Before the
Federal Communications Commission
Washington DC 20554

In the Matter of	
Procedures to Govern the Use of Satellite Earth Stations on Board Vessels in the 5925-6425 MHz/3700-4200 MHz Bands and 14.0-14.5 GHz/11.7-12.2 GHz Bands	IB Docket No. 02-10

REPLY COMMENTS OF THE FIXED WIRELESS COMMUNICATIONS COALITION

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Pursuant to Section 1.415 of the Commission's Rules, the Fixed Wireless Communications Coalition (FWCC) files these Reply Comments in response to the Notice in the above-captioned docket.[1]

A. Summary

Fixed Service (FS) point-to-point microwave has successfully shared C-band spectrum with Fixed Satellite Service (FSS) earth stations for almost 40 years. Now the Commission proposes to place satellite earth stations on moving ships -- "earth station vessels" (ESVs) -- into the same bands. ESVs pose a serious threat of interference to FS systems that support vital public safety and critical infrastructure functions. The Fixed Wireless Communications Coalition (FWCC) therefore asks the Commission to prohibit ESV operation on C-band

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[1] *Use of Satellite Earth Stations on Board Vessels*, 18 FCC Rcd 25248 (2003) (Notice). The FWCC is a coalition of companies, associations, and individuals interested in the Fixed Service -- *i.e.*, in terrestrial fixed microwave communications. Our membership includes manufacturers of microwave equipment, licensees of terrestrial fixed microwave systems and their associations, and communications service providers and their associations. The membership also includes railroads, public utilities, petroleum and pipeline entities, public safety agencies, and/or their respective associations, landline and wireless, local, and interexchange carriers, and telecommunications attorneys and engineers. Our members build, install, and use both licensed and unlicensed point-to-point, point-to-multipoint, and other fixed wireless systems, in frequency bands from 900 MHz to 95 GHz. For more information, see www.fwcc.us.

frequencies within 300 km of the U.S. coastline. We have no objection to Ku-band operation anywhere, or to C-band operation on the open sea, where Ku-band coverage may not be adequate.

Alternatively, if the Commission allows C-band ESVs near the coastline, then it must take the necessary steps to protect FS operations from interference. ESV proponents generally object to such measures on the ground that they may increase costs or impair service. Instead, the ESV industry seeks rules that would shift some of the risk and expense of ESV operation to the FS. But the Commission has always required an incoming technology to protect licensed incumbents. FS operators built their systems in prudent reliance on the Commission's Rules. They should not now be asked to accept deleterious changes solely to favor another industry. As the financial beneficiaries of their own operations, ESV providers should pay the costs of safely squeezing those operations into already congested spectrum. Any other result would entail the FS involuntarily subsidizing ESVs -- a patently unfair outcome.

ESV proponents counter with a claim that FS operators have never been able to substantiate interference from ESVs. Signals from a moving ESV are intermittent, transient, and hard to track down. Without basic operational information about the ESV, identifying it as the cause of interference requires taking the FS link out of service for an extended period. And even when FS operators have taken the trouble to shut down a link and gather data on an interference incident, ESV providers have still refused to provide the information needed to identify a particular ESV as the source. The lack of substantiation thus reflects not an absence of interference, but rather an absence of cooperation from the ESV industry.

ESVs differ fundamentally from fixed earth stations in the process of frequency coordination, which enables FS operators and earth stations to share the same frequencies. An applicant for a new fixed facility -- whether FS or FSS – must notify those already in the band of its plans in full technical detail. Each incumbent can use that information to calculate how much power its receivers will see from the new facility, and can object if the levels would be high enough to disrupt service.

Some ESV proponents want the option of skipping frequency coordination altogether. Instead they would offer information to allow identification of a vessel that causes interference, presumably on the theory that the ESV could then be notified and turned off. That is not an acceptable approach. Even if the offending vessel can ultimately be identified, it will have long since moved on.

Frequency coordination is essential. But in the case of ESVs -- unlike fixed earth stations -- it is not enough. The interference calculations in frequency coordination depend critically on the location of the proposed facility. An ESV must coordinate not just at a single location, but at every point along its planned route. Effectiveness of the coordination depends on the vessel's staying on that planned course. Even then, there may be route segments where interference into FS links cannot be resolved. And, if an FS operator chooses to accept a momentary risk of interference as the ESV moves through the FS antenna pattern, then the coordination will also depend on the vessel's maintaining some minimum speed.

