Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
	)	
Streamlining Licensing Procedures for Small Satellites	)	IB Docket No. 18-86
	)	
	)	

REPLY COMMENTS OF GLOBALSTAR, INC.

Globalstar, Inc. ("Globalstar"), hereby replies to comments on the Federal Communications Commission's ("Commission's") Notice of Proposed Rulemaking regarding streamlined licensing procedures for small satellite systems.[1] The Commission should not allow standalone small-satellite operations in Globalstar's licensed mobile satellite service ("MSS") spectrum at 1610.6-1613.8 MHz because such operations would create an unreasonable threat of harmful interference to Globalstar's MSS network, including public safety users and other customers. At the same time, the Commission should rely on Big LEO spectrum to promote small-satellite development by permitting inter-satellite links ("ISLs") between small satellites and licensed Big LEO MSS systems under streamlined Part 25 rules.

I. The Commission Should Not Permit Standalone Small-Satellite Operations in Globalstar's Licensed Big LEO Spectrum at 1610.6-1613.8 MHz

As Globalstar described in its comments, standalone small-satellite systems are not compatible with Globalstar's MSS operations in this spectrum.[2] Earth station-to-small-

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1 *Streamlining Licensing Procedures for Small Satellites*, IB Docket No. 18-86, Notice of Proposed Rulemaking, FCC 18-44 (rel. Apr. 17, 2018) ("*NPRM*").

2 *See* Comments of Globalstar, Inc., IB Docket No. 18-86, at 8-10 (July 9, 2018) ("Globalstar Comments").

satellite transmissions at 1610.6-1613.8 MHz would likely cause harmful interference to Globalstar's co-channel MSS operations.[3]

The Commission should reject the CSSMA's flawed arguments in support of standalone small-satellite operations at 1.6 GHz. The burden in this rulemaking should be on small-satellite proponents to demonstrate that standalone systems can operate in Big LEO spectrum without causing harmful interference to Globalstar's licensed MSS operations. CSSMA falls far short of meeting this burden with its brief, vague technical presentation that even it concedes "must be subjected to more rigorous analysis."[4] CSSMA also fails to propose specific technical or operational rules that would protect Globalstar's Big LEO operations from harmful interference.

CSSMA broadly claims that a combination of directional earth station antennas, relatively low earth station EIRP, and a compatible air interface will enable small-satellite systems to coexist successfully with Globalstar's MSS operations at 1610.6-1613.8 MHz.[5] As described below, however, these arguments are devoid of technical detail and demonstrate a faulty understanding of Globalstar's MSS network.

First, CSSMA argues that the use of directional earth station antennas would help avoid harmful interference to Globalstar's MSS operations, but its analysis is conclusory and

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[3] In the *NPRM*, the Commission seeks comment on standalone small-satellite use of Globalstar's licensed MSS spectrum at 1610.6-1613.8 MHz. *See NPRM* ¶ 69. For the same reasons that preclude such operations at 1610.6-1613.8 MHz, the Commission should reject the Commercial Smallsat Spectrum Management Association's ("CSSMA's") suggestion that standalone small-satellite operations be permitted throughout Globalstar's licensed Big LEO service uplink spectrum at 1610-1618.725 MHz (as well as in Iridium's licensed MSS spectrum at 1617.775-1626.5 MHz). *See* Comments of the Commercial Smallsat Spectrum Management Association, IB Docket No. 18-86, at 49 (July 9, 2018) ("CSSMA Comments").

[4] CSSMA Comments at 72.

[5] *See id.* at 69-72.

unconvincing. CSSMA provides no technical evidence beyond referencing the typical size, gain, and beamwidth of a direction antenna and suggesting that predictive software could enable these antennas to cease transmissions during periods of potential interference.[6] This sparse showing does not constitute meaningful support for small-satellite operations at 1.6 GHz.

