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

In the Matter of	)	
	)	
LightSquared Technical Working Group Report	)	IB Docket No. 11-109
	)	
LightSquared License Modification Application, IBFS File Nos. SAT-MOD-20120928-00160, -00161, SES-MOD-20121001-00872	)	IB Docket No. 12-340
	)	
New LightSquared License Modification Applications IBFS File Nos. SES-MOD-20151231-00981, SAT-MOD-20151231-00090, and SAT-MOD-20151231-00091	)	IB Docket No. 11-109; IB Docket No. 12-340
	)	
Ligado Amendment to License Modification Applications IBFS File Nos. SES-MOD-20151231-00981, SAT-MOD-20151231-00090, and SAT-MOD-20151231-00091	)	IB Docket No. 11-109

REPLY TO OPPOSITIONS TO PETITION FOR RECONSIDERATION OF AIR LINE PILOTS ASSOCIATION, INTERNATIONAL

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Airline pilots rely upon reliable and secure GPS satellite services for critical navigation and warning systems that have prevented airline accidents. Terrain Awareness and Warning Systems ("TAWS") and GPS-navigation systems aboard airliners provide pilots and passengers with invisible three-dimensional life-saving guardrails in the sky. With the increasing elimination of traditional ground-based navigation and radar facilities by the Federal Aviation Administration ("FAA") it is more important today than ever to ensure that critical GPS-based cockpit warnings and navigation continue to operate as intended. Nothing presented in the Oppositions filed in response to the Air Line Pilots Association, International's ("ALPA's") Petition for Reconsideration[1] presents any valid reason for the Federal Communications Commission ("FCC") to refuse ALPA's reasonable requests to reconsider its decision to ensure that airline GPS-navigation and TAWS are properly protected, and to give these critical airline safety systems the evaluation they deserve before granting Ligado a license.

I. The Order Did Not Properly Address Concerns Applicable to Certified Aviation Receivers

Ligado's Opposition (at 16-17) attempts to dismiss ALPA's (and ASRI's) concerns about the incomplete and limited testing of certified aviation GPS receivers using the "assessment zone" concept with bald assertions such as "ASRI and ALPA are wrong," and that the Commission "relied upon and accepted 'the FAA's standards based analyses,'" citing the Order, at ¶ 71. Such rhetorical assertions failed to address ALPA's substantive concern that the operational evaluations relied upon in the Order were substantially limited and demonstrably

[1] *See* Ligado Networks LLC ("Ligado") Opposition for Petitions for Reconsideration or Clarification (June 1, 2020)("Ligado Opp'n"); JWH Unmanned Solutions, LLC ("JHW") Opposition to Petitions for Reconsideration or Clarification (June 1, 2020)("JHW Opp'n"); The Brattle Group Opposition to Petitions for Reconsideration (June 1, 2020)("Brattle Opp'n"); *see also* Comments of Deere & Company (June 1, 2020).

incomplete. ALPA does not seek to undermine the FAA's testing and evaluation results, such that they are, but rather ALPA simply points to the significant limitations of the FAA's operational evaluation which even the FAA's parent agency, the Department of Transportation ("DOT"), fully acknowledged: "[t]he FAA has not completed an exhaustive evaluation of the operational scenarios in developing this assessment zone. Further, the current analyses do not include an operational assessment of the impact of the assessment zone in densely populated areas, which may present additional variables, including the risk posed to people and property for operations such as UAS using certified avionics which may be required to operate within the assessment zone."[2]

This statement describing the incomplete nature of the FAA's assessment zone evaluation was not created by ALPA, but by DOT. Since the FAA is a component agency of the DOT the DOT's conclusion that the FAA analyses were "not exhaustive," and did not include, for example, "densely populated" areas, is authoritative. The National Telecommunications and Information Administration ("NTIA") concluded after evaluating all collected GPS data, including the raw data produced in the DOT ABC Assessment, that even very low power levels from a terrestrial system in the adjacent band will degrade the functionality and performance of the very sensitive equipment required to receive and process GPS signals.[3] Under these circumstances it was improper to give decisive weight to performance-based testing over existing established standards.

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[2] DOT, *Global Positioning System (GPS), Adjacent Band Compatibility Assessment – Final Report* at VII (Apr. 2018), https://www.transportation.gov/sites/dot.gov/files/docs/subdoc/186/dot-gps-adjacent-band-final-reportapril2018.pdf ("DOT ABC Report").

[3] *See* Petition for Reconsideration or Clarification of the NTIA, at 9 (May 22, 2020).

