

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554**

In the Matter of)	
)	
Amendment of Parts 2, 15, 80, 90, 97, and)	
101 of the Commission's Rules Regarding)	ET Docket No. 15-99
Implementation of the Final Acts of the World)	
Radiocommunication Conference (Geneva, 2012))	
(WRC-12), Other Allocation Issues, and Related)	
Rule Updates)	

COMMENTS OF THE SMALL UAV COALITION

The Small UAV Coalition
Jennifer L. Richter
Counsel to the Small UAV Coalition
Akin Gump Strauss Hauer & Feld LLP
1333 New Hampshire Avenue, NW
Washington, DC 20036
(202) 887-4524

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EXECUTIVE SUMMARY

The Small UAV Coalition (the “Coalition”) is pleased to submit these comments in response to the Notice of Proposed Rulemaking (“NPRM”) released by the Federal Communications Commission (the “Commission” or “FCC”) regarding implementation of spectrum allocation decisions from the 2012 World Radiocommunication Conference (“WRC-12”). The Coalition commends the Commission for beginning the important work of allocating spectrum for unmanned aerial systems (“UAS”). The UAS industry is expanding rapidly worldwide at a pace that is challenging the United States legal and regulatory system. Indeed, the global market for non-military UAS already has grown into a multi-billion dollar industry. This growth has occurred principally outside of the United States, one of the largest potential markets for UAS use, due to onerous regulations and a federal prohibition against commercial use with limited exemptions.

The Commission, the Federal Aviation Administration (“FAA”) and other agencies have joint responsibility to ensure the United States is on pace to implement a risk-based regulatory framework that will support commercial and recreational UAS operations. For its part, the Commission should endeavor to support innovation and technology leadership in the United States by moving quickly in this proceeding, and others, to ensure that spectrum is available to support the wide range of communications functions that are critical to UAS. These functions include but are not limited to aircraft-to-ground, ground-to-aircraft, and aircraft-to-aircraft communications needed for both line-of-sight and beyond line-of-sight control links, diagnostics, tracking, collision avoidance and payload communications.

Spectrum access is needed for UAS of all sizes, and at all altitudes. However, with the release of the FAA’s proposed small UAS rule, there is particular pressure to find suitable spectrum solutions for small UAS at low altitudes. Small unmanned aerial vehicles (“UAVs”) flying at low altitudes already have entered the commercial marketplace and, as the number of commercial small

UAS operations increase, there will be a corresponding need for robust spectrum solutions for sophisticated command and control and electronic payload support. It is vital, therefore, that the Commission expeditiously enable sufficient spectrum solutions – utilizing a variety of unlicensed and licensed bands – for small UAVs operating at low altitudes. At the same time, a focus on small UAS should not delay FCC or FAA work to find spectrum solutions that will support safe operations of UAS at higher altitudes.

The Coalition emphasizes the following in these comments: (1) The Commission should plan comprehensively for airborne uses of spectrum, enabling and allowing robust spectrum solutions for UAS at all altitudes, including small UAS that have immediate spectrum needs; (2) The 5030-5091 MHz band addressed in the NPRM may not be a near-term solution for control links for small UAS at low altitudes, but the Commission’s allocation of this band should be flexible and accommodate future uses of the band by low-altitude small UAS and uses beyond the line of sight; (3) The Commission should work with the small UAS industry and the wireless industry to plan for use of commercially available licensed and unlicensed bands for control links and other UAV communications functions; and (4) The Commission should permit flexible Aeronautical Mobile Service (“AMS”) use of spectrum in the 5925-6700 MHz band by manned and unmanned aircraft and not limit use to Aeronautical Mobile Telemetry (“AMT”) for flight testing.

Spectrum is critical to the safe functioning of small UAS, and the low-altitude traffic management system that will support it. Working in concert with the FAA, the National Telecommunications and Information Administration (“NTIA”), the National Aeronautics and Space Administration (“NASA”), the Department of Homeland Security (“DHS”), and the small UAS industry, the Commission is positioned to play an indispensable role that will enable and advance the promise of this new industry.

