5 kbps, strictly limiting the type and number of applications it can support and imposing a high per-bit cost.¹² As a result, airport surface communications are constrained by, among other things, the lack of broadband connectivity for the exchange of safety and regularity of flight data.¹³ AeroMACS will be supporting the FAA's new DataComm program by allowing the offloading of large amounts of aircraft data from the VHF datalinks.¹⁴ This offloading will reduce safety traffic congestion on the legacy aviation VHF datalink networks, and thereby

¹² Monica Paolini, *AeroMACS: A common platform for air traffic management applications*, at 4, Senza Fili Consulting, White Paper (2015), http://files.wimaxforum.org/Document/Download/SenzaFili_AeroMACS-White_Paper_2015.

¹³ See Monica Paolini, *Enabling the next generation in air traffic management with AeroMACS*, Senza Fili Consulting, White Paper (2014), http://files.wimaxforum.org/Document/Download/SenzaFili_AeroMACS_140701.

¹⁴ FAA, NextGen Programs, Data Communications (Data Comm), <https://www.faa.gov/nextgen/programs-/datacomm/> (last visited Mar. 16, 2017).

ensure critical Air Traffic Control (ATC) messages are not unnecessarily delayed between the FAA controllers and aircraft.

More specifically, the highest concentration of sources, users, and stakeholders of information required for safe and regular flight operations occurs at the nation's airports.¹⁵ Within the national airspace system, the airport is where aircraft are in closest proximity to each other and to a wide variety of service and operational support vehicles, personnel, infrastructure and service applications (such as air traffic controllers, aircraft pilots, airline operators, ramp operators, aircraft service providers, and emergency service, snow removal and deicing personnel, all of which contribute to safety and regularity of flight).¹⁶ Communications needs among these various elements of the air traffic system are growing rapidly and have outstripped the limited capacity for current safety spectrum. To accommodate increased aircraft and airport traffic without sacrificing safety requirements, the development of a next generation surface communications system was needed with the capacity to handle the current and future operational requirements as discussed above.

AeroMACS is the result of a global initiative to develop such a next generation surface communications system. Since 2007, an AeroMACS trial has been underway at the National Aeronautics and Space Administration (NASA) Glenn Research Center Testbed located on the Cleveland Hopkins International Airport. The FAA also has selected several U.S. airports to deploy Airport Surface Surveillance Capability (ASSC) via AeroMACS, including San Francisco.

¹⁵ James M. Budinger & Edward Hall, *Aeronautical Mobile Airport Communications System (AeroMACS)*, at 1, Section 1.1, NASA (Oct. 2011) (“Budinger and Hall NASA/TM 2011-217236”), <https://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20110022433.pdf>.

¹⁶ *See id.* *See also FCC 2017 Report and Order* ¶ 39 (“AeroMACS frequencies might be used by pilots to receive weather and airfield information; by fire rescue, snow removal, and ground personnel to coordinate operations; and by airport security personnel to monitor live video feeds.”).

Federal Government-sponsored trials also are underway at other U.S airports. For example, Boston Logan International Airport has announced a plan in conjunction with the FAA to implement an AeroMACS operational network for use by the Massachusetts Port Authority and airlines.¹⁷ Among the benefits cited in a presentation by the FAA of this particular trial are to:

- “Make other U.S. Airport operators aware of the benefits of AeroMACS service
- Define potential AeroMACS services
- Help to develop appropriate FAA guidance (Advisory Circular)
- Study the network performance, resource allocation, security, and congestion issues peculiar to AeroMACS
- Study potential partnerships among different AeroMACS users.”¹⁸

Other trials and deployments are taking place worldwide. Trials scheduled internationally include Beijing Capital International Airport, King Abdulaziz International Airport (Saudi Arabia), and Milan-Malpensa Airport. China Airlines, China Eastern, and Xiamen Airlines are already using AeroMACS in the cockpit; and Gol Airlines (Brazil) is planning a trial for later this year.

As the Commission previously has noted, the potential services and applications provided by AeroMACS (Federal and non-Federal) can be grouped into three major categories: 1) ATC and Air Traffic Management (ATM) and infrastructure; 2) airline operations; and 3) airport

¹⁷ See Juliet Van Wagenen, *AeroMACS Could Emerge as an Enterprise Solution for the FAA*, Avionics (Jan. 19, 2016), http://www.aviationtoday.com/av/military/AeroMACS-Could-Emerge-as-an-Enterprise-Solution-for-the-FAA_86975.html#.VwbTV3nfPeI. Implementation of Airport Surface Surveillance Capability (ASSC) using AeroMACS began at San Francisco in May 2013; and field trials of improved weather observation systems using AeroMACS began in July 2015 at Otis Air Force Base. Other trials in the U.S. scheduled for 2016 are at Dallas/Fort Worth International Airport, Detroit Metropolitan Wayne County Airport, Atlantic City International, Syracuse Hancock International, Daytona Beach International, and Chicago O’Hare International Airport.

¹⁸ Brent Phillips, FAA, AeroMACS FAA Status Update, Presentation to the WiMAX Forum Webinar, slide 31 (Mar. 30, 2016) (“AeroMACS FAA Status Update”).

and/or port authority operations.¹⁹ While the first is a Federal Government initiative, the latter two will take place under the FCC's jurisdiction. AeroMACS deployment at airports will leverage commercial off-the-shelf WiMAX hardware and software being developed around the world, and cost savings will be realized for all three categories as the AeroMACS facilities potentially could be shared among these three programs.

AeroMACS is designed to provide reliable and secure broadband communications connectivity to aeronautical mobile and fixed stations at an airport for safety and regularity of flight.²⁰ AeroMACS will enable valuable System Wide Information Management (SWIM) data to be sent wirelessly as soon as the aircraft lands, helping reducing aircraft turnaround time, and allowing the future data intensive aircraft to send information seamlessly. Mobile stations that will be connected also include Electronic Flight Bags, handheld terminals used by airport personnel while on or near airport grounds, ground support vehicles of all types (*e.g.*, service and emergency vehicles) anytime and anywhere they may be located on the airport grounds, as well as aircraft while on the ground at arrival or at take-off. AeroMACS also makes it possible to connect to a larger number of fixed infrastructure elements (*e.g.*, sensors, weather stations, and radars) to collect and continuously update more detailed information. To cite just a few examples, an AeroMACS network can assist in transmitting detailed real-time data and providing pilots up-to-date information on flight plans, maps, and weather forecasts.²¹

¹⁹ See *FCC 2015 Actions*, 30 FCC Rcd at 4205 n.138 (citing Budinger and Hall NASA/TM 2011-217236 at 6, Section 3.2).

²⁰ AeroMACS is designed to provide ATM in the ground domain of the air transport system – that is, within airport infrastructure and in aircraft on the ground. While the aircraft is in the air, communication between the ground and aircraft will continue to rely on existing VHF Digital Link and future L-band satellite systems. As the aircraft lands, it will establish a connection to the AeroMACS ground network to exchange data with ground infrastructure and to use ATM applications.