II. The Commission's Analysis of Risks to Airline Operations including to Terrain Awareness and Warning Systems (TAWS) was Incomplete

Prior to the availability of TAWS, Controlled Flight into Terrain was the leading cause of fatalities in aviation.[4] Since then, U.S. airliners equipped with TAWS have had an incredible record with no known passenger fatalities due to controlled flight into terrain. TAWS as a safety-of-life system must be fully operational in flight irrespective of where an airliner is located, particularly in situations where the aircraft is experiencing an emergency and may in fact be outside of normal operational airspace.

Ligado and JHW simply failed to substantively respond to ALPA's valid and serious concerns that the Commission's Order didn't ensure that airline GPS-navigation and TAWS remain fully operational irrespective of the location of the aircraft and regardless of whether visual flight conditions are present. JHW asserted (at 3) that only normal airline operations need be considered by the Commission when it evaluates risks. JHW claimed (at 9-10) that ALPA misstates the "proper use" of GPS at low altitudes and the "risks" of low-altitude flight. JHW pontificated that since aircraft on approach or landing are at extreme risk of collision with the ground or structures if they operate below FAA obstacle clearance surfaces, "for that reason [aircraft] do not do so when on instrument approaches." JHW's statements are nonsense. Its statements are akin to saying that because motor vehicles are at an extreme risk of collision if they depart a highway, guard rails are not necessary. We all know that motor vehicles depart their intended pathways for a variety of reasons, and so do aircraft. Some of those circumstances

[4] *SE001: Terrain Awareness and Warning System (TAWS) – Final Report to CAST*, https://www.skybrary.aero/index.php/SE001:_Terrain_Awareness_Warning_System_(TAWS)_-_Final_Report (2006; includes updates to date)(last visited June 8, 2020).

were identified in ALPA's Petition. Pet. at 9.[5] If aircraft could be counted to fly only normal and preplanned flight paths, there would be no need for TAWS devices.

JHW's Opposition (at 6) misconstrued ALPA's position and complained "the FAA has *never* treated the standoff cylinder as an obstruction necessary for inclusion in applications such as Terrain Awareness and Warning Systems ("TAWS"), nor would such treatment be appropriate." ALPA never suggested that standoff cylinders were appropriate to include as obstructions in a TAWS database. Rather, ALPA contended that the risk scenarios mentioned in its Petition may occur within the assessment zone, including within a standoff cylinder.

Some of the scenarios mentioned in ALPA's Petition are by their very nature emergency situations and not the routine operations analyzed by the FAA. The helicopter TAWS analysis mentioned in the DOT ABC Report (at 148) and heavily relied upon by Ligado's Opposition (at 18) was based on an assumption that the helicopter was operating normally at a defined stand-off distance from the base station acceptable to Ligado. The FAA never conducted an operational evaluation of emergency or non-normal airline TAWS operations in the immediate vicinity of a proposed Ligado base station. Thus, based upon the limited performance-based testing in the record there is no substantial basis to conclude that airline TAWS and GPS-navigation will not be adversely affected in the immediate vicinity of Ligado base stations. Given that the performance of certified TAWS units within the assessment zones and stand-off cylinders surrounding Ligado's proposed base stations remains unknown, ALPA remains greatly concerned that the Commission reached its findings and conclusions without properly evaluating

[5] Reasons mentioned by ALPA in its Petition why an aircraft may operate outside of an intended flight path include approaches to landing in conditions such as wind shear, turbulent or rough weather, high winds, during emergency situations such as an engine failure on takeoff, or during collision avoidance maneuvers near an airport at a low altitude.

continuity and functionality of TAWS (and GPS-navigation) in the vicinity of Ligado base stations.

The Order's reliance on visual separation to mitigate base station interference is apparently based on the "stakeholder input" from a single operator, Metro Aviation.[6] *See* Ligado Opp'n at 18. The input of a single non-airline operator is an insufficient basis to conclude that GPS-equipped aircraft will remain be able to rely upon visual conditions to remain clear of Ligado base stations under a wide variety of normal and non-normal operational conditions. The visual flight rules do not eliminate the legal requirement for installed GPS-navigation and TAWS equipment to be operational in all relevant locations in any weather conditions.[7] Relevant locations for purposes of TAWS performance include but are not limited to urban areas and areas near airports served by airlines where Ligado base stations may be located.[8]

Interpretation of the federal aviation regulations is not within the Commission's, or Ligado's, purview. Ligado is not an aviation operator and its argument that the Commission properly relied upon the visual flight rule to mitigate the potential harmful interference in the immediate vicinity of its proposed base stations is simply nonresponsive to ALPA's concerns. As

[6] Ligado's Opposition cites (at 18) the Letter from Mike Stanberry, President, Jim Arthur, Director of Operations, Metro Aviation, to Marlene H. Dortch, Secretary at 1-3, FCC, IB Docket Nos. 11-109, *et al.* (filed July 9, 2018). Metro Aviation is a relatively small Part 135 helicopter emergency services operator based in Shreveport, LA, it is not an airline. *See* https://www.metroaviation.com/.