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COMMENTS OF THE SMALL UAV COALITION

The Small UAV Coalition (the “Coalition”) is pleased to submit these comments in response to the Notice of Proposed Rulemaking (“NPRM”) in the above-captioned proceeding, which proposes to implement spectrum allocation decisions from the 2012 World Radiocommunication Conference (“WRC-12”).¹ The unmanned aerial systems (“UAS”) market, particularly the small unmanned aerial vehicle (“UAV”) market, is growing exponentially in the United States and globally, with new innovations for small UAS occurring at a pace that is challenging the United States legal and regulatory system. The global market for non-military UAS already has expanded into a \$2.5 billion industry that is growing 15% to 20% annually.² This growth has occurred principally outside of the United States, one of the largest potential markets for UAS use, due to onerous regulations and a federal prohibition against commercial use with limited exemptions under Section 333.

¹ See *Amendment of Parts 2, 15, 80, 90, 97, and 101 of the Commission’s Rules Regarding Implementation of the Final Acts of the World Radiocommunication Conference (Geneva, 2012)(WRC-12), Other Allocation Issues, and Related Rule Updates, et al.*, ET Docket No. 15-99, *et al.*, Report and Order, Order, and Notice of Proposed Rulemaking, 30 FCC Rcd 4183 (2015). Hereinafter, the Report and Order portion of this item is referred to as the “WRC-07 Implementation Order,” and the Notice of Proposed Rulemaking portion is referred to as the “NPRM.”

² See, e.g., *Fortune*, “Get ready for ‘Drone Nation,’” Clay Dillow (Oct 8, 2014), *available at*: <http://fortune.com/2014/10/08/drone-nation-air-droid/>.

Investment in the UAS industry is increasing fast, as UAS startups already have raised \$172 million in equity financing in 2015 – more than the previous three calendar years combined.³

As use cases for small UAS continue to expand worldwide, and the Federal Aviation Administration (“FAA”) works to implement its proposed small UAS rule,⁴ it is imperative that the Commission work with industry, the FAA, and others to plan for sufficient spectrum to support the myriad communications functions that are necessary for low-altitude small UAS operations.⁵

Although spectrum access is needed for UAS of all sizes, and the Commission should move forward to find spectrum solutions for safe UAS operations at all altitudes, there is an immediate need to find suitable spectrum solutions for small UAS at low altitudes due to the FAA’s pending small UAS rule.

The Coalition emphasizes the following in these comments: (1) The Commission should plan comprehensively for airborne uses of spectrum, enabling and allowing robust spectrum solutions for UAS at all altitudes, including small UAS that have immediate spectrum needs; (2) The 5030-5091 MHz band is unlikely to be a near-term solution for control links for small UAS at low altitudes, but the Commission’s allocation of this band should be flexible and accommodate future uses of the band by low-altitude small UAS and uses beyond the line-of-sight; (3) The Commission should work with the small UAS industry and the wireless industry to plan for use of commercially available licensed and unlicensed bands for control links and other UAV communications functions; and (4) The Commission should permit flexible Aeronautical Mobile Service (“AMS”) use of

³ See *CB Insights*, “Game of Drones: Drone Startup Funding Hits High. Have Raised More in 2015 than Last 3 Years Combined” (May 31, 2015), *available at*: <https://www.cbinsights.com/blog/drone-startup-venture-capital/>.

⁴ See *Operation and Certification of Small Unmanned Aircraft Systems*, Docket No. FAA-2015-0150; Notice No. 15-01, Notice of Proposed Rulemaking (2015) (“FAA Small UAS NPRM”).

⁵ Small UAVs weigh 55 lbs or less and are typically flown at altitudes below 500 feet.

spectrum in the 5925-6700 MHz band by manned and unmanned aircraft and not limit use to Aeronautical Mobile Telemetry (“AMT”) for flight testing.

I. COALITION BACKGROUND.

The Coalition was formed a year ago by leading technology companies that share an interest in advancing regulatory, legal, and policy changes to permit the safe operation of small UAS in the near-term, within and beyond the line of sight, with varying degrees of autonomy, for commercial, civil, consumer, recreational and philanthropic purposes.⁶ Such purposes include, for example, closed-set filmmaking, surveying and mapping, precision agriculture, consumer delivery, disaster management, infrastructure inspection, and aerial photography.

Working together with industry and government, the Coalition supports sensible, risk-based regulations for small UAS flying at low altitudes, both domestically and internationally, with the goal of achieving international harmonization. As discussed herein, this includes working with the Commission, the FAA, the National Telecommunications and Information Administration (“NTIA”), the National Aeronautics and Space Administration (“NASA”), and the Department of Homeland Security (“DHS”) to arrive at sensible spectrum solutions that will support safe and reliable operations of small UAS in the United States in the near-term.