²¹ RTCA, Inc., Terms of Reference, RTCA Paper No. 319-15/PMC-1419, at 3 (Sept. 22, 2015), http://www.rtca.org/Files/Terms%20of%20Reference/SC-223_Dec_2015_TOR.pdf (“Two of the more widely recognized applications that this system could support are the loading of a full 4D Flight Plan including surface movement

A broadband connection capable of tracking the position of aircraft, mobile devices and fixed devices on the ground and transmitting detailed real-time data increases the reliability and speed of surface communications, and in many cases may allow applications to be automated, potentially freeing limited and expensive human resources.

AeroMACS provides support for a wide range of Federal and non-Federal applications/services including high-speed data and video as well as VoIP, with a predominant leaning towards data to overcome the communication errors and inefficiencies often encountered with current voice-dominated communications. AeroMACS will also support multi-cast and broadcast services. Support for quality-of-service (QoS) will ensure critical payloads receive appropriate priority and meet latency requirements; and support for multiple classes-of service (CoS), ranging from best efforts to real-time, will help ensure that AeroMACS stakeholders have access to sufficient capacity when needed.

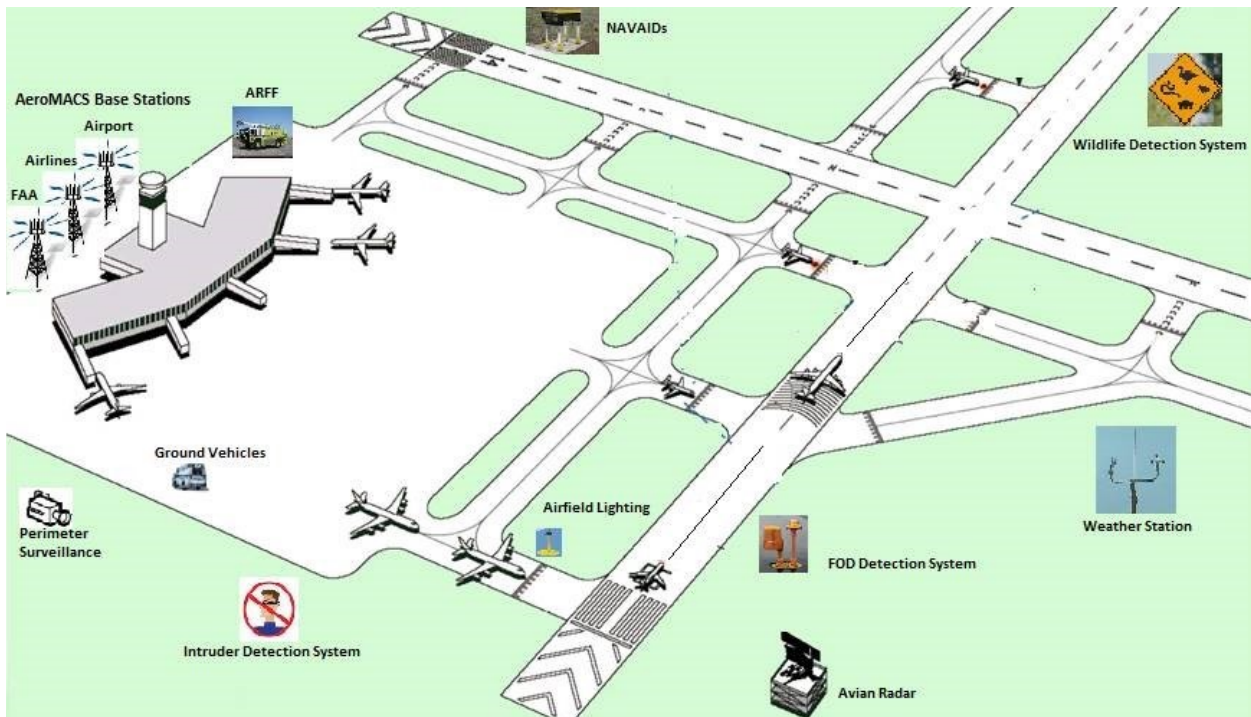
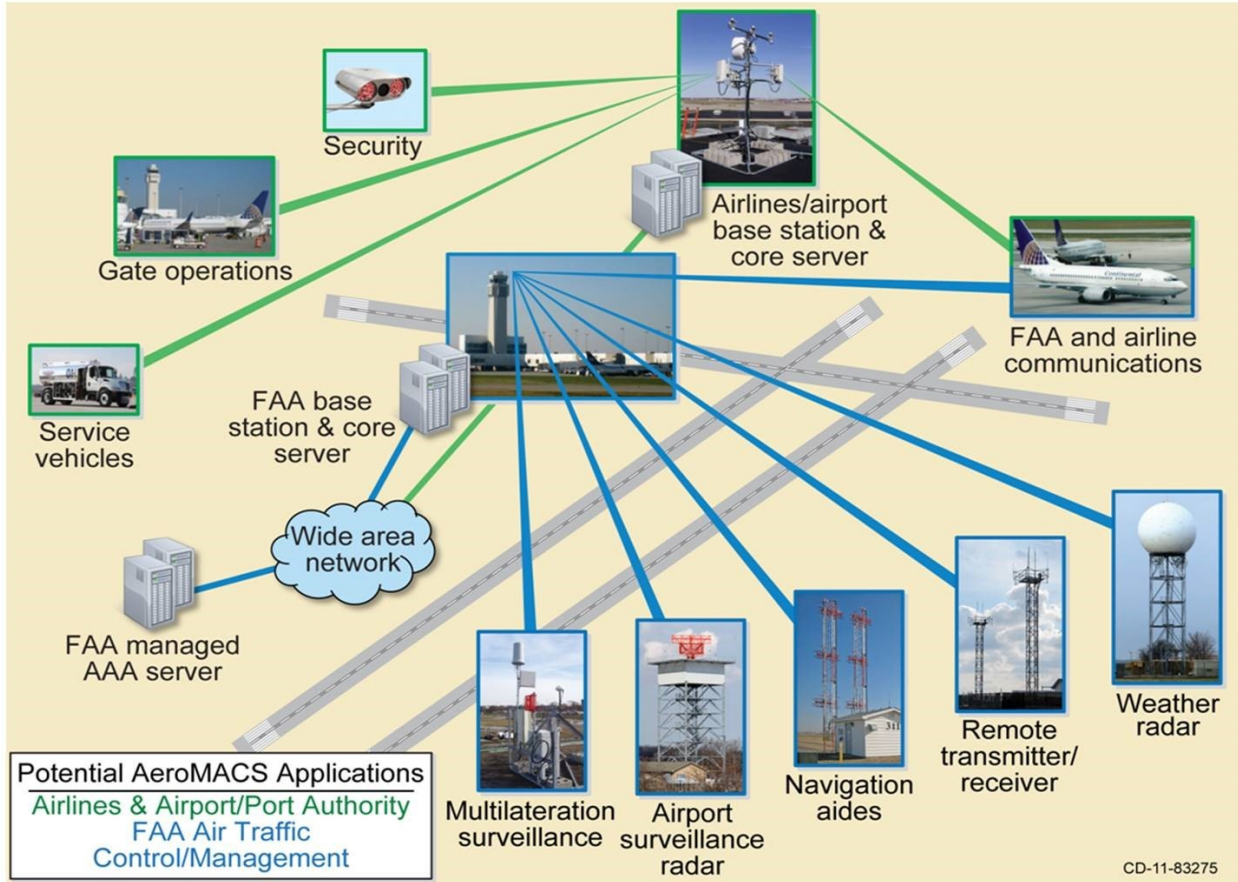
Airport coverage will typically be achieved with a combination of multisector base stations and point-to-point links. Deployment for runway and taxiway areas will be driven primarily by coverage requirements and likely use of macro-cells. In contrast, deployment in gate and ramp areas, where there is the highest concentration of aircraft and ground support equipment of various types, will be governed primarily by capacity requirements, thus often requiring more closely spaced, micro-cell and pico-cell base stations. Other areas of the airport property likely will be served by a combination of macro-cells and micro-cells.²² The new