[7] *See* 14 CFR 91.213 (installed equipment must be operational), 14 CFR 121.354 (TAWS requirement); FAA Advisory Circular AC 20-138D Change 2, Section 12-2, Positioning and Navigation Systems, Failure Classification (Apr. 7, 2016) ("From enroute through Category I precision approach, the loss of navigation function is typically considered to be a major failure condition for the aircraft.").

[8] Ligado's Opposition (at 20) dismisses ALPA's concerns regarding SATCOM operations as involving issues already comprehensively addressed. ALPA defers to the reply(s) of other Petitioners on this topic.

airline pilots, we stand firm, TAWS must remain functional in all normal and non-normal operations while the aircraft is in flight.

III. ALPA's Safety Concerns about Risks from UAS and General Aviation aircraft remain Unrebutted

JHW's Opposition contends (at 7) that "[c]ontrary to what the Petitioners suggest, Ligado's proposed operations . . . do not present a legitimate harmful interference risk to these UAS over what is already expected by UAS manufacturers." JHW asserts this is true even for those that will operate as close as within 50 feet of Ligado's base stations. JHW Unmanned Solutions works with UAS manufacturers that build UAS to inspect infrastructure that exposes the UAS to high intensity radiated fields ("HIRF"). These UAS, which are often used for the close inspection of utility transmission lines and towers, are built to withstand operation within HIRF generated by those transmission lines.

JHW's contentions, if accurate, are only true for a subset of UAS operators There are over 1.5M UAS registered in the United States of many makes and models, including home built UAS. These UAS may use GPS receivers of any kind as there are no standards for the design of UAS. ALPA is concerned about operations of all kinds of UAS, including those used by hobbyists through those used in commercial service. As JHW admits (at 7) his comments apply to UAS that are specifically designed to operate in close proximity to HIRF which by necessity must have additional protection. In the absence of evidence to the contrary it must be assumed these electronically hardened UAS comprise only a very small fraction of the 1.5M UAS currently in operation. The Commission's Order itself (at ¶ 72) concludes UAS are likely to be equipped with non-certified aviation receivers: "A more likely scenario would be that small UAS will use less expensive, smaller form factor, lighter weight non-certified devices." A consumer UAS cannot be assumed to have HIRF protection.

There is no basis in the record to conclude that the sample units tested by Roberson and Associates, LLC ("RAA") are representative of the broad range of GPS receivers installed in UAS. The FAA does not require UAS or their sub-systems including GPS receivers, to be certified or to utilize certified components. However, the FAA *does* allow UAS operators to navigate with sole reliance on GPS. Even though the Order acknowledges that smaller UAS likely will use non-certified aviation devices, the base station EIRP limits will allow UAS using these devices to operate within 50 feet of base stations. Since a consumer small UAS will likely not have a certified aviation GPS receiver, its performance near the cylinder is unknown, and certainly it cannot be assumed to be unaffected even if it stays outside of the cylinder.

Drone operators experiencing interference in the vicinity of base stations may fly in unwanted and unplanned directions and at unplanned altitudes. There are documented examples of UAS that have flown for several miles at altitudes above 400 feet after the operator has lost navigational control.[9] Small UAS are generally intended to operate below 400' altitude but are capable of flying thousands of feet above ground. For example, a typical consumer UAS can be flown without modifications, in areas from sea level to Denver, Colorado where the elevation is more than 5,000 above sea level. The UAS interference assessment in the Order is neither comprehensive or complete, and a meaningful UAS-related risk assessment is absent from the Order for both present and foreseeable UAS vehicle technologies.

Finally, while JHW states (at 11), that use of non-certified and portable GPS devices by general aviation ("GA") pilots for primary navigation would be a violation of FAA regulations,

[9] For example, in June 2018, a DJI Phantom 3 consumer drone in Las Vegas, NV began "losing GPS" and, "drifted over two miles at an altitude of 450 feet towards McCarran International Airport where it landed only a few feet away from an active runway." Haye Kesteloo, *Drone pilot fined $20,000 after fly-away DJI Phantom 3 lands at McCarran Airport in Las Vegas* (Nov. 24, 2019), https://dronedj.com/2019/11/24/drone-pilot-fined-20000-mccarran-airport-las-vegas/.

he does not assert that this is not in fact happening. In the absence of evidence to the contrary that should have been assessed as a risk factor. Should a scenario occur where a GA pilot using a non-certified or hand held device receives errant GPS navigation information, there is an increased likelihood that the aircraft will wander off course into an airport traffic area or the path of an airline aircraft. The Commission's reliance on limited and incomplete performance-based testing sponsored by Ligado to conclude that non-certified UAS and GA receivers will not be meaningfully affected is, as stated in our petition (at 13-15), another reason the Order should be reconsidered and withdrawn for additional findings.