II. THE COMMISSION SHOULD PLAN COMPREHENSIVELY FOR AIRBORNE USES OF SPECTRUM, ENABLING AND ALLOWING ROBUST SPECTRUM SOLUTIONS FOR UAS AT ALL ALTITUDES, INCLUDING SMALL UAS THAT HAVE IMMEDIATE SPECTRUM NEEDS.

The Coalition commends the Commission for moving this WRC-12 implementation item ahead and starting the important work to allocate spectrum for UAS. However, as opposed to small commercial UAV operations, which the FAA is working to approve, the C-band spectrum at 5030-

⁶ Members of the Coalition include 3D Robotics, Aerialtronics, AirMap, AGI, Amazon Prime Air, Botlink, DJI Innovations, Drone Deploy, EHang, Flirtey, Google[x] Project Wing, GoPro, HAZON Solutions, Intel, InterMedia Development Corporation, Kespry, Parrot, PrecisionHawk, SkyWard IO, SkyPan, Strat-Aero, Verifly, Verizon, and Zero Tech.

5091 MHz is envisioned primarily for use by larger UAVs flying at higher altitudes in the national airspace (“NAS”). The Coalition urges the Commission to find near-term spectrum solutions for small UAVs at low altitudes, while continuing its work to find spectrum solutions for larger UAVs which will provide consumer benefits in the not-so-distant future.

In an effort to support the Commission’s work, the Coalition offers the following four principles as potential guideposts for the Commission’s consideration: (A) Develop a plan and permit airborne uses of spectrum bands whenever possible; (B) Be mindful that spectrum is needed for UAS at every altitude; (C) In view of the FAA’s pending small UAS rule, recognize the importance of spectrum solutions for small UAVs flying at low altitudes; and (D) Harmonize spectrum bands for global UAS integration.

A. Principle 1: Develop a Plan and Permit Airborne Uses of Spectrum Bands Whenever Possible.

The Commission should work with industry and other regulators, perhaps as part of a working group, to develop a plan and timeline for enabling airborne use of spectrum for UAS at all altitudes. Until such time as a plan is in place, the Commission should opportunistically consider airborne use of all potential spectrum bands that come up for Commission consideration. For example, in its aptly named “Spectrum Frontiers” proceeding, the Commission should consider UAS use of licensed bands above 24 GHz as part of the upcoming NPRM.⁷ Google, the Consumer Electronics Association, Qualcomm Incorporated, 4G Americas, and Alcatel-Lucent urged the Commission in that proceeding to consider permitting innovative, airborne uses of spectrum above

⁷ See *Use of Spectrum Bands Above 24 GHz for Mobile Radio Services, et al.*, GN Docket No. 14-177, *et al.*, Notice of Inquiry, 29 FCC Rcd 13020 (2014); see also “Leading Towards Next Generation ‘5G’ Mobile Services,” Tom Wheeler, Chairman, FCC, Official FCC Blog (Aug. 3, 2015), available at: <https://www.fcc.gov/blog/leading-towards-next-generation-5g-mobile-services> (“My goal is to foster an environment in which the widest possible variety of new technologies can grow and flourish. The Commission took the first step in the fall of 2014 when it adopted a Notice of Inquiry asking about expanded wireless use of higher-frequency bands. We expect to follow up on the Notice of Inquiry and issue a Notice of Proposed Rulemaking ... on the use of higher-frequency bands for mobile and other uses this year.”).

24 GHz.⁸ The Commission should examine whether “5G” applications and usage scenarios might include small UAVs in these higher-frequency bands and for what purposes.

The Commission also should move forward expeditiously to develop service rules for the L-band at 960-1164 MHz to permit UAS use of this spectrum, including small UAVs at low altitudes. The Commission adopted an Aeronautical Mobile (Route) Service (“AM(R)S”) allocation for the band, making it available for airborne uses.⁹ However, the Commission has not yet adopted service rules specifying whether UAS use is permitted in all, or part, of the band, and the technical requirements for such use. The 960-1164 MHz band may be well-suited to support small UAS operations at low altitudes. Given the burgeoning market and the FAA’s near-term timing for

