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Washington, D.C. 20554

FCC Seeks Comment on Recommendations Approved by the Advisory Committee for the 2015 World Radiocommunication Conference	IB Docket No. 04-286 WAC/117

COMMENTS OF GOOGLE INC.

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I. INTRODUCTION

Google strongly supports View A of WAC/117r1's proposed future agenda item (under WRC-15 agenda item 10) regarding High Altitude Platform Stations ("HAPS"). View A is preferable to View B because it provides a wider range of specific bands to study for a new generation of lightweight aircraft to deliver broadband, thereby providing stakeholders greater flexibility to respond to emerging technological developments. By not prejudging the outcome of detailed coexistence studies in particular bands, View A is better designed to achieve fair and efficient spectrum use. View A also avoids internal inconsistencies and unnecessary complexity introduced by View B.

View A will best position the ITU to promote the development of new technologies that bring modern broadband Internet access to the developing world—an important goal shared by Google, global industry, the U.S. Government, and countries across the world. WRC-15 comes just as unmanned aerial system ("UAS") technology and investment are reaching a critical point, with multiple U.S. companies planning HAPS deployments to extend the reach of broadband to unserved and underserved communities across the globe. Now is the time to study whether existing ITU-R regulations are sufficient to facilitate this important innovation, as an important step toward putting in place a regulatory framework that permits American innovators to respond to this global opportunity.

II. THE UNITED STATES SHOULD ACT TO PROMOTE BROADBAND INTERNET ACCESS ACROSS THE GLOBE

As President Obama has recognized,

> We have to do everything we can to encourage the entrepreneurial spirit, wherever we find it. We should be helping American companies compete and sell their products all over the world. We should be making it easier and faster to turn

> new ideas into new jobs and new businesses. And we should knock down any barriers that stand in the way.[1]

The U.S. Government therefore "has an important role to play in developing coordinated policies to promote broadband deployment and adoption, including promoting best practices, breaking down regulatory barriers, and encouraging further investment."[2] Likewise, internationally, the United States and other nations understand that the world community must do more to facilitate the integration of all people, particularly people in developing countries, smaller economies, and among rural and disadvantaged groups, "into an increasingly knowledge-based society."[3] Nonetheless, today two-thirds of the world's population remains without access to the Internet. Two-thirds of those individuals live in rural areas that are difficult to serve cost-effectively with traditional telecommunications infrastructure.[4]

With this challenge in mind, Google and other U.S. businesses have embarked on ambitious projects to expand broadband availability, in communities ranging from Austin,

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1 Barack Obama, President, U.S., Remarks by the President at the Signing of the America Invents Act (Sept. 16, 2011), *available at* https://www.whitehouse.gov/the-press-office/2011/09/16/remarks-president-signing-america-invents-act.

2 Memorandum from Barack Obama, President, U.S., Expanding Broadband Deployment and Adoption by Addressing Regulatory Barriers and Encouraging Investment and Training, Office of the Press Secretary (Mar. 23, 2015), *available at* https://www.whitehouse.gov/the-press-office/2015/03/23/presidential-memorandum-expanding-broadband-deployment-and-adoption-addr.

3 Inter-American Telecomm. Comm'n, *Agenda for Connectivity in the Americas – Plan of Action of Quito*, Org. of American States, at 3 (Nov. 23, 2003), *available at* http://scm.oas.org/pdfs/2011/CP27789Anexo-4b.pdf.

4 MCKINSEY & CO., *Offline and Falling Behind: Barriers to Internet Adoption*, Technology, Media, and Telecom. Practice, at 43 (Aug. 2014), http://www.mckinsey.com/~/media/McKinsey/dotcom/client_service/High%20Tech/PDFs/Offline_and_falling_behind_Barriers_to_Internet_adoption.ashx.

Texas,[5] to Christchurch, New Zealand,[6] to Kampala, Uganda, to remote, rural communities.[7] These projects include cutting-edge efforts to use solar-powered fixed-wing unmanned aerial vehicles, flying in a station-keeping pattern over a fixed point on the Earth's surface, to bring high-speed broadband where it has never reached before.