guidance (i.e., the ‘D-Taxi’ application) directly into the aircraft’s flight management system. Subsequent changes to this air traffic set of instructions would then be accomplished either at the gate or whenever and wherever a change was needed while operating on the airport surface. Exchange of Aeronautical Information Services (AIS) and meteorological data could also be accomplished using this link, albeit, its use would be restricted at this time to use on the airport surface only.”).

²² While AeroMACS will be limited to supporting surface applications at airports, in order to advance safety and regularity of flight while maintaining aviation obstacle clearance surfaces some AeroMACS base stations (BS) may need to be located slightly off airport property.

AeroMACS applications open the opportunity to improve ATM, relieve traffic congestion, reduce delays, improve airport safety, minimize the environmental impact of flying, and contain costs. An FAA depiction of the AeroMACS architecture at an airport is provided on the following page as Diagram 1.²³

²³ AeroMACS FAA Status Update at slides 28, 33.



III. THE FCC ACTIONS THAT LAID THE GROUNDWORK FOR AEROMACS

In April 2015, the FCC adopted a *Report and Order, Order, and Notice of Proposed Rulemaking* intended to implement certain radio frequency (RF) allocation decisions from the Final Acts of the World Radiocommunication Conference (Geneva, 2007), including those related to AeroMACS.²⁴ In the *Report and Order* portion of its action,²⁵ the FCC described some of the history of the international work on AeroMACS, including the fact that at WRC-07 the ITU added an AM(R)S frequency allocation for the 5091-5150 MHz band on an international basis.²⁶ This worldwide frequency allocation is provided for airport surface communications dealing with safety and regularity of flight.²⁷ Based on the ITU action, the FCC allocated the 5091-5150 MHz band to the aeronautical mobile service on a primary basis for Federal and non-Federal use, limited to AMT for flight testing of aircraft and AM(R)S for AeroMACS networks.²⁸

In the *Notice of Proposed Rulemaking* portion of its 2015 actions, the FCC proposed to “to allocate the 5000-5030 MHz bands to the AM(R)S on a primary basis for Federal and non-Federal use, limited to surface applications at airports that operate in accordance with international aeronautical standards (*i.e.*, AeroMACS).”²⁹ Citing the support of the WiMAX

²⁴ See *FCC 2015 Actions*, 30 FCC Rcd 4183.

²⁵ *Id.* at 4205-10.

²⁶ *Id.* at 4206-07, citing ITU-R M.1827, “Guideline on technical and operational requirements for stations of the aeronautical mobile (R) service (AM(R)S) limited to surface application at airports and for stations of the aeronautical mobile service (AMS) limited to aeronautical security (AS) applications in the 5091-5150 MHz,” ITU, 2007 (superseded 2015), available at <https://www.itu.int/rec/R-REC-M.1827-0-200710-S/en>.

²⁷ See Izabela Gheorghisor et al., *AeroMACS Implementation Analyses*, MITRE Corporation, Section 2.1 (Sept. 2014) (“Mitre”), http://www.mitre.org/sites/default/files/publications/pr_14-4004-aeromacs-implementation-analyses.pdf.

²⁸ *FCC 2015 Actions*, 30 FCC Rcd at 4207.

²⁹ *Id.* at 4264. With U.S. support, WRC-07 also determined that the band 5000-5030 MHz was to be reviewed for allocation to AM(R)S and AeroMACS at the next Conference. See United States Delegation Report [on] World Radiocommunication Conference 2007, submitted to the Secretary of State by Ambassador Richard M. Russell,

Forum, the FCC recently adopted this proposal, finding a need for additional spectrum for AeroMACS “especially at the nation’s busiest airports.”³⁰ To implement this decision, the FCC added an entry in the U.S. Table of Allocations for a primary AM(R)S allocation in the 5000-5010 MHz band and adopted new Table of Allocations footnote US115, which “contains the primary AM(R)S allocation for the 5010-5030 MHz band, limits the use of the AM(R)S allocation in the 5000-5030 MHz band to surface applications at airports that operate in accordance with international standards (*i.e.*, AeroMACS), limits AeroMACS operations in the 5010-5030 MHz band to those requirements that cannot be satisfied in 5000-5010 MHz and 5091-5150 MHz bands, requires that AeroMACS systems in the 5010-5030 MHz band be capable of operational modification if receiving harmful interference from, or causing interference to, the radionavigation-satellite service, and authorizes aeronautical fixed communications that are an integral part of the AeroMACS system on a primary basis.”³¹ As mentioned previously, however, the FCC deferred issues related to service rules and a frequency coordinator to a future proceeding.³² Given the allocation decisions at WRC-12, the efforts of the aeronautics community, including the FAA, to implement AeroMACS, and the actions taken to date by the FCC, now is the time for the FCC to consider service rules for the AeroMACS bands.

United States Head of Delegation, Section 1.1.6. WRC-12 could not agree however to an international AM(R)S allocation in that band.

³⁰ *FCC 2017 Report and Order* ¶ 40.

³¹ *Id.* ¶ 39 n.92.

³² *Id.* ¶ 40 n.96.