In fact, as indicated in Globalstar's comments, the use of directional antennas would not prevent harmful interference to Globalstar's MSS operations.[7] As each orbiting Globalstar satellite traverses North America, it "hears" all transmissions at 1610-1618.725 MHz across a constantly moving 5,800 kilometer-wide area on the Earth's surface. Given the size of this 1.6 GHz "return link" satellite footprint,[8] Globalstar's satellites would be subject to numerous – possibly hundreds – of "in-line" small-satellite earth station signals directed to the same orbital vicinity. Effective coordination here is impossible since Globalstar's satellites will likely be in continuous view of multiple small-satellite earth stations transmitting to a variety of small satellites.

Globalstar is concerned not only about "in-line" interference, but also with interference from "sidelobe" transmissions from high-gain directional earth station antennas. While a directional earth station antenna – such as the generic example referenced by CSSMA – might have a primary signal beamwidth of only 6.8 degrees,[9] its "interference

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6 *See id.* at 70-71.

7 *See* Globalstar Comments at 9 ("[T]here are no technical restrictions that would lower the risk of harmful interference from small-satellite operations to Globalstar's MSS offerings. . . . [D]irectional antenna requirements for small-satellite systems are not feasible.").

8 Globalstar's "return link" consists of its feeder downlink at 6 GHz (satellite to gateway) and its service uplink at 1.6 GHz (mobile terminal to satellite).

9 CSSMA Comments at 70.

beamwidth" includes these sidelobes and will typically be as great as 18 degrees.[10] Given this sidelobe beamwidth, emissions from numerous directional earth station antennas around the United States would threaten severe, harmful aggregate interference to Globalstar reception of user terminal traffic at 1.6 GHz.[11]

CSSMA states that the relatively low EIRP of small-satellite earth station transmissions would also limit their interference impact, but it offers no detail regarding the maximum and average EIRP of these facilities.[12] Without such information, the Commission cannot assess CSSMA's questionable claim that small-satellite earth station transmissions would result in a power flux density at Globalstar's satellites no greater than the "the largest amplitude CDMA uplink" from Globalstar's user terminals.[13] Globalstar notes that its simplex services and access channels at 1.6 GHz are low-power services that lack ground device power control. Therefore, these systems are vulnerable to interference and reduced quality of service in the presence of stronger amplitude signals.

CSSMA further suggests that air interface compatibility would facilitate spectrum sharing between standalone small satellites and Globalstar's MSS network.[14] It incorrectly

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[10] Earth station sidelobe transmissions could range from 13 dB to 20 dB down from the main lobe. This means that such sidelobes are approximately equivalent to an antenna with 7-14 dBi gain (with up to 18 degrees beamwidth), which is significantly higher than the omnidirectional antenna gain on any Globalstar device.

[11] Given the interference beamwidth of these earth station transmissions, even the deployment of a modest number of small-satellite earth stations at 1610.6-1613.8 MHz would create a serious risk of harmful interference to Globalstar's MSS operations.

[12] *See* CSSMA Comments at 70.

[13] *Id.*

[14] *See id.* at 69.

assumes, however, that Globalstar continues to rely on the IS-95 air interface.[15] Following the deployment of Globalstar's second-generation ground infrastructure, Globalstar now utilizes a proprietary version of the 3GPP Release-7 air interface, which is not compatible with IS-95.[16] In any event, the Commission should not require Globalstar to maintain air interface compatibility indefinitely with what will inevitably be a wide variety of future small-satellite operators. Such a requirement is technically infeasible and financially prohibitive.

Without compelling evidence to the contrary, the Commission should assume that small-satellite earth station transmissions at 1.6 GHz would threaten substantial harmful interference to Globalstar's MSS constellation. CSSMA downplays the significance of such interference, claiming that "this circumstance would appear to the Globalstar satellite to be just the same as several additional [Globalstar] users occupying" Globalstar's Big LEO uplink spectrum.[17] In fact, harmful aggregate interference from co-channel small-satellite operations would materially reduce Globalstar's subscriber capacity, diminish its service coverage, and degrade the quality of its satellite services.

In arguing that it would be fine for small-satellite earth stations to rob Globalstar of its licensed capacity, CSSMA mischaracterizes Globalstar's network and exaggerates its existing return link capacity at 1.6 GHz. Notably, Globalstar is currently authorized to operate on only seven 1.23 MHz frequency division multiplex ("FDM") channels at 1610-

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15 *See id.* (citing a paper from 2000 for the proposition that Globalstar "employ[s] an air interface standard quite similar to the (now obsolete) IS-95 cellular standard").