As U.S. policymakers have pointed out, "UAS could provide Internet service to remote areas by remaining aloft for months at a time—far longer than manned aircraft."[8] Because such an approach minimizes the amount and therefore the expense of ground-based infrastructure required to connect remote locations, it promises to allow U.S. companies such as Google, in partnership with existing mobile carriers, to connect corners of the globe that would otherwise remain unserved by modern telecommunications. Although airborne infrastructure presents its own challenges, Google and others have invested substantially and made great strides towards deploying such technologies throughout the world.

The U.S. can assist these efforts and ensure that American companies remain at the forefront of technological innovation by supporting proposals at the next WRC to improve the international regulatory environment for these high-altitude broadband projects. Constructive and forward-thinking proposals will also aid a diverse array of other U.S. industries that stand to benefit from expanded global connectivity via UAS. For example, such proposals would keep

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5 GOOGLE, INC., *Austin*, Google Fiber, https://fiber.google.com/cities/austin/.

6 GOOGLE, INC., *Loon for All*, Project Loon, https://www.google.com/loon/.

7 GOOGLE, INC., *Project Link*, http://www.google.com/get/projectlink/.

8 John B. Morris Jr., Assoc. Adm'r, Office of Policy Analysis and Dev., NTIA, *Testimony of John B. Morris, Jr. Before the Subcommittee on Aviation Operations, Safety, and Sec. Comm. on Commerce, Sci., and Transp. U.S. Senate* (Mar. 25, 2015), *available at* http://www.ntia.doc.gov/speechtestimony/2015/testimony-associate-administrator-morris-senate-commerce-committee-unmanned-aircraft-systems.

America "at the forefront of aviation,"[9] benefitting the growing U.S. UAS industry. Likewise, American telecommunications equipment manufacturers, chip makers, software companies, media companies, and social networking companies will all benefit from expanded global audiences.

III. EXISTING HAPS IDENTIFICATIONS MAY LIMIT THE REACH OF BROADBAND INTERNET

Under the ITU's regulations, a platform operating at altitudes between 20 and 50 kilometers, in a station-keeping pattern over a fixed point on the ground is classified as a "high altitude platform station" or "HAPS."[10] A UAS flying in a circle to provide broadband to a constant area below could be considered a HAPS. Thus, the ITU's HAPS regulations could have a dramatic effect on industry's ability to connect underserved areas using unmanned aircraft. Although ITU-R generally regards HAPS as stations in the fixed service, Article 4.23 of the Radio Regulations nonetheless singles out HAPS for special regulatory limitations. Article 4.23 provides that transmissions to or from high altitude platform stations shall be limited to bands specifically identified in Article 5.[11] Thus, existing ITU regulations explicitly authorize HAPS to

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9 Anthony Foxx, *Remarks from U.S. Transportation Secretary Anthony Foxx on the UAS Rulemaking Announcement*, U.S. Dep't of Transp. (Feb. 15. 2015), http://www.transportation.gov/briefing-room/remarks-us-transportation-secretary-anthony-foxx-uas-rulemaking-announcement.

10 ITU Radio Reg. § 1.66A.

11 In fact, Article 4.23 appears to be in conflict with the Constitution of the ITU, which provides that member nations "reserve for themselves . . . the right to make special arrangements on telecommunication matters which do not concern Member States in general." Const. and Convention of the Int'l Telecomm. Union as amended by the 2010 Plenipotentiary Conference Art. 42. Thus, under the ITU Constitution, no provision of the Radio Regulations may limit member states' ability to authorize any service, from any type of station, within their own borders, so long as steps are taken to prevent harmful interference to other authorized services. *See also* ITU Radio Reg. § 4.4 (recognizing member states' right to "assign to a station any frequency in derogation of either the Table

operate in only a limited number of bands, and these bands are subject to significant technical, geographic, or other regulatory restrictions.

HAPS may operate as fixed stations in a portion of the 5 925-6 700 MHz fixed band, using a channel from 6 440 to 6 520 MHz for HAPS-to-ground communications, and a channel from 6 560 to 6 640 MHz for ground-to-HAPS signals.[12] However, this identification applies only in five countries: Australia, Burkina Faso, Cote d'Ivoire, Mali, and Nigeria and, even there, only permits deployment in these bands with the explicit consent of any nation within 1000 km.[13] The identification also provides HAPS no interference protection from subsequent deployments of other services.[14]

The Radio Regulations also explicitly provide for HAPS operations as fixed stations between 27.9 and 28.2 GHz for HAPS-to-ground transmissions, and between 31.0 and 31.3 GHz for ground-to-HAPS.[15] However, use of both of these channels is subject to sharp geographic limitations, with no identification at all for any country within Region 2.[16] And, similar to the 6 440-6 640 GHz identification, HAPS receive no protection from subsequent deployments of fixed, mobile, or other services allocated on a primary basis in these bands.[17]

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of Frequency Allocations in this Chapter or the other provisions of these Regulations," provided that they do not cause harmful interference to other authorized services).