IV. THE PROPOSED PART 87 TECHNICAL RULES ARE BASED ON ALREADY-ADOPTED INTERNATIONAL STANDARDS

Based on the work at WRC-07, AeroMACS standards development began in 2009 with the stand-up of RTCA Special Committee 223³³ and the European Organization for Civil Aviation Equipment (EUROCAE) Working Group 82 (WG-82).³⁴ The development of AeroMACS in the U.S. began as a collaborative effort among the FAA,³⁵ NASA, as well as broad sectors of industry. AeroMACS was incorporated into the FAA's Next Generation Air Transportation System in the U.S.³⁶ and harmonized with EUROCONTROL/Europe's Single European Sky ATM Research (SESAR) program.³⁷

RTCA³⁸ published Minimum Operational Performance Standards (MOPS) for AeroMACS based on IEEE standard 802.16-2009³⁹ in 2014.⁴⁰ The ICAO is also engaged with

³³ FAA, First Meeting, RTCA Special Committee 223: Airport Surface Wireless Communications, 74 Fed. Reg. 50271 (Sept. 30, 2009). See also RTCA, SC-223 Internet Protocol Suite (IPS) and AeroMACS, <http://www.rtca.org/content.asp?pl=108&sl=58&contentid=58> (last visited Mar. 16, 2017).

³⁴ See Mitre, Section 2.1, for a description of the AeroMACS standardization process.

³⁵ For a FAA presentation on AeroMACS, see James Budinger, *Aeronautical Mobile Airport Communications System (AeroMACS) for Access to SWIM*, FAA (Nov. 3, 2010), http://www.faa.gov/nextgen/programs/swim/documentation/media/demo_tim_6/10_tim6%20aeromacs%20budinger%20rev1%2003-nov-2010.pdf.

³⁶ Budinger and Hall NASA/TM 2011-217236, *supra* note 15.

³⁷ Action Plan 17 Future Communications Study: Final Conclusions and Recommendations Report, EUROCONTROL & FAA (Nov. 2007), https://www.eurocontrol.int/sites/default/files/field_tabs/content/documents/communications/112007-ap17-final-report.pdf.

³⁸ RTCA is an FAA-sponsored association of aeronautical organizations with diverse membership. Organized in 1935 as the Radio Technical Commission for Aeronautics, RTCA today includes over 200 government, industry, and academic organizations from the United States as well as other nations, who seek technical solutions to problems involving the application of electronics and telecommunications to aeronautical operations. The findings of RTCA are in the nature of recommendations to all organizations concerned. While RTCA is not a government agency, its Special Committees act under the Federal Advisory Committee Act and its findings and recommendations are often adopted and turned into policy by government agencies. See Review of Part 87 of the Commission's Rules Concerning the Aviation Radio Service, *Second Report and Order and Second Further Notice of Proposed Rule Making*, 21 FCC Rcd. 11582, 11587 n.19 (2006) ("2006 Aviation Radio Service Order"). See also <http://www.rtca.org/content.asp?pl=49&contentid=49>.

³⁹ IEEE, *IEEE Standard for Local and Metropolitan Area Networks, Part 16: Air Interface for Broadband Wireless Access Systems*, IEEE Std. 802.16-2009 (May 29, 2009).

⁴⁰ RTCA, *Minimum Operational Performance Standards (MOPS) for the Aeronautical Mobile Airport Communications System (AeroMACS)*, RTCA DO-346 (Feb. 20, 2014).

further AeroMACS standards development; and it adopted Standards and Recommended Practices (SARPs) for AeroMACS,⁴¹ which entered into force in November 2016.⁴² The WiMAX Forum AWG, with members and observers from all of the aforementioned entities, has been engaged throughout this multi-year effort to develop a system profile that would meet the current and envisioned applications for the AeroMACS network.

Based on the work already completed in the RTCA's MOPS, the ICAO's SARPs, as well as the EUROCAE Minimum Aviation System Performance Standards (MASPs),⁴³ the WiMAX Forum proposes the Part 87 technical rules set forth in Appendix A.⁴⁴ No changes are proposed to the equipment certification requirements under Part 87 of the rules. Specifically, AeroMACS transmitters used by non-Federal licensees would need to be certified in accordance with 47 C.F.R. §§ 87.145 and 87.147.

V. FEDERAL AND NON-FEDERAL SHARING

Because the FCC has allocated both the 5091-5150 MHz core AeroMACS Upper Band and the 5000-5030 MHz AeroMACS Lower Band on a primary basis for both Federal and non-Federal use, a sharing arrangement will be required. The WiMAX Forum recommends that sharing take place between Federal and non-Federal users in accordance with a Memorandum of

⁴¹ ICAO is an international body, operating under the auspices of the United Nations, which develops standards and recommended practices for international application in civil air navigation. Its recommendations, in part, serve as the basis for the Commission's Aviation Radio Service rules. *See 2006 Aviation Radio Service Order*, 21 FCC Rcd. at 11590 n.38 (citing 47 CFR §87.1(a)(3)). ICAO works with Member States and industry groups to reach consensus on international civil aviation SARPs and policies in support of a safe, efficient, secure, economically sustainable and environmentally responsible civil aviation sector. *See* ICAO, About ICAO, <http://www.icao.int/-/about-icao/Pages/default.aspx> (last visited Mar. 16, 2017).

⁴² *See* Letter from Fang Liu, Secretary General, to ICAO, Adoption of Amendment 90 to the International Standards and Recommended Practices, Aeronautical Telecommunications – Communications Systems (Annex 10, Volume III to the Convention on International Civil Aviation) (Apr. 5, 2016).

⁴³ EUROCAE is a European non-profit organization dedicated to aviation standardization. *See* EUROCAE, <https://www.eurocae.net/about-us/our-history/> (last visited Mar. 16, 2017).

⁴⁴ To the extent that portions of the MOPS, SARPs or MASPs that relate to the proposed technical rules are modified prior to the Commission adoption of AeroMACS service rules, the WiMAX Forum will bring those modifications to the Commission's attention.

Agreement (MOA) to be negotiated: 1) on behalf of Federal users by the National Telecommunications and Information Administration (NTIA)⁴⁵; and 2) on behalf of non-Federal users by the Channel Manager to be designated by the Commission (discussed in Sections VI and VIII below). The contemplated MOA would set forth the framework for Federal and non-Federal users to coordinate operations and ensure that their respective networks do not interfere with each other.⁴⁶ By employing a MOA between the Channel Manager and NTIA, rather than prescribe sharing mechanisms in the Commission’s rules, the Commission will maximize the flexibility afforded industry and Federal interests to maximize the efficient use of the AeroMACS spectrum over time by employing whatever sharing approaches make the most sense at any given time for a particular airport. As discussed below with respect to the benefits of utilizing a Channel Manager for managing the non-Federal use of this spectrum, AeroMACS is in its nascent stages, there is much to be learned about how it can best be deployed at the nation’s airports, and every effort should be made to establish a flexible regulatory regime capable of adapting as the marketplace and the technology evolves.

VI. AUTHORIZATION OF NON-FEDERAL USERS

The licensing approach proposed in Appendix A for non-Federal users is “License by Rule,” whereby an eligible non-Federal entity is authorized under Part 95⁴⁷ to operate

⁴⁵ The WiMAX Forum anticipates that NTIA will coordinate with FAA and other Federal users of AeroMACS.