⁸ See, e.g., Comments of Google Inc., GN Docket No. 14-177, at 10 (filed Jan. 15, 2015) (“While the Commission’s Notice appears to focus primarily on the deployment of terrestrial mobile broadband, the high-frequency bands could be useful for a variety of non-traditional uses that do not already enjoy reserved spectrum and, therefore, may be public interest priorities. . . . The bands could, for example, be useful for offering broadband access via airborne platforms such as high-altitude balloons or unmanned aerial vehicles, where deployment of terrestrial networks is uneconomic.”); Comments of the Consumer Electronics Association, GN Docket No. 14-177, at 3 (filed Jan. 15, 2015) (“While most of the focus of the NOI is on opening the mmW band to expansion of existing mobile broadband services, the Commission should not lose sight of the fact that the mmW bands hold great promise for meeting a wide range of other service needs, including backhaul, other point-to-point applications, unlicensed wireless cable replacement, satellite and aerial broadband, and other services.”); Comments of Qualcomm Incorporated, GN Docket No. 14-177, at 7 (filed Jan. 15, 2015) (“5G technology will enable new mission-critical services and thus will need to expand well beyond human communication requirements, particularly in areas such as latency, security, and reliability. Mission critical communications services – where failure is not an option – include the control of critical infrastructure, such as the power grid, and remote control of vehicles, aerial drones, and even medical procedures.”); Comments of 4G Americas, GN Docket No. 14-177, Attachment at 10 (explaining that 5G services in bands above 24 GHz could be used to support public safety services, including “drone or robot-based surveillance systems to monitor remote areas.”); Letter from Jeffrey A. Marks, Alcatel-Lucent, to Marlene H. Dortch, Secretary, FCC, GN Docket 14-177, Notice of Ex Parte, Attachment at 17 (filed March 11, 2015) (emphasizing that 5G in bands at or above 24 GHz “will be a unified ecosystem that serves both traditional as well as potential new applications like drones.”); see also Comments of Samsung Electronics America, Inc. and Samsung Research America, GN Docket 14-177, at 6 (filed Jan. 15, 2015) (explaining that “low-latency [5G] networks will support pre-crash sensing, which enables vehicles to sense imminent collisions and exchange relevant data that could mitigate a collision’s impact. Other low-latency services enabled by 5G could include self-driving cars, public safety communications systems, augmented reality, and ‘tactile internet.’”).

⁹ See WRC-07 Implementation Order, ¶ 127. AM(R)S is defined as an “aeronautical mobile service reserved for communications relating to safety and regularity of flight, primarily along national or international civil air routes.” 47 C.F.R. § 2.1(c).

commercial small UAV deployments, the Commission should move forward expeditiously to explore and develop service rules for UAS operations in the 960-1164 MHz band.

B. Principle 2: Be Mindful That Spectrum is Needed for UAS at Every Altitude.

UAS operations at every altitude require suitable spectrum solutions, and those solutions may be different. For example, small UAS that do not require airworthiness certificates¹⁰ will not be required to use aviation-protected spectrum. In fact, the FAA's proposed small UAS rule does not prescribe spectrum solutions for small UAVs operating at low altitudes.¹¹ The proposed rule thus leaves industry free to consider many different options for spectrum, including use of commercially available licensed and unlicensed spectrum, and existing commercial wireless networks, for control links, UAV tracking, diagnostics, collision avoidance, and payload. The range of available technologies is particularly wide given that small UAVs will operate between the ground and 500 feet, the same altitudes most commercial wireless networks are designed to serve.

Large UAVs, such as unmanned cargo and military UAVs, will operate at higher altitudes in commercial airspace and may have different spectrum requirements, including use of aviation-protected spectrum. Various WRC proposals have been made to provide spectrum for these types of large UAVs. In addition to the spectrum that is the subject of this NPRM, the United States has proposed that WRC-15 consider additional spectrum allocations for UAS operating in commercial airspace, including spectrum in the Fixed Satellite Service that would be used for beyond line-of-sight communications for large UAVs.¹² Clearly, there has been and continues to be a great deal of forward movement on spectrum solutions for large UAVs at higher altitudes.

¹⁰ See FAA Small UAS NPRM at 12.

¹¹ See *id.*

¹² See Agenda Item 1.5, U.S. WRC Proposals Submitted to CITELE PCC II (July 30, 2015), *available at*: <https://www.fcc.gov/encyclopedia/us-contributions-sent-citel-pccii> ("In the context of this agenda item, a UAS consists of an [unmanned aircraft] with an Earth station on-board to interconnect the [unmanned aircraft] and the associated Earth station of the unmanned aircraft control station ... through a satellite

Finally, UAS such as Facebook’s Aquila and Google’s Titan will operate at high altitudes in the stratosphere to provide communications platforms. A small amount of High Altitude Platform Station (“HAPS”) spectrum is allocated for these types of operations in some countries, but access to additional spectrum is needed in the United States and internationally. The United States has proposed an agenda item studying the potential identification of additional HAPS spectrum at WRC-19.¹³

C. Principle 3: In View of the FAA’s Small UAS Rule, Recognize the Importance of Spectrum Solutions for Small UAVs Flying at Low Altitudes.