IV. The Commission to Failed to Properly Consider the Costs of its Decision

Agencies must ordinarily consider costs unless Congress directs otherwise. The Commission previously recognized a need for and adopted cost-benefit guidance. It was unreasonable and arbitrary for the Commission not to perform a cost-benefit analysis before granting Ligado a license in this case. Ligado's Opp'n at 13, argues that the Order "[c]orrectly [c]alculated" the costs and benefits associated with granting Ligado's applications. In fact, the Order contains no discernible cost-benefit calculation at all. The Commission did identify unquantified benefits in the prospect of enhanced public access to 5G services, but it failed to account for any costs or burdens imposed on the parties or the pubic by the Order.

Ligado's Opposition (at 14) attempts to boldly pave over the Order's absence of a cost-benefit analysis by asserting that the Commission concluded "that the allegations of harmful interference are baseless or sufficiently addressed – which mitigates any possible costs." Unfortunately, no such analysis is discernible upon review of the actual Order. A filing provided by the Brattle Group largely echoes Ligado's position and concludes because of the reduction in base station power to 10W and the Order's ultimate finding of no harmful interference that the cost to consumers, corporations and the government will be "near zero." *See* Brattle Opp'n at 10-

14. Neither Brattle nor the Commission addressed the possibility of non-economic harm to the public.

In contrast, the record itself is replete with unresolved references to likely equipment replacement costs including government equipment and existing GPS equipment, receivers, and antennas in the possession of corporations and private parties including small businesses in amounts and at figures the Commission didn't even try to guess. Agencies act arbitrarily and capriciously where they "entirely fail[] to consider an important aspect of the problem."[10] The Commission's lack of any reasonable cost-benefit analysis is a glaring oversight and a valid reason for the Order to be withdrawn and re-evaluated.

V. The Issues raised in the Commission's 2020 Licensing Order are distinctly new and different those covered in the 2003 Flexible Delivery Rulemaking

Ligado argues ALPA's Petition essentially seeks reconsideration of the FCC's 2003 ATC decision. Ligado is essentially incorrect. The approval of 10W transmitters for 5G network use presents a fundamentally different type of expansion beyond that envisioned in the Commission's 2003's Flexible Delivery Rulemaking. The 2003 Rulemaking concluded that "flexible delivery" could be authorized so long as an "added terrestrial component remained ancillary to the principal MSS offering." FCC 03-15, at 3-4. Although the Commission in 2003 declined to adopt a formal definition of "ancillary," in the Ligado proceeding the satellite component appears ancillary to the proposed terrestrial 5G service leading to widespread concern and opposition among legacy MSS users including those in the aviation industry. While the Order does note (at ¶ 121) that Ligado remains a significant and substantial provider of MSS, the

[10] *Motor Vehicles Mfrs. Ass'n of the United States, Inc. v. State Farm Mut. Auto. Ins. Co.*, 463 U.S. 29, 43 (1983).

Commission does so almost as an afterthought. The Order's focus is on terrestrial 5G service with 10W output, a level of power far that far outstrips the satellite component.

Such a significant policy shift should be handled in an open or public policy proceeding with notice and opportunity for public comment where the burden and risk of harm to the public can be properly considered.

CONCLUSION

Considering the evidence of and the risks identified by ALPA and others, it is clear the Commission made a hasty, arbitrary, and incorrect decision will impede ongoing work on spectrum sharing. For that and the reasons discussed above ALPA urges the Commission to reconsider, reverse its decision, and withdraw in its entirety its April 22, 2020 Order granting Ligado a license and authorizing the operation of terrestrial transmitters in the 1525-1559 MHz and 1626.5-1660.5 MHz bands.

Respectfully Submitted,

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CERTIFICATE OF SERVICE

Pursuant to the Commission's Rules of Practice, I hereby certify that on this 8th day of June, 2020, I filed the foregoing Reply to Oppositions to Petition for Reconsideration of the Air Line Pilots Association, International via the Commission's ECFS electronic filing system, and served by electronic mail by consent an electronic copy of the Reply on the following:

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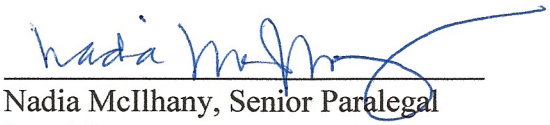

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