Via E-mail

Ian Atkins
Group Manager, Spectrum Strategy and Policy
Federal Aviation Administration
800 Independence Avenue SW
Washington, DC 20591

Re: 374_AJW_2018 Reauthorization White Paper FAA Work Overview

Dear Mr. Atkins:

CTIA[1] appreciates this opportunity to offer comments in response to the draft, pre-decisional "FAA Work Overview" (the "Overview") by the Federal Aviation Administration ("FAA") in response to the request of Congress in Section 374 of the FAA Reauthorization Act of 2018 ("Section 374").[2] The Overview details the FAA's proposals related to unmanned aircraft systems ("UAS" or "drones") control link spectrum.

CTIA has worked collaboratively with the FAA and the Federal Communications Commission ("FCC") for years to explore how existing wireless networks, built and operated by CTIA members, can support and advance important UAS communications functions, including control links, remote identification and tracking and payload communications. CTIA members build, operate, and manage commercial wireless networks; manufacture communications components, devices, and network equipment; and manufacture UAS and their components.[3] CTIA members play many roles in the UAS ecosystem,

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[1] CTIA® (www.ctia.org) represents the U.S. wireless communications industry and the companies throughout the mobile ecosystem that enable Americans to lead a 21st- century connected life. The association's members include wireless carriers, device manufacturers, suppliers as well as apps and content companies. CTIA vigorously advocates at all levels of government for policies that foster continued wireless innovation and investment. The association also coordinates the industry's voluntary best practices, hosts educational events that promote the wireless industry, and co-produces the industry's leading wireless tradeshow. CTIA was founded in 1984, and is based in Washington, DC.

[2] FAA Reauthorization Act of 2018, PL 115-254, § 374, 132 Stat 3186 (2018) ("Section 374").

[3] For more detail, *see* CTIA, *Commercial Wireless Networks: The Essential Foundation of the Drone Industry* (Nov. 13, 2017), https://www.ctia.org/news/commercial-wireless-networks-the-essential-foundation-of-the-drone-industry-2).

including as providers of essential communications networks that support safe and secure UAS operations, as operators of UAS, and as operators of Low Altitude Authorization and Notification Capability ("LAANC"), the precursor to UAS Traffic Management ("UTM"). CTIA is engaged with the FAA, the FCC, the Department of Homeland Security, and the National Aeronautics and Space Administration ("NASA") on various initiatives addressing UAS integration issues.[4] CTIA and its members are excited to play a key role in the transformative opportunities presented by UAS for the U.S. economy. The U.S. wireless industry invested $27B in the U.S. economy in 2018.[5] Recently, researchers predicted that the U.S. will "lead in cellular R&D and capital expenditures in the 5G value chain with 27% average annual [share of] investment[6]," from which UAS communications stands to benefit significantly. CTIA values the meetings it has had with you and your colleagues regarding the Section 374 report, and we are pleased to be listed as a contributor to the Overview.

At the outset, CTIA applauds the recognition in the Overview of the value brought to UAS spectrum solutions by "terrestrial-based cellular network infrastructure and services."[7] As many government and industry working groups have noted, licensed commercial wireless networks provide the coverage, authentication and security, quality of service, reliability and redundancy, latency, and global interoperability required for safe UAS control links[8]. Moreover, the FCC's flexible use policy for licensed mobile wireless spectrum lends itself well to supporting wireless services for a whole host of devices, including drones.[9]

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[4] CTIA and its members have participated in the FAA's UAS Identification and Tracking Aviation Rulemaking Committee ("ARC"); the FCC TAC working group for Communication Strategies for UAS; the UAS Integration Pilot Programs; the NASA UTM Pilot Program; and the Department of Homeland Security ("DHS") Critical Infrastructure Partnership Advisory Council ("CIPAC").

[5] *See* Meredith Attwell Baker, CTIA President and CEO, *China Plays Catch Up as the U.S. Launches the 5G Economy* (Nov. 1, 2019), https://www.ctia.org/news/china-plays-catch-up-as-the-u-s-launches-the-5g-economy.

[6] Qualcomm and HIS Markit, *The 5G Economy: How 5G will contribute to the global economy* (Nov. 2019), https://www.qualcomm.com/media/documents/files/ihs-5g-economic-impact-study-2019.pdf.

[7] FAA Section 374 Overview, Stakeholder Collaboration Version, at 4 (Oct. 18, 2019) ("Overview").