⁴⁶ To the extent that Federal users share AeroMACS channels with non-Federal users, NTIA may want the Federal users to be listed in the Channel Manager database, not for FCC licensing purposes but strictly for informational purposes only. For example, Federal entities such as the FAA list their earth station parameters in the FCC’s International Bureau Electronic Filing System (IBFS) for informational purposes (see, for example, IBFS File Nos. SES-DBE-19960514-01194 and SES-DBA-20161130-00918).

⁴⁷ The proposed rules amend Part 95 to include AeroMACS as a Citizens Band Radio Service eligible for licensing by rule. Section 307(e) of the Communications Act of 1934, as amended, 47 U.S.C. § 307(e), expressly delegates to the Commission the discretion to define the scope of the term “citizens band radio service”; and the Commission has repeatedly exercised that authority to license new services by rule under Section 307. See, e.g., Amendment of the Commission’s Rules with Regard to Commercial Operations in the 3550-3650 MHz Band, *Report and Order and Second Further Notice of Proposed Rulemaking*, 30 FCC Rcd 3959, 4011 (2015) (“3.5 GHz Decision”). The

AeroMACS stations without an individual license issued by the FCC: a) upon required registration in a centralized database administered by a single, non-profit, impartial, non-governmental entity (the Channel Manager) appointed by the Commission; and b) the assignment of channels at the desired location by the Channel Manager.⁴⁸ The centralized database registration will ensure coordination among eligible non-Federal users of the AeroMACS band, ensure nationwide consistency in the allocation and use of the available channels⁴⁹ in the AeroMACS bands, and facilitate sharing of the AeroMACS bands with Federal users in a manner that will avoid interference. The Channel Manager will process requests by non-Federal users for access to AeroMACS channels, assign channels to non-Federal users in a fair and equitable manner to ensure efficient use of AeroMACS spectrum and to prevent either hoarding or warehousing of spectrum by any one entity, and coordinate with other authorized users of the AeroMACS frequencies, including Federal AeroMACS users and AMT users of the 5091-5150 MHz band.⁵⁰ Additionally, the Channel Manager will be the first point of contact for both Federal AeroMACS or AMT users and non-Federal AeroMACS licensees that experience harmful interference from non-Federal use of AeroMACS channels. The Channel Manager should be responsible in the first instance for the coordination between affected users and the resolution of interference caused by non-Federal users.⁵¹

AeroMACS technical service rules are proposed to be incorporated in Part 87, Subpart T of the Commission's Aviation Service rules. Federal users will not be licensed by the FCC; instead they will be authorized by NTIA.

⁴⁸ The eligibility criteria of non-Federal users for AeroMACS licenses are discussed in the next section.

⁴⁹ "Available" channels in this context refer to channels not assigned for Federal use nor held in reserve.

⁵⁰ The Channel Manager will have discretion to assign a given channel to a non-Federal licensee for use either across the entire airport property or only at specific locations on the airport property, or on a time-sharing basis, in order to facilitate sharing and for efficient utilization of spectrum.

⁵¹ The ultimate authority for resolving claims of harmful interference from non-Federal users would reside in the Commission.

The proposed Part 95 license by rule/database approach using a Channel Manager is consistent with, among others, the FCC's actions in the Wireless Medical Telemetry Service (WMTS) and Medical Body Area Network (MBAN) services.⁵² In contrast to Part 95 license by rule, individual licensing by the FCC is generally designed to give a licensee an exclusive, protected service area. Non-Federal users of AeroMACS on the airport surface, on the other hand, will share AeroMACS spectrum as directed by the Channel Manager and will be encouraged to utilize the spectrum efficiently. Similar to WMTS and MBANs, licensing by rule will minimize regulatory procedures and costs, thus facilitating deployment.⁵³ The Commission has authority under Section 307(e) of the Communications Act to define the citizen's band radio services and to license them by rule.⁵⁴ The license by rule/database approach will facilitate the adoption and deployment of AeroMACS networks by providing non-Federal applicants the means to obtain access to spectrum in a timely and efficient fashion to address their communication requirements. The authorization for a non-Federal user to operate on AeroMACS frequencies at a particular airport should be in effect for the period of time assigned by the Channel Manager and so long as the registration in the database is accurate, while the Commission would remain ultimately responsible for enforcing compliance with its rules.

⁵² See Amendment of Parts 2 and 95 of the Commission's Rules to Create a Wireless Medical Telemetry Service, *Report and Order*, 15 FCC Rcd 11206, 11216 (2000) ("*WMTS Report and Order*"); Amendment of the Commission's Rules to Provide Spectrum for the Operation of Medical Body Area Networks, *First Report and Order and Further Notice of Proposed Rulemaking*, 27 FCC Rcd 6422, 6437 (2012) ("*MBAN Report and Order*"). Although AeroMACS is proposed to be a Part 95 "license by rule" service, incorporating associated technical rules in another rule Part (in this case, Part 87) is consistent with FCC precedent. See *3.5 GHz Decision*, 30 FCC Rcd at 3978 (incorporating Part 95 Citizen Broadband Radio Service technical rules in Part 96); 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, *Report and Order*, 17 FCC Rcd. 9980, 10090-91 (2002) (incorporating in Section 90.259(b) certain technical rules regarding the geographic areas where Part 95 WMTS is primary).

⁵³ *WMTS Report and Order*, 15 FCC Rcd at 11216.

⁵⁴ See 47 U.S.C. § 307(e)(1) and (3).

VII. ELIGIBILITY FOR NON-FEDERAL AEROMACS LICENSES

AeroMACS communications must be limited to communications related to safety and regularity of flight. Non-Federal entities eligible to register for access to channels in the AeroMACS bands should be limited to:⁵⁵

A. Airport Operators, including a private entity, a governmental port authority, an airport management company, or a proxy authorized by an airport to operate on its behalf.

Airport licensees should be permitted to authorize others to utilize their networks to advance the safety and regularity of flight.

B. Airline Carriers: The nation's busiest airports serve multiple passenger and cargo airlines, all of which will be eligible users to access the AeroMACS network. The assignment by the Channel Manager of specific dedicated channels across an airport property may be justified at airports serving as a major hub for a large airline carrier. Airline carriers with a smaller presence likely would be authorized by the Channel Manager to operate only on shared channels. Airline licensees should be permitted to authorize others to utilize their networks to advance the safety and regularity of flight.

C. Aeronautical Communications Network Providers (ACNPs): Smaller airport hubs may find it more financially viable to enlist the services of an ANCP or other third party network access provider to provide a dedicated common user AeroMACS network to eligible aviation users on a contractual basis. ACNP licensees should be permitted to authorize others to utilize their networks to advance the safety and regularity of flight.

D. Others: Other proposed authorized mobile and fixed users of AeroMACS channels could also include owners of private or corporate aircraft, hangar maintenance service

⁵⁵ The foreign ownership restrictions of Section 310(b) of the Communications Act of 1934, as amended, should not be applied to non-Federal users.

providers and others, so long the communications are used exclusively for the purpose of promoting safety and regularity of flight.