12 ITU Radio Reg. § 5.457.

13 *Id.*

14 *Id.*

15 *Id.* §§ 5.537A, 5.543A.

16 *Id.*

17 *Id.*

Finally, the Radio Regulations explicitly authorize HAPS operations as fixed stations between 47.2 and 47.5 GHz and between 47.9 and 48.2 GHz.[18] This is the only specific global identification for HAPS. But these frequencies are subject to significant rain fade, which causes signals between HAPS and the ground to become greatly attenuated in humid or rainy conditions—conditions that are common in many underserved regions of the world that would most benefit from HAPS-based service. HAPS operating in these bands are also subject to technical restrictions described in Resolution 122 (WRC-07) which, among other things, limit the maximum density of terminals on the ground in communications with a HAPS station, and impose a restrictive power-flux-density at the operating nation's terrestrial border.[19]

These restrictions raise a serious question regarding whether it is possible to deliver over HAPS a broadband service that enables meaningful participation in online activities. If such a service is possible under current regulations, then industry can build on the work of the proposed studies in developing HAPS-based services. If not, then, at WRC-19, the global community can revise unnecessary restrictions and potentially identify new bands for HAPS, as needed. Although technical challenges remain, Google is confident that its own work, and likely the work of other companies pursuing similar models, will make HAPS-based connectivity possible. However, without the technical and regulatory certainty that View A would promote, the promise of HAPS to connect users in rural, underserved markets may remain unfulfilled.

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[18] *Id*. § 5.552A.

[19] *Id*.; ITU-R Res. 122 (WRC-07).

IV. VIEW A PROVIDES A BETTER FRAMEWORK FOR DELIVERING ON THE PROMISE OF HAPS BY AVOIDING SPECIAL TREATMENT FOR CERTAIN SATELLITE INTERESTS

View A puts forward a simple idea: the United States would propose to initiate studies to determine whether the existing identifications for HAPS are adequate to deliver modern broadband services. If these studies conclude that the existing identifications are not sufficient, additional studies will be conducted before WRC-19 to determine whether these needs can be met by easing the restrictions on existing HAPS identifications or by identifying additional spectrum for HAPS use. Studies on potential new or expanded identifications will be confined to fixed bands that adjoin existing HAPS identifications or otherwise fall within the frequency ranges of 5 925 MHz – 15.35 GHz (not including the "Planned Bands"), 21.2 GHz – 22.0 GHz, and 23.6 - 29.1 GHz. View A does not propose to identify the entirety of these ranges for HAPS but, instead, proposes only to study these ranges to identify portions of these bands currently allocated to the fixed service that would be most suitable for HAPS use. Furthermore, the Planned Bands — those subject to Appendices 30, 30A, and 30B — will not be considered for use by HAPS even if they otherwise would fall into the range of bands that would be studied under View A.

It is axiomatic that sharing and compatibility studies in the ITU-R would protect existing users in studied bands. Therefore, the studies proposed in View A *Resolves* 3 will focus on sharing and compatibility between HAPS and existing services to ensure that existing users of the affected bands will be protected from harmful interference. In addition, although View A does not propose to identify any additional spectrum for HAPS use in the mobile service, *Resolves* 3 of View A would allow the ITU-R to study the use of HAPS to deliver mobile broadband, in partnership with existing mobile operators. This work would further ease the task

of operators as they seek to deliver mobile broadband service directly to users in the developing world.

Elements of the fixed satellite industry have put forward a competing View B. View B differs from View A primarily in that it would eliminate from consideration for HAPS use a number of bands that are used by the fixed satellite industry. View B would also expressly invite the ITU-R to study compatibility with services in adjacent bands. Services in adjacent bands that have concerns also would be free to bring those concerns into sharing and compatibility studies under View A, and as provided by Article 4.3. But to expressly require the study of compatibility with every service in adjacent bands, regardless of whether operators in those services request it, creates unnecessary hurdles to new technology.