[8] *See e.g.,* FAA Drone Advisory Committee ("DAC"), FAA Remote Identification Aviation Rulemaking Committee, discussed *supra.*

[9] Flexible use spectrum policy suggests a non-restrictive approach to spectrum use for the subject band, allowing the spectrum user to choose the services and technologies to be deployed. The FCC has moved to flexible use licensing because it ensures the radio spectrum is used efficiently and intensively – an important public interest goal – and ensures "the spectrum is put to its most beneficial use, allow licensees to respond to consumer demand for new services, and maximize the probability of success for new services." *Transforming the 2.5 GHz Band*, Notice of Proposed Rulemaking, 33 FCC Rcd 4687, ¶ 10 (2018). Julius Knapp, Chief of the FCC's Office of Engineering and Technology Bureau, remarked at a panel on spectrum for UAS at 2019 Mobile World Congress-Los Angeles that the innovative drone use cases being employed today and in the near future arose

CTIA offers these comments on three issues related to the Overview. First, CTIA comments on a gap in the "content area" of the Overview. The Overview focuses almost exclusively on new and innovative operational concepts related to deployment of portions of the L-Band and the C-Band.[10] As CTIA understands it, the request of Congress in Section 374 is for a broader analysis of spectrum options for UAS control links to the extent there are *barriers* to using the L-Band and C-Band, or to the extent all UAS are not *required* to use the L-Band or C-Band. As noted in the Overview, there are a number of barriers to utilizing the L-Band and C-band for *all* classes of UAS at *all* altitudes.[11] In view of the pressing need for viable UAS control links for today's UAS operations, CTIA urges the FAA and FCC to identify in the Section 374 report other spectrum options that are immediately viable for UAS control links, including existing commercial wireless networks—the viability and desirability of which the FAA has emphasized in prior pre-decisional presentations related to Section 374.[12] Second, CTIA addresses concepts raised in the Overview related to whether C-Band spectrum could be deployed on infrastructure that enables commercial wireless networks. CTIA also addresses questions raised by the FAA about whether C-Band spectrum can be shared between aviation and non-aviation uses.

Finally, in view of the FCC's role as the expert agency on spectrum policy, CTIA requests that the FAA coordinate its work closely on the Section 374 report with the FCC. The Overview notes that it does "not yet include FCC or [National Telecommunications and Information Administration ("NTIA")] inputs." Any formal rulemakings to consider service and technical rules for the L-Band and C-Band, including consideration of the FAA's new operational concepts for these bands, will be led by the FCC. As the L-Band and C-Band are allocated for shared federal and non-federal use, close coordination among the FCC, FAA, and NTIA will be necessary in order to enable UAS use of those bands.

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out of the flexibility of the FCC's licensing framework, without which the industry would be required to wait for specific allocations for each new technology, delaying deployment and hindering innovation. MWC Los Angeles, "Up, Up and Away: Unmanned Aerial Services" (Oct. 23, 2019).

[10] Although the FAA refers to the 5030-5091 MHz spectrum band as the "C-Band," we note that there is an open FCC proceeding at this time related to different C-Band spectrum, from 3.7 – 4.2 GHz, which is not germane to these comments. *Expanding Flexible Use of the 3.7 to 4.2 GHz Band*, Order and Notice of Proposed Rulemaking, 33 FCC Rcd 6915 (2018). The Overview also refers to the 960-1164 MHz spectrum band as the "L-Band."

[11] The Overview details a number of barriers to using the L-Band and C-Band. *See* Overview at 6-8.

[12] In prior presentations, the FAA noted that the opportunity under Section 374 is to propose to Congress and the White House a system of spectrum use for UAS control links. The FAA discussed structured spectrum use including using LTE/Cellular technologies, leveraging commercial cellular infrastructure, and supporting LTE/Cellular operations. UAS Spectrum and Section 374 PowerPoint Presentation, FAA Spectrum Strategy and Policy, at 3.

I. IN ORDER TO BE COMPLETE, THE RESPONSE TO SECTION 374 MUST NOT ONLY ACKNOWLEDGE THAT THERE ARE BARRIERS TO UAS UTILIZING THE L-BAND AND C-BAND, BUT DESCRIBE ALTERNATIVE SPECTRUM OPTIONS FOR UAS CONTROL LINKS.