E. Developmental Users: Manufacturers or prospective users of AeroMACS and their representatives should be eligible to obtain authorization to operate such equipment for the purpose of network development or product demonstration on a temporary basis.

VIII. THE FCC SHOULD PROPOSE DESIGNATING A SINGLE, NATIONWIDE CHANNEL MANAGER FOR NON-FEDERAL AEROMACS USERS

The WiMAX Forum proposes that a single, nationwide non-Federal Channel Manager be designated to provide consistency in managing the AeroMACS resources as a single point of contact with other authorized users of the AeroMACS bands. Specifically, the Channel Manager would be charged under our proposal to “assign AeroMACS channels to eligible non-Federal entities and manage the use of such channels, in a manner that reasonably maximizes the efficient utilization of the spectrum at each location where AeroMACS spectrum is utilized and protects the spectrum from either hoarding or warehousing. The AeroMACS Channel Manager shall act as a single non-Federal point of contact for spectrum coordination with Federal Government users and other authorized users of the 5000-5010 MHz, 5010-5030 MHz, and 5091-5150 MHz bands, including aeronautical mobile telemetry (AMT) users (in particular, the Channel Manager is urged to cooperate with aeronautical mobile telemetry (AMT) users in accordance with Table of Allocations footnote US444B(c)).”⁵⁶ As discussed below, to accomplish those objectives, the non-Federal Channel Manager should be provided flexibility to condition channel assignments on future modifications by the Channel Manager and compliance with such sharing mechanisms as the Channel Manager may require in the satisfaction of its duties.

⁵⁶ See Appendix proposed Section 87.606(b).

Designating a single non-Federal Channel Manager will minimize the burden on both AeroMACS users and other spectrum users. End users should not be forced to deal with multiple channel managers nationwide or to grapple with a multitude of different allocation and interference procedures. For example, a single, nationwide non-Federal Channel Manager will facilitate frequency coordination with AMT users of the 5091-5150 MHz band, as AMT also acts through a single entity on coordination matters.⁵⁷ Additionally, with a single non-Federal AeroMACS Channel Manager, the representative of Federal users need only enter into a single MOA with the non-Federal AeroMACS community, not hundreds of MOAs with individual AeroMACS users.

Having only a single non-Federal Channel Manager also will simplify AeroMACS registration by non-Federal users, especially airlines operating at multiple airports, because there will be a single point of contact for all airports. A single, nationwide non-Federal Channel Manager also is appropriate, given that potential AeroMACS users represent a small part of the RF user ecosystem and the number of registrants is likely to be proportionally small. Additionally, a single, nationwide Channel Manager will ensure consistent application of standards and procedures from airport to airport to facilitate aircraft and airline carrier access. As reference, it is worth noting that in both the cases of WMTS and MBANs,⁵⁸ the FCC designated a single nationwide database manager/coordinator.

⁵⁷ The Aerospace and Flight Test Radio Coordinating Council (AFTRCC) is designated as a non-Federal coordinator for flight test frequencies in the 5091-5150 MHz band. *See FCC 2015 Actions*, 30 FCC Rcd at 4214. The role of the Channel Manager for AeroMACS is not intended to conflict with AFTRCC's role but rather to complement it. Table of Allocations footnote US444B(c) in 47 C.F.R. § 2.106 urges operators of AM(R)(S) and AMT systems to cooperate with each other in the exchange of information about their planned deployments at specified airports.

⁵⁸ Amendment of the Commission's Rules to Provide Spectrum for the Operation of Medical Body Area Networks, *Order on Reconsideration and Second Report and Order*, 29 FCC Rcd 10662, 10681-83 (2014) ("*MBAN Single Coordinator Order*"); Amendment of Parts 2 and 95 of the Commission's Rules to Create a Wireless Medical Telemetry Service, *Order*, 16 FCC Rcd 4543 (2001).

The FCC should propose establishing minimum qualifying criteria for selecting the non-Federal AeroMACS Channel Manager.⁵⁹ The minimum qualifying criteria should be intended to ensure that the designated Channel Manager can successfully accomplish the functions required by the new rules in a fair and efficient manner. The FCC should require that the Channel Manager demonstrate the following characteristics:

- Ability to register and maintain a database of non-Federal AeroMACS transmitter locations and operational parameters;
- Knowledge and familiarity with AeroMACS technology, trials and deployments;
- Familiarity with AeroMACS coverage and capacity capabilities and limitations and engineering expertise to act as a frequency coordinator in order to mitigate interference potential among competing uses and to maximize spectrum efficiency while ensuring the safety and regularity of flight;
- Ability to work with Federal users of AeroMACS technology; and
- Be a non-profit, impartial entity.

The designated AeroMACS Channel Manager should be required to make its services available to eligible non-Federal users nationwide on a non-discriminatory basis. It should be willing to serve a minimum ten-year term, after which the Channel Manager will serve until it either elects not to continue or is removed by the Commission.⁶⁰ The Channel Manager should be authorized to charge non-Federal users on a non-discriminatory basis any reasonable combination of registration fees, channel application fees, and periodic or usage fees to maintain their channel assignments and to provide the funding for the Channel Manager's duties. The fees should be limited to the Channel Manager's costs when reasonably calculated to reflect its current and anticipated expenses (for example, pertinent expenses could include but are not

⁵⁹ For example, in proposing a single MBAN frequency coordinator, the FCC proposed minimum qualifying criteria. *MBAN Report and Order*, 27 FCC Rcd at 6458-59.

⁶⁰ *Compare* Wireless Telecommunications Bureau Opens Filing Window for Requests to be the Frequency Coordinator for Medical Body Area Networks, *Public Notice*, 29 FCC Rcd 13750, 13751 (WTB MD 2014).

limited to the costs associated with developing a database, automated registration procedures, coordination procedures, including the AMT coordinator's fees, and the expense of any third-party technical consultant).⁶¹

It is not by accident that the rules proposed in Appendix A for the Channel Manager do not specify how the Channel Manager is to assign channels to eligible users, whether any types of entities should be granted priority or preference in channel assignments, whether channels can be shared by different entities, the duration of channel assignments, build-out requirements, or the like. This was done intentionally to provide the Channel Manager flexibility to manage the AeroMACS spectrum so as to maximize efficient usage. At this nascent stage of AeroMACS evolution before service applications have been fully developed, it would not be prudent to adopt overly specific and prescriptive rules. It is not yet clear how AeroMACS usage by Federal and non-Federal entities will unfold over time, how much spectrum various AeroMACS applications will require, and who will be the primary users. Rather than trying to predict these factors without sufficient real-world experience, the Commission should adopt rules that allow the Channel Manager to react flexibly to marketplace and technological developments.