In short, even a successfully coordinated ESV can still cause interference if it leaves the coordinated route, enters an uncoordinated route segment, or slows down. For that reason the FWCC strongly urges the Commission to require that ESVs be fitted with GPS-based equipment

programmed to shut down automatically if the vessel departs from its coordinated parameters. Some ESV proponents argue for a manual shut-off system instead. But that can take effect only after the interference has occurred, and the FS operator has been able to identify the vessel and report the incident -- far too late to be helpful.

In the event interference does occur, FS operators need real-time access to information that can identify the source, including ESV itineraries, frequency, bandwidth, and satellites, along with an ESV point of contact. ESV operators object that some of this information is competitively sensitive. To alleviate their concerns about improper disclosure, and also of frivolous interference complaints, we suggest the ESV data be held by a trusted third party that would receive data on an FS interference incident and provide back to the FS operator only the name of a vessel (if any) capable of having caused the interference.

In addition, we suggest that ESV frequency coordinations be limited to 36 MHz in each direction on each of two satellites per operator and be updated every six months; that ESV license terms be limited to two years; that ESVs be restricted to ships of 5,000 gross tons or greater, so as to limit operation to deep draft vessels that operate in coastal waters or major waterways; that ESVs docked in port continue to be treated as temporary-fixed earth stations; and that the coordination distance be set at 300 km and the presently-used long-term and short-term coordination objectives at -154 and -131 dBW/4kHz -- more lenient than the values generally required by the FS.

One ESV operator asks the Commission to take into account its large investment in C-band equipment. The Commission should remind this party of its repeated warnings that any investments made under experimental licenses and Special Temporary Authorities are at the

provider's risk. That makes all such past investments irrelevant to the Commission's decision here. And, finally, we note that ESV operation is not a new technology or service meriting special encouragement under Section 7 of the Communications Act, but rather is a decades-old technology used to deliver long-established services. Nothing here is new but the location of the end users.

The FS routinely transmits communications for dispatching police and fire vehicles, coordinating railroad trains, controlling pipelines, regulating electric and water utilities, and backhauling wireless telephone traffic. Its reliable operation is essential to the nation's safety and well-being. If the Commission permits ESV operation close to shore on shared frequencies, we ask that it impose the necessary controls to ensure that FS communications can continue unencumbered.

B. The Fixed Service is Entitled to Full Protection from ESVs.

The Commission proposes to allow ESVs in frequency bands 5925-6425/3700-4200 MHz (C-band) and 14.0-14.5/11.7-12.2 GHz (Ku-band). The FWCC has no objection to Ku-band ESV operation under any conditions, nor to ESV downlink operation at 3700-4200 MHz, assuming FS stations are not required to protect the ESVs against interference.[2] (The FWCC would strongly oppose any such requirement, as it would make the band unusable over many densely populated areas of the country.)

[2] We take the same position on Intelsat's request to extend the Ku-band downlink spectrum to include 10.95-11.7 GHz. Intelsat at 2. This is part of a heavily used FS band.

We have well-founded concerns about ESV operations at 5925-6425 MHz. This band is heavily used by the FS, and would be an uplink band for ESVs. High-powered transmissions from moving ships pose a serious threat of interference to FS receivers.

1. Equitable and statutory considerations mandate full protection for the Fixed Service.

Beneath all the detail, this proceeding comes down to a simple policy question: will ESVs be made subject to the same non-interference requirements that are imposed on other services?

The Commission established the C-band FS allocation in 1948,[3] and added an FSS allocation in 1965.[4] Rules and procedures developed over the four decades since enable the FS and FSS to coexist successfully. Indeed, the sharing arrangements work so well that FS operators routinely use the band for critical safety and infrastructure services that require 99.999% ("five 9's") or better availability. These include forwarding police and fire dispatch communications, coordinating the movement of railroad trains, controlling natural gas and oil pipelines, regulating the electric grid and water utilities, and backhauling wireless telephone traffic, among many others.[5]

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[3] *Allocation of Frequencies to the Various Classes of Non-Government Services in the Radio Spectrum from 10 Kilocycles to 30,000,000 Kilocycles*, 39 F.C.C. 298 (1948).

[4] *Amendment of Part 2 of the Commission's Rules to Conform, to the Extent Practicable, with the Geneva (1959) Radio Regulations, As Revised by the Space EARC, Geneva, 1963* , 39 F.C.C. 975 (1965).