CTIA played an active role with Congress in developing and refining the requirements for the Section 374 spectrum report. Section 374 asks whether UAS should be permitted, but not required, to operate control links on the L-Band and C-band. It asks the FAA, FCC, and NTIA to address any technical, statutory, or regulatory barriers to using the L-Band and C-Band and, if these bands are not suitable for beyond-visual line-of-sight operations for UAS, then determine other spectrum frequencies that might be appropriate for UAS operations. The Overview does not include an analysis of these other spectrum frequencies, though perhaps the agencies intend to include this in the final Section 374 report.[13] In light of the immediate needs for UAS control links, CTIA urges the FAA, FCC, and NTIA to identify and discuss spectrum alternatives to the L-Band and C-Band for UAS control links in the final Section 374 report to Congress. Commercial wireless networks are an obvious and immediate solution to the needs for safe, secure and reliable UAS control links.

A. There are a Number of Barriers to Utilizing the L-Band and C-Band for UAS Control Links.

Although the FAA explores in the Overview certain "potential opportunities and barriers" to utilizing the L-Band and C-Band, the final Section 374 report should recognize more immediate barriers to utilizing these bands. As discussed more fully below, there are no technical and service rules to enable use of either the L-Band or the C-Band for UAS control links today, and such rules would take years to develop. Moreover, even after such rules exist, these bands are unlikely to offer reliable solutions for control links for all UAS at all altitudes.

First, the final Section 374 report must reflect that there are no pending rulemakings to adopt service and technical rules for the L-Band and C-Band. As a consequence, both bands will require significant work by the FCC to complete and thus would not be available as quickly as other control link options at a time when UAS already are operating in local airspace.[14] Second, even after service rules are promulgated, and

[13] Section 374 also provides that the required report "does not prohibit or delay use of any licensed spectrum to satisfy control links, tracking, diagnostics, payload communications, collision avoidance, and other functions for unmanned aircraft systems operations." Section 374 at (b).

[14] AIA filed a petition for rulemaking with the FCC for the 5030-5091 MHz band, but the FCC has not yet issued a Notice of Proposed Rulemaking. *AIA Petition to Adopt Service Rules for Unmanned Aircraft Systems Command and Control in the 5030- 5091 MHz Band*, Petition for Rulemaking, RM-11798 (filed Feb. 8, 2018). The L-Band allocation is found here: *Amendment of Parts 1, 2, 15, 74, 78, 87, 90, and 97 of the Commission's Rules Regarding Implementation of the Final Acts of the World Radiocommunication Conference (Geneva, 2007), Other Allocation Issues, and Related Rule Updates, et. al.*, Report and Order and Notice of Proposed Rulemaking, 30 FCC Rcd 4183 (2015). The C-Band

the L-Band and C-Band are built and operational, these bands will not be a solution for control links for all UAS. The Overview acknowledges that "C-Band propagation suffers more severe losses in non-line of sight conditions, such as low altitude UAS flying below local clutter of buildings and trees."[15] In the FAA's view, the C-Band "will work well for medium altitudes (*i.e.*, above local clutter), where aircraft would fly mostly in radio line of sight of network towers. Initial tests have shown favorable results regarding UAS range and altitude."[16] The vision for the L-Band also is not an answer for control links for all UAS. The Overview notes that, in order to use the L-Band for UAS applications, incumbent aviation systems must be protected, including "navigation aids, surveillance systems and collision avoidance systems" for manned-aircraft.[17] Use of the L-Band for limited point-to-point uses will be location- and altitude-dependent and will not serve as a solution for UAS control links for all UAS operations.

These barriers to utilizing the L-Band and C-Band are material during a time when UAS control link services are needed. Drones already fly in local airspace pursuant to Part 107[18] and other authorities, including the Integration Pilot Program ("IPP"), which was authorized by the White House on October 25, 2017.[19] Based on current FAA estimates, there will be nearly two million small, low-altitude drones flying in U.S. airspace in 2020.[20] Prior estimates suggested there will be seven million hobbyist and commercial UAS sales in 2020.[21] Recently, the FAA authorized drone deliveries by Google's Project Wing and UPS Flight Forward.[22] The anticipation of increasing UAS operations in local airspace from these delivery drones demands reliable solutions for UAS control links today.

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allocation is found here: *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)*, Report and Order, 32 FCC Rcd 2703 (2017).

[15] Overview at 7.