Given the FAA’s proposed small UAS rule, timing is critical for the Commission to focus on spectrum solutions that will enable small UAV operations at low altitudes. Access to spectrum is an essential prerequisite for UAV manufacturing and for low-altitude traffic management systems that will support small UAV operations for recreational and commercial purposes.

Small UAVs need spectrum to enable communications from ground-to-aircraft, aircraft-to-ground, and aircraft-to-aircraft for such functions as line-of-sight and beyond line-of-sight control links, collision avoidance, tracking, diagnostics, and payload communications. The Commission’s efforts in this proceeding, and others, to enable more options for airborne use of spectrum by UAS at all altitudes are essential for the United States to satisfy the domestic needs of the rapidly growing global UAS market.

Although recreational and commercial users of small UAS around the world rely upon unlicensed bands for control links and other communications functions, unlicensed bands will not be sufficient, alone, when the FAA finalizes its proposed small UAS rule permitting commercial

operating in the FSS.”). This WRC-15 agenda item proposes the addition of technical and regulatory provisions to enable use of FSS bands, including the 10.7-12.75 GHz, 14.0-14.5 GHz, 17.3-20.2 GHz, and 27.5-30.0 GHz bands, for UAS beyond line-of-sight “command and non-payload communications links.” *See id.*

¹³ *See* Agenda Item 10, U.S. WRC Proposals Submitted to CITELE PCC II (July 31, 2015), *available at*: <https://www.fcc.gov/encyclopedia/us-contributions-sent-citel-pccii>.

operations. The unlicensed bands that are in use by UAS today are the 900 MHz, 2.4 GHz, and 5.8 GHz bands, as well as the 433 MHz band in some countries (but not the United States, where the 433 MHz band currently is not authorized). When there are fleets of small UAVs flying at low altitudes, and not just episodic recreational uses or limited Section 333 operations, the industry will need access to more unlicensed and licensed spectrum, under the appropriate circumstances, for a myriad of functions. The commercially licensed bands that are desirable for use are discussed in Section IV of these comments. The Commission's assistance is needed to ensure timely access to sufficient spectrum bands for small UAS.

D. Principle 4: Harmonize Spectrum Bands for Global UAS Integration.

The final guidepost for the Commission's consideration is international harmonization. When the Commission is adopting UAS spectrum solutions, for large and small UAS, it should consider harmonization with spectrum bands that are in use by UAS in other countries. Harmonization will lead to greater predictability and economies of scale for global UAV manufacturers, increase operational efficiencies in the UAS industry, and help ensure safe and compliant UAV flights in the United States and abroad.

III. THE 5030-5091 MHz BAND MAY NOT BE A NEAR-TERM SOLUTION FOR CONTROL LINKS FOR SMALL UAS AT LOW ALTITUDES, BUT THE COMMISSION'S ALLOCATION OF THIS BAND SHOULD BE FLEXIBLE AND ACCOMMODATE FUTURE USES OF THE BAND BY LOW-ALTITUDE SMALL UAS AND USES BEYOND THE LINE-OF-SIGHT.

A. The 5030-5091 MHz Band May Not Afford a Near-Term Solution for Control Links for Small UAS at Low Altitudes.

In the NPRM, the Commission proposes to add a primary AM(R)S allocation in the 5030-5091 MHz band for Federal and non-Federal use "to support line-of-sight control links" for UAVs.¹⁴ The Commission explains that the proposed allocation is intended to "help support the

¹⁴ NPRM, ¶ 229.

anticipated growth of UAS and promote the safe operation of UAS.”¹⁵ The Coalition supports allocating this band for flexible UAS use.

In the near-term, however, several factors suggest that the band may not be a viable spectrum solution for small UAVs that hope to use commercial LTE networks as the primary spectrum solution for control links and tracking. First, after the 5030-5091 MHz spectrum is allocated, decisions about how it will be licensed and managed need to be made (*e.g.*, federal, private or hybrid solutions), and then a new wireless network needs to be built and deployed, a process that could take several years. Such a timeframe obviously is not workable for near-term commercial operation of small UAVs. Second, the Coalition understands that the technology, modulation scheme and waveform developed for the 5030-5091 MHz band was not designed with LTE compatibility in mind. For example, technology for the 5030-5091 MHz band will be narrowband while LTE technology is broadband. Despite that, however, the Coalition hopes that in the future this band will be compatible for use by small UAS that are using LTE technology.