Moreover, View B would require the studies to take into account not just the current use, but the planned use of studied bands, and the current and planned use of services in adjacent bands. As the Commission is aware, certain satellite entities have abused the ITU-R registration process. The problem of so-called "paper satellites" is so recognized that the ITU-R has a standing Agenda Item 7 to address it.[20] Yet View B would require HAPS proponents to study

[20] Indeed, no less than nine independent aspects of the paper-satellite problem are currently under consideration for this WRC, and several are the subject of WAC proposals. *See* Draft Proposal For AI 7, Issue G, WAC/124, IB Docket No. 04-268 (filed May 18, 2015) (proposing "[c]larification of bringing into use information provided under RR Nos. 11.44/11.44B"); Proposed Edits to WRC-15 Agenda Item 7 Issue H, WAC/125, IB Docket No. 04-268 (filed May 18, 2015) (proposing "[u]sing one space station to bring frequency assignments at different orbital locations into use within a short period of time," otherwise known as "satellite-hopping"); Draft Proposal For AI 7, Issue I, WAC/126, IB Docket No. 04-268 (filed May 18, 2015) (proposing a "[p]ossible method to mitigate excessive satellite network filings issue").

compatibility with all these "planned" uses in adjacent bands, a requirement that seems calculated to ensure potential HAPS entrants never do in fact enter the market.

In addition to those excessive requirements, View B's *Resolves* 3 would require studies to take account of "applicable studies already performed" in the ITU-R. On the face of it, much of View B's *Resolves* 3 is unnecessary, because "[t]aking into account the applicable studies already performed" is axiomatic in any ITU-R study, including those invited by View A, and need not be stated. But, importantly, View B's *Resolves* would not expressly limit the studies to those relating to the existing identifications listed in the accompanying Resolution, leaving open what previous studies are "applicable." Adverse interests could attempt to delay the delivery of broadband to underserved markets by endlessly referring back to the dozens of studies that relate to HAPS or relevant bands in some indirect fashion. View B's *Resolves* 3 may have been appropriate for Agenda Item 1.1, but it is not appropriate for this far more narrowly targeted proposed Item. A review of the Conference Preparatory Meeting Report for Agenda Item 1.1 is a useful reminder of the resources required to study sharing and compatibility with existing services, their planned use of studied bands, and the current and planned use of services in bands adjacent to the studied bands.

In addition, View B's more narrow frequency ranges would significantly reduce the chances that these studies will yield an optimal spectrum sharing proposal. View B would preempt any analysis of whether additional ranges in the Upper C and Ka Bands could be good homes for HAPS, while shifting the necessary coexistence work onto government agencies and other industries. And if contributions from other administrators or sector members reveal that a new HAPS identification in a band shared between both fixed and satellite services would be the

best and most spectrally efficient outcome, then the premature exclusion of satellite bands will have frustrated sound spectrum planning.

View B is, moreover, internally inconsistent. View B would remove from *Resolves* 2 the ranges adjacent to the existing identifications around 6 GHz and 28/31 GHz. And yet, View B proponents claim they support inviting WRC-19 to take action "potentially including expansion of the frequency ranges of existing identifications."[21] This contradiction casts further doubt on the goals underlying View B.

There is no reason to believe that coexistence between HAPS and satellite services will present special sharing challenges. To the contrary, the potential interference scenarios are technically similar to interference between satellites in geostationary ("GSO") and non-geostationary ("NGSO") orbits, a problem that has received significant, constructive attention within the satellite industry. In fact, experience with this sort of coexistence scenario could position the satellite industry to make especially valuable contributions to coexistence studies under this proposed agenda item. Moreover, ITU-R WRC-12 adopted Resolution 150, which provides precise technical and operational guidance for sharing between HAPS and other services, including satellite.

In short, View B does not seem designed to bring about a successful study cycle. View B's recommended elimination of any FSS satellite bands from consideration baselessly prejudges the outcome of any coexistence studies, and could further delay efforts to bring broadband Internet access to underserved markets.

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[21] Draft Proposals for the Work of the Conference of World Radiocommunication Conference Advisory Committee, WAC/117rev1 at View B, IB Docket No. 04-268 (filed May 18, 2015) ("View B").