[16] *Id*. UAS flying at "medium altitudes," transitioning in and out of Class A airspace at 30,000 feet, will not be flying unmanned, requiring UAS control links with remote pilots, for many years. The focus on control links for these UAS is out of order with the more immediate needs for control links for UAS at lower altitudes, which already are operating.

[17] Overview at 2.

[18] *See* 14 C.F.R. 107.

[19] Presidential Memorandum for the Secretary of Transportation (Oct. 25, 2017), https://www.whitehouse.gov/presidential-actions/presidential-memorandum-secretary-transportation/.

[20] FAA, "FY 2019-2039 Forecasts, Unmanned Aircraft Systems," 43-48, https://www.faa.gov/data_research/aviation/aerospace_forecasts/media/unmanned_aircraft_systems.pdf

[21] FAA, "FAA Releases 2016 to 2036 Aerospace Forecast," https://www.faa.gov/news/updates/?newsId=85227&cid=TW414.

[22] *See* FAA Press Release, U.S. Transportation Secretary Elaine L. Chao Announces FAA Certification of UPS Flight Forward as an Air Carrier (Oct. 1, 2019); FAA Press Release, U.S. Transportation Secretary Elaine L. Chao Announces FAA Certification of Commercial Package Delivery (Apr. 23, 2019).

The UAS industry and its federal partners cannot wait years for adoption of L-Band and C-Band service and technical rules or for deployment of operational systems for these bands. In its final Section 374 report, FAA, FCC and NTIA should identify alternatives to these bands for UAS control links. Apart from timing, if the C-Band and L-Band are not viable to satisfy the need for reliable control links for all UAS at all altitudes, then the FAA, FCC, and NTIA must agree upon immediate solutions for other spectrum bands that can enable UAS control links. Failure to holistically and promptly address the options for UAS control links risks stalling the UAS industry for years.

CTIA acknowledges that the concepts laid out in the Overview "are at a high level" and "are not exclusive to these particular bands" – the C-Band and L-Band: "[O]ther bands may be used to implement the same UAS C2 functions. As Section 374 indicates, the Report has no effect on use of other spectrum."[23] Although these statements are helpful, the Section 374 report to Congress will not be complete if it does not address the extent to which the C-Band and L-Band cannot be used for control links for all UAS, both now and in the future, and detail the viability of other spectrum options for UAS control links, including existing commercial wireless networks available today.

B. In View of the Barriers to Utilizing the L-Band and C-Band, the Section 374 Report Must Address Immediate Alternatives for Control Links, Including Commercial Wireless Networks.

CTIA applauds the FAA for recognizing in the Overview the value of UAS spectrum solutions provided by "terrestrial-based cellular network infrastructure and services."[24] As the FAA has acknowledged, "LTE/Cellular operations for low altitude UAS" is a viable proposal that is under consideration.[25] CTIA encourages the FAA, FCC, and NTIA to explore use of the commercial wireless networks in greater detail as the Section 374 report to Congress is completed. Commercial wireless networks offer the only immediate solution for safe, secure, and reliable UAS control links at this critical time.

Safe UAS operations will depend on use of reliable, secure and protected communications over licensed spectrum, including control links. Because the L-Band and C-Band will not be available for UAS control links for many years, and because these bands will not be capable of satisfying the needs for control links for all UAS at all altitudes, there is no question the FAA will need to rely on other options for control links—and licensed commercial wireless networks are available today to serve that purpose. The FAA and FCC can rely on next-generation wireless infrastructure, deployed across

[23] Overview at 1.

[24] *Id*. at 4.

[25] UAS Spectrum and Section 374 PowerPoint Presentation, FAA Spectrum Strategy and Policy.

the country, to enable advanced UAS operations, including beyond visual line-of-sight flights and flights over people.

Nikolai Vassiliev, Chief of the International Telecommunication Union's ("ITU") Terrestrial Services Department, cited the benefits of UAS communications services via commercial wireless technology.[26] Vassiliev noted the robust coverage of wireless networks, which can enable low-altitude UAS operations beyond visual line-of-sight, the potential for tracking UAS using wireless technology, the harmonization of commercial wireless bands, which will assist in trans-border operations, and the evolving nature of 5G wireless technology, which will provide even better coverage and dynamic data traffic management in the future. In contrast, Vassiliev noted that aviation-protected bands are limited in capacity and intensively used by existing aviation licensees. Aviation-protected bands are or will be congested, posing an additional challenge for use of this spectrum.[27]