Such an approach would not be providing the Channel Manager unbridled discretion. When the Commission selects the Channel Manager, the Commission could require that the winning applicant establish an advisory board that ensures industry input regarding its key activities, including the setting of fees, establishment of sharing processes, and other key operating principles. This advisory board might include representatives from the likely AeroMACS user community (including both aircraft operators and airport operators or their

⁶¹ See, e.g., *WMTS Report and Order*, 15 FCC Rcd at 11218; *MBAN Single Coordinator Order*, 29 FCC Rcd at 10681.

representative trade associations), service providers, and manufacturers. Additionally, the MOA negotiated with NTIA will govern the Channel Manager's interactions with Federal users. And, the FCC always retains authority to revisit the AeroMACS rules and respond either to user concerns or marketplace developments should unanticipated problems arise.

In sum, in its *Notice of Proposed Rulemaking* to establish AeroMACS rules, the Commission should seek comment on the selection procedures necessary for the Commission to begin the selection process promptly after the adoption of AeroMACS service rules; but the Commission should not try to prescribe all aspects of the Channel Manager's functions at this preliminary stage of the development of AeroMACS applications.

IX. SUMMARY AND CONCLUSION

Trials and initial deployments that have taken place both in the United States and internationally over the past several years have clearly demonstrated that AeroMACS, based on IEEE Standard 802.16, is a proven solution for next generation airport surface communications. Several international standards organizations in the aviation community have already adopted the technical requirements and implementation details that provide the basis for proposed service rules. Moving forward with this Petition, therefore, will facilitate AeroMACS deployments at airports nationwide. The aviation industry is in an immediate position to realize significant benefits with improved traffic control and management leading to improved operating efficiencies.⁶²

Respectfully submitted,

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⁶² Doug Gray & Dr. Nima PourNejatian, *AeroMACS: Delivering Next Communications to the Airport Surface*, WiMAX Forum (Apr. 17, 2015), http://files.wimaxforum.org/Document/Download/AeroMACS-Delivering_Next-Generation_Communications_to_the_Airport_Surface.

APPENDIX A
PROPOSED FCC RULE REVISIONS

PART 87 – AVIATION SERVICES

SUBPART A—General Information

Section 87.5 is amended by adding a new definition at the beginning to read as follows:

§ 87.5 Definitions.

AeroMACS. The Aeronautical Mobile Airport Communications System utilizing the 5000-5010 MHz, 5010-5030 MHz, and 5091-5150 MHz bands for high capacity wireless safety and regularity of flight communications (mobile and fixed) supporting airport surface applications.

SUBPART B — Applications and Licenses

Section 87.18(a) is amended to read as indicated in red:

§ 87.18 Station License Required.

(a) Except as noted in paragraph (b) of this section, stations in the aviation service must be licensed by the FCC either individually or by fleet, **or, in the case of AeroMACS stations authorized under Section 95.401(i), licensed by rule.**

* * * *

SUBPART E—Frequencies

Section 87.171 is amended as indicated in red:

§ 87.171 Class of station symbols.

The two or three letter symbols for the classes of station in the aviation services are:

Symbol and class of station

AMC – AeroMACS

§ 87.173 Frequencies.

Section 87.173(b) is amended as indicated in red:

Frequency table:

Frequency or frequency band	Subpart	Class of station	Remarks
5000-5010 MHz	T	AMC	AeroMACS
5010-5030 MHz	T	AMC	AeroMACS
5091-5150 MHz	T	AMC	AeroMACS
* * * *			

Subpart L—Aeronautical Utility Mobile Stations

§87.345 Scope of service.

Section 87.345 is amended by adding subsection (g):

(g) Transmissions by aeronautical utility mobile stations for AeroMACS service are authorized in accordance with Subpart T of this chapter.

§87.349 Frequencies.

Section 87.349 is amended by adding subsection (g):

(g) Aeronautical utility mobile stations used for AeroMACS may operate in the 5000-5010 MHz, 5010-5030 MHz, and 5091-5150 MHz bands in accordance with Subpart T of this chapter.

Part 87 is amended by adding a new Subpart T as follows:

SUBPART T—AeroMACS

§ 87.601 Scope of service.

AeroMACS supports wireless broadband communications connectivity for safety and regularity of flight to fixed and mobile stations in the airport surface. Applications fall into three general categories: Air Traffic Services (ATS), including Air Traffic Control (ATC) and Air Traffic Management (ATM); Aeronautical Operations Communications (AOC); and communications related to airport operations, safety, and security.

§ 87.602 Eligibility.

Eligible non-federal licensees for access to specific channels in the AeroMACS bands include:

- (a) Airport Owners or Operators, including a private entity, a governmental port authority, an airport management company, or a proxy authorized by an airport to operate on its behalf;
- (b) Airline Carriers (both passenger and cargo) and owners of private or corporate aircraft;
- (c) Aeronautical Communications Network Providers (ACNPs) or other third party network access provider (NAP) that has entered into an agreement with the Airport Owner or Operator;
- (d) Other entities, such as hangar maintenance service providers, that engage in communications used exclusively for the purpose of safety and regularity of flight.
- (e) Manufacturers or Network Providers of AeroMACS equipment and their representatives may operate such equipment for the purpose of demonstration upon registration by an eligible user for a temporary period.

§ 87.603 Authorized locations.

AeroMACS base stations may be installed where needed to provide adequate service to the airport being served.

§ 87.604 Equipment authorization requirement.

AeroMACS transmitters must be certified in accordance with §§ 87.145 and 87.147 of this chapter.

§ 87.605 Frequency coordination and channel registration.

- (a) Prior to operation, potential non-Federal AeroMACS users must demonstrate their eligibility to and register all devices with the Channel Manager designated by the Commission pursuant to Section 87.606 of this chapter.
- (b) A registered non-Federal AeroMACS user must notify the Channel Manager whenever registered base station equipment or type of mobile station is taken out of service for more than 30 days, unless the device is replaced with another transmitter utilizing the same technical characteristics as those reported on the effective registration. The registered AeroMACS user shall maintain the information contained in each registration current in all material respects and shall not make any change in the location or operating parameters previously registered prior to modifying its registration with the Channel Manager.

§ 87.606 Non-Federal AeroMACS Channel Manager.

(a) The Commission will designate as the single nationwide AeroMACS Channel Manager for non-Federal users a non-profit, impartial entity with a requisite understanding of the AeroMACS technology.

(b) The AeroMACS Channel Manager will assign AeroMACS channels to eligible non-Federal entities from time to time either on an exclusive or shared basis, and manage the use of such channels, in a manner that reasonably maximizes the efficient utilization of the spectrum at each location where AeroMACS spectrum is utilized and protects the spectrum from either hoarding or warehousing. The AeroMACS Channel Manager shall act as a single non-Federal point of contact for spectrum coordination with Federal Government users and other authorized users of the 5000-5010 MHz, 5010-5030 MHz, and 5091-5150 MHz bands, including aeronautical mobile telemetry (AMT) users (in particular, the Channel Manager is urged to cooperate with aeronautical mobile telemetry (AMT) users in accordance with Table of Allocations footnote US444B(c)). The Channel Manager will be obligated to enter into a Memorandum of Agreement (MOA) with representatives of Federal Government AeroMACS users to govern their respective efforts to promote the joint Federal and non-Federal use of the AeroMACS channels; such MOA will be subject to Commission approval.