Google notes that five of the seven proposed future agenda items approved by the WAC on May 20th, 2015, would directly benefit the satellite industry, by considering new allocations for fixed satellite service operations,[22] permitting fixed satellite service earth stations on aircraft between 12.75 and 13.25 GHz,[23] easing orbital restrictions imposed on stations in the broadcast satellite service in the planned bands,[24] proposing to provide guidance on NGSO operations in certain fixed satellite service bands,[25] and potentially creating an entirely new radio service for space weather sensors.[26] There is therefore little risk that FSS satellite interests will be disadvantaged or under-protected if the United States were to adopt View A, which merely proposes to study satellite bands—among others—for coexistence with HAPS.

The specific criticisms of View A voiced in View B are unfounded. View B claims that View A fails to address protection of existing services.[27] But, in fact, View A explicitly provides that, under this agenda item, any ITU-R Recommendation or Report and any regulatory change by WRC action must be made based on the studies on "sharing and compatibility between broadband applications delivered over high altitude platform stations and existing services."[28] As

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22 Draft Proposals for the Work of the Conference of World Radiocommunication Conference Advisory Committee, WAC/121, IB Docket No. 04-268 (filed May 18, 2015).

23 Draft Proposals for the Work of the Conference of World Radiocommunication Conference Advisory Committee, WAC/122, IB Docket No. 04-268 (filed May 18, 2015).

24 Proposals for the Work of the Conference of World Radiocommunication Conference Advisory Committee, WAC/128, IB Docket No. 04-268 (filed May 18, 2015).

25 Draft Proposals for the Work of the Conference of World Radiocommunication Conference Advisory Committee, WAC/120, IB Docket No. 04-268 (filed May 18, 2015).

26 Proposed Edits to NTIA Draft Proposal on WRC-15 AI 10 of World Radiocommunication Conference Advisory Committee, WAC/129, IB Docket No. 04-268 (filed May 18, 2015).

27 View B.

28 Draft Proposals for the Work of the Conference of World Radiocommunication Conference Advisory Committee, WAC/117rev1 at View A, IB Docket No. 04-268 (filed May 18, 2015) ("View A").

noted above, all ITU-R studies inherently address the protection of incumbent users. And, in any event, the Radio Regulations do not permit new assignments or changes of existing assignments without protecting existing services, regardless of the text of the agenda item. Article 4.3 specifically provides that:

> Any new assignment or any change of frequency or other basic characteristic of an existing assignment . . . shall be made in such a way as to avoid causing harmful interference to services rendered by stations using frequencies assigned in accordance with the Table of Frequency Allocations in this Chapter and the other provisions of these Regulations.[29]

View B also asserts that View A seeks to study bands outside of those currently allocated for fixed use. This is incorrect. View A proposes to invite WRC-19 to identify additional spectrum in one of two ways. It invites WRC-19 to consider a) "expansion of the frequency ranges of existing identifications for HAPS within *existing fixed service allocations*"[30] and b) "identifying additional frequency ranges for use by HAPS in accordance with *resolves to invite* ITU-R 2."[31] *Resolves* 2, in turn, invites ITU-R to study only the "feasibility of identifying *fixed* service allocations for the use of HAPS in the frequency ranges of 5 925 MHz – 15.35 GHz, 21.2 GHz – 22.0 GHz, and 23.6 - 29.1 GHz which are not subject to Appendices 30, 30A, and 30B."[32] Thus, under either of these alternatives, the proposed future agenda item explicitly limits the identification of additional HAPS spectrum to existing fixed allocations. While *Resolves* 3 is broad enough to study the compatibility of existing services with HAPS used for mobile

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29 ITU Radio Reg. § 4.3.

30 View A (emphasis added).

31 *Id.*

32 *Id*. (emphasis added).

broadband, it does not contemplate the identification of spectrum for HAPS in mobile allocations.

V. CONCLUSION

As the proponents of both View A and View B recognize, the United States should take the lead in promoting international regulatory reforms to support American efforts to bring high speed Internet access to underserved communities using HAPS. With this country's history of innovation and strong interests in connecting the developing world, it is fitting that this proposal would come to CITEL as an American contribution. View A is more likely to result in the compatible expansion of existing identifications for HAPS within fixed allocations. View B, in contrast, imposes numerous redundant restrictions and study requirements, all while shifting the burden of this work away from the satellite industry. View A proposes collaborative studies to identify the best spectral home for broadband over HAPS, while protecting existing services, without favoring one industry over another.

Respectfully submitted,

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