Wireless technology offers many advantages for safe and secure UAS operations, including the following features:

- **Authentication and Security.** The wireless industry has a long history of working to protect its customers, networks, and technology from cyber threats, and can do the same with respect to UAS control links. Wireless networks are equipped with a variety of security approaches, including authentication technologies that validate and authorize users seeking to access the networks. These technologies help to protect network users—including UAS control links. The communications and aviation sectors are among the 16 sectors included in the National Institute for Standards & Technology ("NIST") Critical Framework for Cybersecurity (the "NIST Framework"), a longstanding public-private partnership focused on innovation, collaboration, sharing information related to cybersecurity, and responding to evolving cybersecurity threats at the network, device, and application layers.[28] The NIST

[26] Nikolai Vassiliev, Chief of the Terrestrial Services Department, International Telecommunications Union, *Potential Spectrum and Telecom Technologies for Small UAS*, ICAO Drone Enable (Sept. 2017), https://www.icao.int/Meetings/UAS2017/Documents/Nikolai%20Vassiliev_Background_Day%201.pdf.

[27] *Id*. at slide 7.

[28] For additional discussion on how the wireless industry applies cybersecurity protections and the NIST Framework in the Internet of Things, *see* Comments of CTIA, Considerations for Managing Internet of Things (IoT) Cybersecurity and Privacy Risks (Draft NISTR 8228) (Oct. 24, 2018), https://api.ctia.org/wp-content/uploads/2019/11/CTIA-Comments-re-NISTIR-8228.pdf.

Framework expands on significant industry efforts to collaborate on standards and guidance for cybersecurity protection.[29]

- **Quality of Service.** Wireless technology offers quality of service for UAS control links, with the coverage, performance, and latency required to support safe and secure UAS communications, both within and beyond visual line-of-sight. Commercial wireless networks today match the operational need for UAS, covering 99.9% of the U.S. population[30] in areas where UAS are likely to fly. Given this robust coverage, commercial wireless networks can readily provide support for UAS control links and connect drone operators with UTM systems.

- **Reliability and Redundancy.** The reliability of wireless technology will minimize and mitigate the risk of "lost link" with a ground station or UTM. Wireless networks include overlapping, adjacent cell sites that minimize the possibility of UAS connection issues.[31] The FAA Drone Advisory Committee cited the reliability of wireless networks as a positive factor in supporting beyond visual line-of-sight missions as follows: "Cellular networks in the US are engineered for massive volumes and cover more than 99% of Americans at approximately 300 million people. 56% of US population resides inside mode C veil. High-risk areas are populated and located in proximity to transport infrastructure (e.g. airports). Cellular networks are designed to serve these populated areas with high capacity and high reliability/coverage."[32] Moreover, the redundancy is already built in to the wireless networks.

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[29] *See id*. at 7 for a discussion of such industry efforts.

[30] Communications Marketplace Report, FCC Report, 33 FCC Rcd 12558, at Fig. A-29 (2019), https://docs.fcc.gov/public/attachments/FCC-18-181A1.pdf.

[31] For additional discussion of how wireless networks address lost link and handoff issues, *see* Qualcomm, *LTE Unmanned Aircraft Systems, Trial Report* (May 12, 2017), https://www.qualcomm.com/media/documents/files/lte-unmanned-aircraft-systems-trial-report.pdf.

[32] RTCA, *Drone Advisory Committee Report*, at 67 (Nov. 8, 2017), https://www.rtca.org/sites/default/files/dac_ebook_final_novmtg_-_version_2.pdf (the "DAC report"). The DAC report highlighted additional reasons why using commercial wireless networks is the right approach for safe and secure UAS operations: "Key factors influencing recommendation for leveraging LTE networks for CNPC: (1) Many BVLOS and Urban/Suburban operations will occur within areas with high LTE coverage; (2) Operational requirement for communications vary per use case including which phases of flight require coverage, latency, etc.; (3) Timing: Cellular LTE networks are deployed today and operating with high level of reliability and security; (4) LTE is based on 3GPP world standard; (5) Multimode/multiband chipsets for cellular devices support connectivity options over 2G/3G/4G networks as well as other radio technologies such as Wi-Fi; (6) LTE UAS link performance in terms of latency, reliability, coverage, data rate, UAS density, positioning accuracy, etc. being demonstrated and validated through field trials and simulation; (7) UAS device volume and bandwidth need is low compared to capacity of LTE networks; (8) LTE services could also be used for UAS payload communications (e.g., sensor control, sensor data downlink). Using the same technology for CNPC and non-

Unlike using aviation bands, which have no back-up or redundancy, wireless networks leverage multiple bands in order to provide seamless service, including for UAS control links.