[5] MTN says the importance of these services is irrelevant and "of no legal consequence" because C-band is a commercial band, not a "safety service band." MTN at 4-5. This is incorrect for two reasons. First, there are no reserved "safety service bands" in the FS allocations. Second, the Communications Act instructs the Commission to regulate radio services "as public interest, convenience, or necessity requires[.]" 47 U.S.C. Sec. 303

The principle behind the FS/FSS sharing arrangements is straightforward: each new facility -- whether an FS link or FSS earth station -- must choose its location and frequencies to ensure it will not interfere with facilities already in place.[6] The rules also leave room for reasonable expansion by both industries. *The Commission should condition the introduction of ESVs into the band on their meeting these same principles.*

Because they transmit while in motion, ESVs have a much higher propensity to cause interference than do fixed earth stations. We do not dispute that avoiding interference to FS links may entail some cost to ESV operators, and possibly may limit the services they can offer. On the other hand, if the Commission failed to protect the FS from ESVs, that would impair the service we provide, which amounts to shifting costs of providing ESV service to the FS. Requiring the FS to subsidize ESV operations would violate the most elementary principles of fundamental fairness.

We cannot find any instance in which the Commission knowingly and deliberately allowed a new service to operate on commercially licensed frequencies without affording the incumbents full protection. Indeed, its doing so would violate the Communications Act, which since 1934 has charged the Commission to

> [m]ake such regulations not inconsistent with law as it may deem necessary to prevent interference between stations . . . .[7]

(preamble). This language should impart a high priority to critical infrastructure services.

[6] *See generally* 47 C.F.R. Secs. 25.203, 101.103 (requiring frequency coordination).

[7] 47 U.S.C. Sec. 303(f).

ESV proponents' complaints about an "overt bias toward the FS at the expense of ESVs"[8] -- and their quest for "fair and balanced rules"[9] -- thus reflect a grave misunderstanding of the Commission's task here. The goal is *not* to reconcile the interests of two industries with an equal claim to the same band of spectrum. The claims are not equal at all. As the interfering latecomer, ESVs are subordinate to the FS. The Commission properly set out the premise that ESV operation

> shall not cause harmful interference to, claim protection from, or otherwise impose constraints on the operation or development of other radio services operating in the bands.[10]

PanAmSat states (incorrectly) that the Commission can achieve this objective by making ESVs co-primary with the FS, on the theory that frequency coordination will "eliminate any 'constraints on the operation'" of FS stations.[11] Just the reverse is true: frequency coordination on a co-primary basis will eliminate FS expansion in the heavily populated areas where it is needed most.

Both the Communications Act and principles of simple fairness obligate the Commission to arrive at ESV rules that protect the FS. The Commission may permit the development of ESV service, but not at the expense of FS operators. While ESV proponents are entitled to "regulatory

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[8] MTN at 2. But Stratos, an ESV provider that also operates C-band FS links, understands the need to protect FS operations. Stratos at 7-8.

[9] MTN at 6.

[10] Notice at para. 45.

[11] PanAmSat at 3.

certainty,"[12] they are not entitled to certainty of operation at locations and on frequencies that would interfere with the FS.

2. The Commission must disregard ESV claims of non-interference into the Fixed Service.

ESV provider MTN resists any call to protect the FS by claiming there have been no "substantiated" instances of interference into FS receivers.[13] These claims cannot be credited, for two reasons.

First, in cases where ESV transmissions have been suspected as the cause of interference, ESV operators repeatedly and consistently refused to provide information that could have corroborated the causal connection.[14] The lack of substantiation does not imply a lack of interference -- just a lack of cooperation by ESV operators.

Second, because the source is moving, ESV transmissions as registered at an FS receiver are necessarily intermittent and transient. This makes it difficult to correctly identify ESV interference as such. The interference cannot itself be "seen" on an operating FS link, but rather would have the effect of degrading the threshold of the FS receiver, thereby increasing the fraction of time the microwave path would be out of service. In the absence of cooperation from

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[12] MTN at 3.

[13] *E.g.*, MTN at 9-10; MTN at 2 (claiming "theoretical threat of harmful interference that has failed to materialize"). *See also* Reply Comments of Broadband Maritime at 1-2 (filed March 22, 2004) (comparing FWCC's requests for interference protection to the burning of innocent persons at the stake on allegations of witchcraft).