16 In Globalstar's bent-pipe satellite network architecture, the air interface is determined by ground infrastructure and is therefore fully and continuously upgradable. For its SPOT and simplex services, Globalstar utilizes a non-standard proprietary CDMA air interface that is different from both IS-95 and 3GPP Release 7.

17 CSSMA Comments at 71.

1618.725 MHz, not on thirteen such channels as CSSMA claims.[18] Contrary to CSSMA's suggestion, standalone small-satellite operations at 1.6 GHz could absorb a significant and unacceptable portion of Globalstar's total MSS return link capacity.

While CSSMA addresses only the *capacity* impact of standalone small-satellite earth station operations, these earth station transmissions would also degrade Globalstar's MSS coverage and quality of service, causing dropped calls, failed call attempts, and impaired data transmissions. Because of harmful interference from these operations, Globalstar user terminals would have to transmit at higher power levels to "close" the link for a particular voice call or data communication. Given the limits on user device power, Globalstar's customers would suffer higher dropped call rates and diminished quality of service at the edge of Globalstar's MSS coverage area. This interference would also produce a higher "frame error" rate, degrading call voice quality.[19]

Globalstar's reduced capacity and degraded service would be evident during and after hurricanes and other natural disasters, when terrestrial networks are often unavailable, safety-of-life satellite services are in heavy demand, and Globalstar experiences peak traffic levels. As described in Globalstar's comments, public safety entities involved in relief efforts in North America and around the world have relied on Globalstar's satellite services in these disaster scenarios, and Globalstar's "SPOT" product line has been used to

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[18] *See id.* at 69 (falsely claiming that "[e]ach satellite is capable of operating on thirteen frequency division multiplexed channels").

[19] As Globalstar described in its comments, standalone small-satellite operations at 1610.6-1613.8 MHz would also threaten harmful interference to the Radioastronomy Service ("RAS"). *See* Globalstar Comments at 9. In its filing, CSSMA fails to demonstrate that small-satellite earth station operations could avoid such interference to the RAS.

initiate thousands of rescues around the world.[20] If Globalstar is unable to provide these resilient life-critical services when they are most needed, this result will be contrary to public safety and the public interest.

II. The Commission Should Adopt Its Proposal to Permit Inter-Satellite Links Between Small Satellites and Licensed Big LEO MSS Systems

While the Commission should not allow standalone small-satellite operations at 1.6 GHz, it can still rely on Big LEO spectrum to promote the development of the small-satellite industry. Specifically, the Commission should adopt its proposal to permit ISLs between small satellites and licensed Big LEO MSS systems under streamlined Part 25 rules.[21] The Commission should reject the arguments of the sole commenter opposing these ISLs.

While EchoStar Satellite Operating Corporation and its affiliate Hughes Network Systems, LLC (collectively, "EchoStar"), generally support the use of ISLs between small satellites and large scale satellite systems, they assert that these ISLs should be permitted only in spectrum already allocated for Inter-Satellite Service ("ISS") use.[22] Specifically, EchoStar argues that ISL operations should occur only in bands containing an International Telecommunication Union ("ITU") allocation for "space-to-space" operations and that the Commission should not revise its definition for MSS to allow ISL deployments in MSS spectrum under streamlined Part 25 procedures.[23] Under this approach, ISLs between small satellites and licensed Big LEO MSS operators would be prohibited in the Big LEO bands.

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20 *See* Globalstar Comments at 2-3.

21 *See NPRM* ¶ 71.

22 Comments of EchoStar Satellite Operating Corporation and Hughes Network Systems, LLC, IB Docket No. 18-86, at 6 (July 9, 2018).

23 *Id.* at 6-8.