- **Interoperability.** Through the Third Generation Partnership Program ("3GPP"), the wireless industry has developed technology standards for 4G LTE and 5G, and is working on standards for leveraging these networks for UAS control links and other functions. 3GPP standards are global and based on industry consensus, not proprietary to a particular company or entity. Global adoption of harmonized standards for the wireless industry can be leveraged for the benefit of UAS and UTM, providing the consistency and interoperability needed to allow vendors and manufacturers to take advantage of economies of scale, thus ensuring a vibrant, global UAS ecosystem.

The FCC's Technological Advisory Council ("TAC") UAS Working Group recently validated the use of commercial wireless technology for UAS communications. The UAS Working Group found that "3GPP technology satisfies the expected communications requirements for low altitude UAVs."[33] The TAC UAS Working Group identified advantages of 3GPP technologies, including leveraging existing infrastructure, readily-available commercial hardware, flexibility to meet varying flight operations, and extensive security and privacy support.[34]

Existing commercial 4G LTE networks already can support UAS control links, and further optimization after wide-scale testing will expand the capabilities. 5G wireless technology will enable safe and secure UAS deployments on a larger scale[35] and will offer reduced latency, providing UAS with an even faster and more reliable communications platform for UAS control links and other functions. The FAA should recognize this in the final 374 report.

CNPC UAS communications could provide cost savings; (9) Cost of entry is low for connectivity and equipment (~$15 LTE Cat 1 Module) given leverage from the massive scale of cellular; (10) UAS equipage for LTE + other radio connectivity (2G, 3G, Wi-Fi) is extremely low in weight (4-10g on average, not including battery or antenna(s)); (11) Ability to uniquely identify each UAS; (12) Ability to handle redundant communication paths e.g. SMS plus data, or two concurrent data sessions with different APNs (Access Point Names). Can also utilize multiple providers to improve coverage; and (13) Provides latest evolution for spectrally efficient simultaneous service to multiple devices."

[33] Presentation by the Communication Strategies for UAS Working Group at the FCC's March 26, 2019 TAC Meeting, https://www.fcc.gov/news-events/events/2019/03/technological-advisory-council-meeting-march-26-2019.

[34] *See id.*

[35] *See* Qualcomm, *Drones + 5G: The Sky's the Limit* (Nov. 14, 2016), https://www.qualcomm.com/news/onq/2016/11/14/drones-5g-skys-limit).

II. CREATING A C-BAND CELLULAR NETWORK THAT LEVERAGE TODAY'S WIRELESS NETWORKS COULD HAVE MERIT, BUT KEY OPERATIONAL AND STANDARDIZATION QUESTIONS REMAIN.

CTIA commends the FAA for the novel approach to deploying the C-Band as described in the Overview, which may rely on 3GPP standards (instead of those of the Radio Technical Commission for Aeronautics ("RTCA)-228) and provide excess capacity for non-UAS uses. Instead, the Overview proposes to use "terrestrial-based cellular network infrastructure and services" for deployment of the C-band, creating a "C-Band cellular network."[36] The FAA recommends that the "data backhaul connections and radio towers used in commercial cellular networks could support UAS operations in the C-Band. Use of the existing commercial cellular infrastructure . . . could significantly expedite the roll-out of a nationwide, commercial UAS C2 Network [on the C-Band]."[37] The FAA raises a number of additional concepts, including the potential for sharing the C-Band for aviation and non-aviation "ancillary" uses.[38]

CTIA members are still considering the FAA's C-Band proposal as explained in the Overview. Although the concepts are interesting, a complete and coherent approach needs to be developed, with the participation of CTIA members, describing how the cellular wireless ecosystem could provide command and control services in this band while also accessing potential excess spectrum capacity. For example, with respect to deploying the C-Band on existing wireless infrastructure, CTIA and its members have many questions, including who will bear the costs of this deployment, whether operation of the C-Band implicates different requirements than those used for operation of the commercial wireless bands, whether there are interference issues related to deployment of this new spectrum on the network, and who will pay the ongoing costs of rent and maintenance. With respect to sharing the C-Band between aviation uses and non-aviation, ancillary uses, CTIA notes that the C-Band is not standardized for wireless services. Further, C-Band is not allocated for mobile wireless, and the band is not in chipsets. Providing a band class for the C-Band is not an item under consideration at 3GPP. It is also unclear whether there will be enough ancillary spectrum in the band to support the required investment to deploy it on the wireless networks and build it into chipsets.