[14] For details on past ESV stonewalling of the FS community on suspected interference, see *Reply Comments of the Fixed Wireless Communications Coalition* at 5-7 , IB Docket No. 02-10 (filed June 10, 2002); *Comments of the Fixed Wireless Communications Coalition* at 4 & n.5, IB Docket No. 02-10 (filed May 10, 2002).

the ESV operator, identifying an interfering ESV transmitter as the cause of an outage requires the FS operator to shut down the system, stopping all communications for an extended period of time.[15] These interruptions are not practical where the link carries communications that support vital public safety and critical infrastructure functions.

In short, MTN has no right to dismiss interference instances as not "substantiated" when MTN itself has withheld the information needed for substantiation.

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[15] We related the following incident in an earlier pleading. The FS operator ultimately had to change frequencies by trial and error to eliminate the interference.

> The FWCC has since become aware of another possible incident of ESV interference to FS communications, this one involving a link operated by Verizon Wireless in the vicinity of Newport News, VA. One end of this 12.6-mile link is at 37-12-41.9 N and 76-34-53 W (the "Lee Hall" site), transmitting on 6226.89 MHz with space diversity receive antennas at 175/145 ft. AGL. The other end is at 37-22-51.2 N and 76-29-30.7 W (the "Gloucester" site); transmitting on 5974.85 MHz, with space diversity receive antennas at 170/135 ft AGL. The radio is by Tadiran Microwave Networks, Model CM6HC/3DS3, using a 30 MHz RF channel. The link was installed in mid-November 2000. In the summer of 2001, traffic outages began to occur, and the manufacturer was called in to investigate. During a several-month period, alarms were observed in the Lee Hall radio indicating sudden onset of high bit-errors. Monitoring of the link by the manufacturer established that fading activity during the period was completely uncorrelated in time with the traffic-affecting events, and thorough evaluation of the equipment disclosed no hardware malfunctions. The problem occurred on both diversity antennas at the Lee Hall site; that is, when the outages occurred, the link automatically switched to the other antenna, but the problem persisted. The source of the interference could not be identified because of the intermittent nature of the outages. . . . This fact pattern supports the inference that the outages were being caused by intermittent transmissions in the direction of the Lee Hall site on the same frequency as the original (pre-swap) receive frequency at that location. The proximity to Newport News strongly suggests the possibility of a nearby vessel equipped with an ESV station.

Comments of the Fixed Wireless Communications Coalition at 4 n.5, IB Docket No. 02-10 (filed May 10, 2002).

C. Methods for Protecting the Fixed Service

In principle, there are two alternative ways to protect the FS from ESV interference: prohibiting C-band ESV operation within 300 km of the U.S. coastline; or permitting such operation under the constraints and controls needed to keep the interference into FS receivers to acceptably low power levels.

1. No C-band operation within 300 km of the U.S. coastline

The surest protection against interference is to rule out C-band operation within 300 km of the U.S. coastline.[16] ESVs could still use C-band far out at sea, but would have to shift to Ku-band as they approach land.

Most ESV proponents disfavor this approach.[17] They argue that Ku-band transponder capacity is insufficient to support the level of service they wish to offer;[18] that Ku-band satellites offer only limited footprints and are susceptible to rainfall outages in some areas;[19] that restricting C-band in favor of Ku-band would put U.S.-licensed ESVs at a disadvantage abroad;[20] and that dual-band operation would increase costs.[21] On the other hand, Inmarsat points out that

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[16] The Commission agrees: "[I]t it is significantly more difficult to establish a regime to permit sharing between FS systems and 'in-motion' ESVs in the C-band as compared with the Ku-band. For this reason, we strongly favor rules that would encourage ESV use of the Ku-band over the C-band." Notice at para. 29.

[17] On the other hand, Boeing seeks to offer ESV service exclusively in Ku-band.

[18] MTN at 7; Telenor at 4.

[19] Intelsat at 4; MTN at 7; Telenor at 4-5; Stratos at 9; SES Americom at 3.

[20] Stratos at 9.