As indicated in the *NPRM*, the Commission has in recent years granted numerous experimental authorizations permitting small-satellite communications with the Globalstar and Iridium networks in the Big LEO band to enable indirect data communications between these small spacecraft and ground networks.[24] Indeed, the primary purpose of the Commission's ISL proposal was to permit these small satellite-to-Big LEO communications under new streamlined Part 25 procedures rather than force parties' continued reliance on inapt experimental licensing procedures. While Globalstar appreciates EchoStar's interest in adhering to existing ITU allocations, its effort here to exclude the Big LEO band simply makes no sense.

ISLs between small satellites and Globalstar's established Big LEO system will generate important benefits for small-satellite operators. These operators will be able to maximize operational efficiency by utilizing Globalstar's existing MSS network to connect to ground facilities. Relying on these ISLs, they will not need to invest in expensive earth station infrastructure or secure dedicated frequencies for Earth-to-space and space-to-Earth links.

Small-satellite communications with Globalstar's constellation have caused no interference to date, and Globalstar does not expect such ISLs to raise any technical concerns in the future. In addition, as Iridium suggests, the Commission can consider additional technical rules for ISL operations to minimize the risk of inter-system interference between the Globalstar and Iridium networks.[25] Globalstar also agrees with Iridium that the

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24 *NPRM* ¶ 71.

25 *See* Comments of Iridium Communications, Inc., IB Docket No. 18-86, at 11 (July 9, 2018) ("Iridium Comments") ("[T]he Commission should develop technical rules specific to smallsat intersatellite links to protect Big LEO constellations.").

Commission should clarify that ISLs in Big LEO spectrum will be limited to communications between small satellites and licensed Big LEO systems.[26] In contrast to ISLs connecting small satellites to Big LEO systems, small-satellite-only ISLs would likely cause substantial harmful interference to Globalstar's licensed MSS offerings.

Rather than create a new, separate allocation for ISLs in the Big LEO band that would support small-satellite-only ISLs, the Commission should amend the U.S. Table of Allocations by adding a "space-to-space" directional indicator to the MSS spectrum allocations at 1613.8-1626.5 MHz and 2483.5-2500 MHz.[27] The Commission should also add a use footnote to the U.S. Table stating that authorized small satellite "space-to-space" operations in this Big LEO spectrum would constitute an "application" of the mobile satellite service. At the ITU, the Commission should advocate for similar amendments to the international table of allocations. In combination with streamlined licensing procedures, these domestic and international allocation changes should enable robust, interference-protected commercial communications between small satellites and Globalstar's MSS constellation.

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26 *See id.* ("[T]he Commission should clarify that intersatellite links in this spectrum are limited to communications between smallsats . . . and licensed BIG LEO systems.").

27 *See* Globalstar Comments at 7-8. Currently, in the U.S. Table of Allocations, the domestic MSS allocations covering 1610-1626.5 MHz (encompassing Globalstar's Big LEO service uplink spectrum at 1610-1618.725 MHz) include the "Earth-to-space" directional indicator, while the domestic MSS allocation at 2483.5-2500 MHz (Globalstar's service downlink spectrum) contains the "space-to-Earth" directional limitation. 47 C.F.R. § 2.106.

In its comments, Inmarsat argues that "space-to-space" directionality should be added to all MSS bands, including those used by non-geostationary systems (like Globalstar) and geostationary networks (like Inmarsat). As Inmarsat indicates, the addition of "space-to-space" directionality in these bands will ensure that these small-satellite communications will not create frequency coordination difficulties with respect to existing satellite systems. *See* Comments of Inmarsat Inc., IB Docket No. 18-86, at 4 (July 9, 2018).

III. Conclusion

The Commission should not allow standalone small-satellite operations in the 1610.0-1613.8 MHz band because earth station-to-small satellite transmissions would cause harmful aggregate interference to Globalstar's safety-of-life MSS offerings. At the same time, the Commission should pursue the domestic and international allocation changes necessary to permit ISLs between small satellites and Globalstar's Big LEO MSS constellation under streamlined Part 25 rules.

Respectfully submitted,

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ATTACHMENT

Declaration

I hereby certify under penalty of perjury that the engineering statements made in the foregoing Reply Comments of Globalstar, Inc., are true and correct to the best of my knowledge.

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