That said, CTIA and its members support the view, which appears to be suggested by the Overview, that standards for use of the C-Band for UAS control links should not be limited to the RTCA-228 command non-payload communications ("CNPC") standard, and that the FAA should embrace the standards for LTE support of UAS control links that have been developed, and are being developed, by 3GPP. The Overview does not address the RTCA-228 CNPC standard developed for the C-Band. The

[36] Overview at 4.

[37] *Id*.

[38] *Id*.

FAA does, however, mention the work of 3GPP to develop standards that will allow commercial wireless networks to support UAS communications, including control links. The FAA has noted efficiency problems with the RTCA standard, which can apparently support only 10 unmanned aircraft per mile, as follows:

> "[I]f you look at the explosion of unmanned aircraft, there would never be enough aviation spectrum to use . . . now, what you have is by far most of the unmanned aircraft, big pilot programs, are working with the main cellular companies for their command and control and all their data links. So that's taken a huge load off what would have been aviation spectrum."[39]

The final Section 374 report should note the viability of the commercial wireless networks to support UAS control links and should describe for Congress the work of 3GPP to establish standards that will allow LTE technologies to satisfy key performance indicators ("KPIs") for UAS.

3GPP already completed certain standards related to UAS communications in its Release 15,[40] and is now working on Releases 16 and 17, the objectives of which are as follows:

- System requirements for UAS-related requirements;
- KPIs for command and control traffic;
- Developing the architecture requirements and solution recommendations to enable application layer support for UAS over 3GPP networks;
- Radio architecture network frameworks for UAS for 5G which includes a proposal for the same functionality enabled in Rel. 15 for LTE, with additional aspects;
- System architecture work related to: identification and tracking of both drones and drone controllers, including studying the extent to which the 3GPP system is involved, authorization and identification of drones and drone controllers by UTM, and the role of the 3GPP system, if any, in authorization and/or authentication of the drone controller; and

[39] Remarks of Ian Atkins, Director of Spectrum Strategy and Policy, FAA, at NTIA Spectrum Policy Symposium: Looking to America's Spectrum Future (Sept. 10, 2019), https://www.ntia.doc.gov/files/ntia/publications/09.10.19_npc_ntia_spectrum_policy_symposium.pdf. The Section 374 Overview also notes the FAA's "additional objective of facilitating U.S. economic growth through the more efficient utilization of these bands, including for non-aviation commercial use." Overview at 1.

[40] Release 15 work focused on height reporting when a drone crosses a network-configured reference altitude, interference detection and mitigation, UAS-dedicated radio measurement reporting, signaling of flight path information from drone to LTE network, location information reporting including a drone's horizontal and vertical velocity, and subscription-based aerial drone remote identification and authorization.

- Drone to controller communications, and drone to drone communications, including: identifying the impacts on UAS operations of lack/revocation of authorization while considering the need for the system to keep track of and control drones, enhancements to existing mechanisms for connectivity between drone controllers, drones and the UTM, considering both line-of-sight connectivity and non-line-of-sight connectivity, and detection and reporting of unauthorized drones towards UTM.

In short, CTIA supports the use of C-Band deployment standards that are compatible with widely deployed, global wireless networks. This will ensure interoperability of those links with UAS control links that are deployed over commercial wireless bands and networks that will connect UTM, UAS Service Suppliers, remote pilots, and law enforcement.

III. CONCLUSION.

The Section 374 report to Congress on viable spectrum options for UAS control links is especially timely in light of clear and immediate needs for safe, secure, and reliable UAS control links. UAS already operates in local airspace under Part 107, as part of the IPP program, and for recently approved drone delivery services. L-Band and C-Band spectrum (the primary focus of the Overview) are unlikely to be available to support UAS control links for many years and, even then, will not be a solution for all UAS at all altitudes. In the final Section 374 report, CTIA urges the FAA, in close collaboration with the FCC and NTIA, to identify and discuss alternatives to the L-Band and C-Band for UAS control links, specifically reflecting the immediate availability of commercial wireless networks for UAS control links.