B. The Commission’s Allocation of the 5030-5091 MHz Band Should Be Flexible and Accommodate Future Uses of the Band by Low-Altitude Small UAS and Uses Beyond the Line-of-Sight.

Although the 5030-5091 MHz band may not be a viable near-term solution for small UAVs, the Coalition urges the Commission to permit flexibility for future uses of the band, including uses by small UAVs at low altitudes and uses beyond the line-of-sight.¹⁶ The Commission’s work should recognize that UAS technology is developing quickly. A flexible approach also is essential as the use of the AM(R)S allocation in the 5030-5091 MHz band is limited to “internationally standardized aeronautical systems.” Since there are no internationally standardized aeronautical systems in the

¹⁵ *Id.*

¹⁶ The adoption of service rules will occur in a future proceeding. *See* NPRM at n. 487.

5030-5091 MHz band, it is essential that the Commission build in flexibility so that international harmonization of aeronautical systems using these frequencies can occur in the future.

Using a flexible approach, the Commission should permit use of the 5030-5091 MHz band by UAS at all altitudes. The Commission also should ensure that the allocation and future service rules are flexible enough to support any UAS operations authorized by the FAA, now or in the future, without requiring the Commission to conduct another rulemaking. Permitted uses should include not only line-of-sight control links, as suggested in the NPRM, but all potential UAS uses that can function in the band on a non-interference basis. Such uses could include, but are not limited to, line-of-sight and beyond line-of-sight control links, tracking, diagnostics, payload communications, etc.¹⁷ Any UAS uses that do not cause harmful interference to other primary services should be permitted by the Commission in the 5030-5091 MHz band with maximum flexibility in order to support technology development and any operations authorized by the FAA in the future. Rather than specifically enumerating permissible UAS uses of the band, the Commission should adopt a flexible allocation and, ultimately, flexible service rules that allow the market and advances in technology to dictate the best uses of the spectrum over time.

With respect to line-of-sight and beyond line-of-sight services, the NPRM characterizes the 5030-5091 MHz band as a solution for “the terrestrial, **line-of-sight** spectrum requirements for the command and control of UAS.”¹⁸ Other United States WRC proposals characterize beyond line-of-sight UAV operations as requiring satellite links and Earth stations aboard UAVs.¹⁹ The Coalition cautions the Commission not to think about beyond-line-of-sight functions as necessarily requiring

¹⁷ The Coalition believes that payload communications that are not related to command and control of the UAV should be permitted in the 5030-5091 MHz band, but such operations should be secondary and not permitted to cause harmful interference with control links in the band.

¹⁸ NPRM, ¶ 225.

¹⁹ See Agenda Item 1.5, U.S. WRC Proposals Submitted to CITELE PCC II (July 30, 2015), *available at*: <https://www.fcc.gov/encyclopedia/us-contributions-sent-citel-pccii>.

satellite communications. Terrestrial spectrum and cellular networks can be used to support both line-of-sight and beyond line-of-sight operation of small UAS without the need for satellite communications. While hybrid satellite solutions may one day be desirable for small UAS, beyond line-of-sight functions can be accomplished using terrestrial commercial spectrum and the ubiquity of today's wireless networks.²⁰

IV. THE COMMISSION SHOULD WORK WITH THE SMALL UAS INDUSTRY AND THE WIRELESS INDUSTRY TO PLAN FOR USE OF COMMERCIALY AVAILABLE LICENSED AND UNLICENSED BANDS FOR CONTROL LINKS AND OTHER UAV COMMUNICATIONS FUNCTIONS.

Although the Coalition supports adding an AM(R)S allocation for UAS use of the 5030-5091 MHz band, the Coalition strongly emphasizes that this band should not be imposed as the sole spectrum solution for control links for small UAVs flying at low altitudes. Instead, consistent with the FAA's view that small UAVs do not require aviation-protected spectrum, small UAV operators should be permitted to use a range of bands for control links and other UAV communications functions. Ensuring access to a range of unlicensed and licensed bands is essential to supporting all communications functions that are critical to small UAS operations. Such functions include but are not limited to aircraft-to-ground, ground-to-aircraft, and aircraft-to-aircraft communications needed for both line-of-sight and beyond line-of-sight control links, diagnostics, tracking, collision avoidance and payload communications.