[21] MTN at 8-9; Telenor at 6 n.11; Stratos at 10. Broadband Maritime further objects that dual-band operation would require a manual change-over, necessitating the presence on board of a person skilled in ESV operations and distracting personnel at the critical time as the

single-band equipment and transponder capacity are far less expensive for Ku-band than for C-band.[22]

For the sake of discussion, we can assume all of the opposing assertions are correct -- that adequate protection for the FS will entail costs and service limitations for ESVs. But if lack of these protections resulted in ESVs causing interference, the costs and limitations would fall on the FS. Considering that the ESV proponents are the sole economic beneficiaries of their own operations, it is reasonable to ask that they bear their own costs.

Intelsat states C-band ESV operation even within 100 km of the coastline is safe for the FS. It assumes that ESV antennas will point at mid-ocean satellites, and hence be aimed away from the coast.[23] But a glance at the map shows dramatic east-west coastline irregularities, so an ESV near parts of (for example) the east coast and pointing eastward can still affect major land areas. Moreover, the back side of an ESV antenna offers only a small improvement in signal suppression relative to the front side -- *e.g.*, 10 dB less gain (or more suppression) on the back side as compared to front toward the horizon for an elevation angle of 19 degrees. In any event, there is nothing to stop an ESV near the coast from choosing a satellite over the continent, even one orbiting at a distant longitude. That would entail pointing the ESV antenna landward, and possibly at a very low angle. Intelsat offers nothing to rule out this scenario.

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ship approaches port. Reply Comments of Broadband Maritime at 4 (filed March 22, 2004). But we are confident the maritime industry can develop a dual-band earth station whose change-over is either automatic or manageable by personnel having a minimum of training. And we think the change-over should occur 300 km out, long before the ship reaches port.

[22] Inmarsat at 17.

[23] Intelsat at 4-5.

2. Coordinated operation with additional precautions

If the Commission permits ESV C-band operation within 300 km of the coast, then protecting FS links will require the combination of measures laid out in the FWCC's first-round comments:

- Prior frequency coordination.
- On-board GPS-based equipment that automatically shuts down the ESV if the vessel departs from the frequency-coordinated route, or enters a route segment that could not be successfully coordinated, or drops below the coordinated speed.
- ESV coordination limited to bandwidth for which the ESV operator can demonstrate actual need, not to exceed 36 MHz in each direction on each of two satellites per operator, and to the azimuths and elevations for those individual satellites.
- Real-time access by FS operators to ESV vessel itineraries, frequency, bandwidth, and satellites, and access to a 24/7 point of contact capable of shutting down ESV transmissions if necessary.
- ESV license terms limited to two years.
- ESV operation limited to ships of 5,000 gross tons or larger.

The Notice proposed imposing *either* frequency coordination *or* the other measures listed above.[24] Some in the ESV industry want the freedom to choose between the two.[25] Some like

[24] Notice at paras. 64-70. The Commission proposed a minimum vessel size of 300 gross tons. Notice at para. 54. We discuss this issue below.

[25] Inmarsat at 18-23.

neither approach.[26] Some support only coordination,[27] while one complains it would be costly and impractical to coordinate each port.[28]

Frequency coordination is necessary. Frequency coordination is essential to preventing interference. The measures proposed for non-coordinated operation merely facilitate identification of the offending vesseland *only after the interference occurs*.[29] The National Spectrum Managers Association points out why giving ESV operators a choice between coordinated and non-coordinated operation is unacceptable:[30] An ESV operator whose efforts at coordination meet with unresolvable objections of interference to FS facilities could proceed anyway, cause the interference, and leave the FS licensee with no recourse but an after-the-fact interference complaint, long after the vessel has moved on.

Frequency coordination is not sufficient. On the other hand, frequency coordination alone is not enough to protect the FS from ESV interference. Unlike the case of a fixed interference source, such as a conventional earth station, a moving source leaves open the very real possibility of interference even after successful frequency coordination.

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[26] MTN at 13 (either approach would increase the current regulatory burdens on ESV operations without providing regulatory certainty).

[27] PanAmSat at 2; Intelsat at 6-7.

[28] Broadband Maritime at 3.

[29] Notice at paras. 64-68.

[30] National Spectrum Managers Ass'n at 16.

(a) How frequency coordination works

An operator planning a new C-band FS link or FSS earth station must provide a frequency coordinator with details of the proposed facility, including the exact location, direction of the path, type of antennas, frequencies, bandwidths, power levels, and modulations.[31] Working with a database of all proposed, applied-for, and licensed FS links and FSS earth stations, the coordinator identifies licensees and applicants potentially in danger of receiving interference from the new facility, and provides them with the technical information in the form of a "prior coordination notice," or PCN. Recipients of the PCN can consent to the new facility, request changes, or object outright. Only after coordination has been successfully completed and any interference issues have been resolved will the Commission accept the application for processing.