(c) The AeroMACS Channel Manager shall create and maintain a database of non-Federal AeroMACS licensees, equipment technical parameters, base station locations, and channel assignments on a per airport basis, and shall share such data with Federal Government AeroMACS users to facilitate efficient frequency coordination. Additionally, the Channel Manager will be the first point of contact for Federal AeroMACS users, AMT users, and non-Federal AeroMACS licensees that experience harmful interference from non-Federal use of AeroMACS channels. The Channel Manager is responsible for identifying the source of any harmful interference and for taking steps in the first instance to resolve interference caused by non-Federal users, although the ultimate responsibility for resolving interference remains with the Commission.

(d) The AeroMACS Channel Manager is authorized to charge non-Federal users a reasonable, cost-based registration fee and other fees not prohibited by the Commission.

§ 87.607 Frequencies and Channels.

The frequencies listed below are available for AeroMACS operation by non-Federal users after registration with, and assignment (consistent with the MOA required under Section 87.606(b)) by, the Channel Manager. Channel spacing is 5 MHz without a guardband between adjacent channels. AeroMACS shall operate in time division duplex (TDD) mode.

Lower AeroMACS Sub-Band (5000 MHz to 5030 MHz)	
Channel Number	Channel Center Frequency (f_c)
1	5005 MHz
2	5010 MHz
3	5015 MHz
4	5020 MHz
5	5025 MHz
Upper AeroMACS Core-Band (5091 MHz to 5150 MHz)	
Channel Number	Channel Center Frequency (f_c)
6	5095 MHz
7	5100 MHz
8	5105 MHz
9	5110 MHz
10	5115 MHz
11	5120 MHz
12	5125 MHz
13	5130 MHz
14	5135 MHz
15	5140 MHz
16	5145 MHz

NOTE: Derived from Sections 7.4.1.1, 7.4.1.2 and 7.4.1.5 of the SARPs. Channel 16 is specified as reference frequency per Section 7.4.2.1, Note 2 of the SARPs.

§ 87.608 Base Station EIRP Limits.

(a) The total base station equivalent isotropic radiated power (EIRP) in a single channel sector shall not exceed:

(1) 39.4 dBm for elevation angles from the horizon up to 1.5 degrees;

(2) 39.4 dBm linearly decreasing (in dB) to 36.4 dBm for elevation angles from 1.5 to 7.5 degrees;

(3) 36.4 dBm linearly decreasing (in dB) to 24.4 dBm for elevation angles from 7.5 to 27.5 degrees;

(4) 24.4 dBm linearly decreasing (in dB) to 1.4 dBm for elevation angles from 27.5 to 90 degrees;

(5) For multiple transmit antenna configurations the EIRP limit is the sum of the individual antennas.

(6) For aircraft (A/C) and ground equipment, the maximum allowable EIRP is +30 dBm.

(b) For purposes of this section, EIRP is defined for these purposes as antenna gain in a specified elevation direction plus the average AeroMACS transmitter power. While the instantaneous peak power from a given transmitter may exceed that level when all of the subcarriers randomly align in phase, when the large number of transmitters assumed in the analysis is taken into account, average power is the appropriate metric.

(c) If a sector contains multiple transmit antennas, e.g., multiple input multiple output (MIMO) antenna, the specified power limit is the sum of the power from each antenna.

NOTE: The EIRP limits are taken from Section 3.3. (Radiated Power) of ICAO SARPs WP4 R5: Attachment to WP-3.

§ 87.609 Transmitted Spectral Mask for frequencies greater than 250 percent of the channel bandwidth away from the Base Station/Mobile Station operating center.

The power spectral density of the emissions when all active sub-carriers are transmitted in the channel shall be attenuated below the maximum power spectral density as follows:

(a) on any frequency removed from the assigned frequency between 50 and 55 percent of the authorized bandwidth: $26 + 145 \log (\text{percent of BW}/50)$ dB.

(b) on any frequency removed from the assigned frequency between 55 and 100 percent of the authorized bandwidth: $32 + 31 \log (\text{percent of (BW)}/55)$ dB.

(c) on any frequency removed from the assigned frequency between 100 and 150 percent of the authorized bandwidth: $40 + 57 \log(\text{percent of (BW)/100})$ dB; and

(d) on any frequency removed from the assigned frequency beyond 150 percent of the authorized bandwidth: 50 dB.

NOTE: This rule is derived from Section 7.4.5.1 of the SARPS (spectral mask and emissions).

§ 87.610 Unwanted Emissions.

(a) Transmitter spurious emissions For AeroMACS frequencies that are greater than 250 percent of the channel bandwidth away from the Base Station/Mobile Station operating center, Base Station and Mobile Station transmitter spurious emissions must not exceed the values in the following table.

FREQUENCY BAND	MEASUREMENT BANDWIDTH	MAXIMUM LEVEL
30MHz < f < 1 GHz	100 kHz	-36 dBm
1GHz < f < 12.75 GHz	30kHz if $2.5 \times \text{BW} \leq f_c - f < 10 \times \text{BW}$	-30 dBm
	300kHz if $10 \times \text{BW} \leq f_c - f < 12 \times \text{BW}$	-30 dBm
	1MHz if $12 \times \text{BW} \leq f_c - f $	-30 dBm
Note: f_c denotes the center frequency and f denotes the frequency of the spurious emission. BW stands for the AeroMACS channel bandwidth of 5 MHz. The above values apply to both MS and BS equipment. All transmitter spurious emission shall be measured at the output of the equipment.		

(b) Receiver spurious emissions. Receiver spurious emissions must not exceed the values in the following table.

FREQUENCY BAND	MEASUREMENT BANDWIDTH	MAXIMUM LEVEL
30MHz < f < 1 GHz	100 kHz	-57 dBm
1GHz < f < 12.75 GHz	1 MHz	-47 dBm

NOTE: The proposed limit on transmitter spurious emissions is from Section 2.2.10.1 of the MOPS. The proposed limit on receiver spurious emissions is from Section 2.2.11 of the MOPS.

Part 95 – Personal Radio Services

The authority citation for Part 95 continues to read as follows:

AUTHORITY: Secs. 4, 303, 48 Stat. 1066, 1082, as amended; 47 USC 154, 303.

Section 95.401 is amended to read as indicated in red:

§95.401 (CB Rule 1) What are Citizens Band Radio Services?

(i) The Aeronautical Mobile Airport Communications System (AeroMACS) – The rules for this service, including technical rules, are contained in Part 87, Subpart T of the Commission's rules.