In addition to the unlicensed bands listed in Section II(C) above, commercially available licensed bands and today's wireless networks are desirable solutions for small UAV communications functions. These bands include, but are not necessarily limited to, the 600 MHz band, 700 MHz

²⁰ The Commission should not adopt an allocation or future service rules that preemptively restrict UAV use of the band to the FAA's formulation of "line-of-sight" operations. The FAA will authorize beyond line-of-sight operations for small UAVs in the future, and the FAA's concept of line of sight is not necessarily in concert with the Commission's concept of line of sight. Radio line of sight, as used by the Commission, may afford more regulatory flexibility based upon the capabilities of automated technologies and the ubiquitous nature of wireless networks today. The Commission's regulations should afford ample flexibility for both line-of-sight or beyond line-of-sight operations, anticipating future progress by the FAA.

band, AWS band, AWS-4 band, PCS band, WCS band, and 2.5 GHz band. The Commission has explained in a separate proceeding that “Commission rules governing the use of airborne mobile devices vary significantly among services. Specifically, airborne use of the 800 MHz cellular band is prohibited and airborne use of the 800 MHz SMR band is prohibited on aircraft that typically fly at altitudes over one mile.”²¹ However, the Commission emphasized that “[t]here are no such restrictions on airborne use of the AWS, PCS, WCS, 700 MHz, or AWS-4 bands.”²² Given that current Commission allocations and service rules for these licensed bands do not expressly prohibit airborne UAS operations, airborne use of these bands may already be permissible without further rulemaking. Working closely with licensed wireless carriers, the Commission should take any steps necessary to ensure that carriers are permitted to utilize these bands, including the 800 MHz band, for UAS use if they so choose on a flexible, non-interference basis.²³

Notably, CTIA – The Wireless Association explained in comments submitted in the FAA’s small UAS rulemaking that the UAS industry will require wireless connectivity, and the wireless industry envisions that existing wireless networks can be seamlessly leveraged to support small UAVs.²⁴ CTIA noted that its members are committed to working with the FAA to “foster the

²¹ *Expanding Access to Mobile Wireless Services Onboard Aircraft*, WT Docket No. 13-301, Notice of Proposed Rulemaking, 28 FCC Rcd 17132, ¶ 5 (“NPRM on Expanding Access to Mobile Wireless Services Onboard Aircraft”).

²² *Id.*

²³ In a separate NPRM, the Commission is examining harmonizing regulations governing the operation of mobile devices on airborne aircraft across all commercial mobile spectrum bands, including the 800 MHz band. For purposes of that NPRM, “commercial mobile bands” include: (1) the 800 MHz cellular band (824-849 and 869-894 MHz); (2) SMR spectrum within the bands (806-824 and 851-869 MHz and 896-901 and 935-940 MHz); (3) the Broadband Personal Communications Service (PCS) band (1850-1915 and 1930-1995 MHz); (4) 700 MHz band (698-757 and 775-787 MHz) (5) the Advanced Wireless Services (AWS) band (1710-1755 and 2110-2155 MHz); (6) the Wireless Communications Service (WCS) band (2305-2320 and 2345-2360 MHz); and AWS-4 (2000-2020 MHz and 2180-2200 MHz). *See* NPRM on Expanding Access to Mobile Wireless Services Onboard Aircraft, ¶ 3, n. 8.

²⁴ *See* Comments of CTIA – The Wireless Association, Docket No. FAA-2015-0150, at 1 (filed April 24, 2015).

integration of small UAS in the national airspace system.”²⁵ The Commission should facilitate and encourage this integration by allowing carriers to flexibly utilize all available commercial spectrum bands including those bands that already are established, as well as any bands for which new allocations or service rules are developed (licensed or unlicensed) such as the 960-1164 MHz band and bands above 24 GHz.

V. THE COMMISSION SHOULD PERMIT FLEXIBLE AMS USE OF SPECTRUM IN THE 5925-6700 MHz BAND BY MANNED AND UNMANNED AIRCRAFT AND NOT LIMIT USE TO AMT FLIGHT TESTING.

The Coalition supports NTIA’s recommendations that the Commission allocate the entire 5925-6700 MHz band to the AMS on a primary basis for Federal use, and allocate the 5925-6425 MHz and 6525-6700 MHz bands to the AMS on a primary basis for non-Federal use.²⁶

The purpose of NTIA’s proposed AMS allocation is to provide additional spectrum for AMT needed for flight testing of aircraft.²⁷ AMT is a type of AMS that transmits from an aircraft station to a receiving station the results of measurements made onboard an aircraft, including those related to the functioning of the aircraft (*e.g.*, engine temperature, fluid pressure, and readings from control surface strain gauges).²⁸ NTIA’s proposed AMS allocation of spectrum in the 5925-6700 would not need to, and should not, prohibit other airborne uses of the spectrum. Indeed, NTIA proposes that the Commission adopt the following footnote text describing operational criteria:

Use of the band 5925-6700 MHz by aeronautical mobile telemetry (AMT) for flight testing by aircraft stations ... shall be in accordance with Resolution 416 (WRC 07). Any such use does not preclude the use of these bands by other non-federal mobile service applications or by other services to which these bands are allocated on a co-primary basis and does not establish priority. Federal use of the aeronautical mobile service allocation in the band 5925-6700 MHz is limited to aeronautical mobile

²⁵ *Id.* at 2.

²⁶ *See* NPRM, ¶ 214.

²⁷ *See id.*, ¶ 206.

²⁸ *See id.*

telemetry for flight test telemetry transmissions by aircraft stations within designated test areas (See US111).²⁹

According to NTIA’s proposed allocation, only Federal use of the band would be limited to AMT operations for flight testing, allowing the Commission to allocate the band for other mobile uses including by both manned and unmanned aircraft. The Coalition encourages the Commission to adopt a commercial allocation for 5925-6700 MHz that is flexible for mobile service applications, including use consistent with the broader definition of AMS. The broad definition of AMS describes “a mobile service between aeronautical stations and aircraft stations, or between aircraft stations, in which survival craft stations may participate”³⁰ Coalition members envision utilizing the 5925-6700 MHz spectrum not only for AMT, which is aircraft-to-ground, but also for other ground-to-aircraft and aircraft-to-aircraft communications consistent with the definition of AMS. These communications would include flight testing, diagnostics, collision avoidance, and control communications. The Coalition also supports secondary use of the spectrum by other users or services, including payload communications by UAVs, provided that reasonable sharing mechanisms can be developed.

Additionally, based on the text of the proposed NTIA footnote, it appears that only Federal use of the band for AMT flight testing would be restricted to the designated test areas listed in footnote US111. The footnote relates specifically to AMT flight testing, and not broader AMS uses.³¹ Accordingly, if the Commission adopts an AMS allocation for this band, non-Federal AMS use of the band should not be restricted to specific test areas by US111 or any other Commission rules. Not only does the footnote not require it, but such a restriction would not be practical;

²⁹ *Id.*, ¶ 214 (emphasis added).

³⁰ 47 C.F.R. § 2.1(c).

³¹ Currently, US111 only applies to the 5091-5150 MHz band, restricting AMT operations for flight testing in the band to a list of 52 test areas. The footnote also provides that flight testing at additional locations may be authorized on a case-by-case-basis.

recreational and commercial UAS use will take place nationwide and not at specifically enumerated test sites.

Finally, the Coalition comments on the operational restrictions referenced in NTIA's proposed footnote from the WRC-07 Resolution 416.³² With respect to the requirement that emissions are limited to transmissions from aircraft stations only, the Coalition urges the Commission to permit transmissions from aircraft-to-ground, ground-to-aircraft, and aircraft-to-aircraft.³³ The allocation should be as flexible as possible to support mobile service applications. The Coalition also supports the requirement that the peak EIRP density of a telemetry transmitter antenna not exceed -2.2 dB(W/MHz),³⁴ and supports requiring use of technical and/or operational measures to facilitate sharing with other services and applications in these bands as long as appropriate mechanisms can be developed.³⁵

VI. CONCLUSION.

The Coalition commends the Commission for beginning the important work of allocating spectrum for UAS. As the global UAS industry continues to rapidly expand, it is essential that the Commission move with similar expedition, in this proceeding and others, to ensure the availability of both licensed and unlicensed spectrum to support the wide range of communications functions that are critical to UAS, particularly small UAVs. Spectrum is needed for UAS of all sizes, and at all altitudes. But given the FAA's proposed small UAS rule, it is critical that the Commission focus on ensuring and providing spectrum solutions that meet small UAV needs in the near-term.

³² See NPRM, ¶¶ 208, 214.

³³ See *id.*

³⁴ See *id.*

³⁵ See *id.*