The coordinator also predicts interference *into* the new facility from preexisting licensees and applicants. Operators of the new facility can choose to accept any such interference, change frequencies, move the planned site, install a berm or other shielding, or take whatever other measures they deem appropriate.

(b) Why frequency-coordinating ESVs does not eliminate the possibility of interference to the FS

Frequency coordination of an ESV differs from that of a fixed earth station in three crucial respects. First, the coordinator must analyze and predict interference from the ESV not just at a single location, but at every point along its planned route. There may be segments of the route where interference into FS links cannot be resolved. Second, the coordination rests

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[31] 47 C.F.R. Sec. 101.103.

critically on the assumption that the ESV will stay on the planned course. The coordination offers no assurances against interference from an ESV operating anywhere else. Third, an FS operator may choose to accept a momentary risk of interference as the ESV moves through an antenna pattern, where it would not accept the ESV's remaining stationary at that point. In such a case the coordination conditions will include a minimum speed for the vessel over that part of the route.

If an ESV violates any of the above conditions -- if it strays from its coordinated route, or continues operating into a segment of the route where coordination was not possible, or drops below the coordinated speed -- then the protections offered by coordination simply cease. Interference into FS receivers becomes an active risk. *There is nothing the FS operator can do to avoid this interference*. Each FS receiver is fixed in location, is permanently aimed, and is equipped to receive on certain frequencies. If an ESV operating at the FS frequency travels through the FS receiver's antenna pattern in violation of the coordination parameters -- even many miles away -- the receiver will be subject to interference.

Notwithstanding these facts, PanAmSat believes there is "no reason for relegating ESVs to secondary status" following coordination.[32] No one suggests an ESV operator would deliberately violate the terms of its coordination, but inadvertent deviations are completely foreseeable. Although nominally under control of shipboard personnel, the ESV equipment is ordinarily unattended. When a cruise line directs a vessel to a port other than those coordinated years earlier, or changing conditions require a vessel to approach a harbor on a different course, or to make an unexpected stop, personnel understandably may overlook the need to turn off the

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[32] PanAmSat at 2.

ESV. This is all the more likely if the departure from usual practice results from an emergency. The recent blockage of 155 ships on the southern Mississippi River illustrates the uncertainties inherent in maritime operations.[33]

Protecting the FS against these contingencies requires a GPS-based mechanism that automatically shuts down the ESV outside the coordinated parameters. The National Spectrum Managers Association agrees an automatic shut-off is necessary to prevent "uncoordinated" levels of potentially harmful interference to FS systems.[34] MTN opposes this proposal, arguing it is an "unreliable substitute" for MTN's around-the-clock staff.[35] But MTN adds that its staff will respond only to an "appropriate regulatory authority," which can step in only long after the interference has occurred.[36] Inmarsat admits the ESV operator will have "no control or visibility" of the vessel's itinerary, and that the itinerary is subject to change in short notice[37] -- two more powerful arguments for an automatic cut-off.

As a further safeguard against the inherent uncertainties of ESV operation, the FS needs real-time access to information that can identify an interfering source -- ESV vessels, itineraries,

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[33] http://www.cnn.com/2004/US/South/03/01/ships.collide.ap/

[34] National Spectrum Managers Ass'n at 12. A minority of NSMA members believe the threat of Commission enforcement would be enough to render an automatic shut-off unnecessary. *Id; see also* Pinnacle Telecom Group at 5. We vigorously disagree. If ESV interference indeed became a problem, the consequences of enforcement would come far too late to be of any help to the FS.

[35] MTN at 22. Inmarsat (at 21-22) also prefers a manual shut-off.

[36] *Id*. MTN's sole affirmative objection to an automatic cut-off is a possible "backfire" of the mechanism, *id*., which MTN does not explain.

[37] Inmarsat at 19.

frequency, bandwidth, and satellites -- along with a point of contact capable of shutting down an offending ESV. To avoid the need for disclosure of competitively sensitive data, we would agree to having a trusted third party hold the ESV-provided information. An FS operator experiencing interference would give the third party the location, azimuth, and frequency of the affected receiver, and time and duration of the incident. The FS operator would receive back only the name of the vessel (if any) in a position to have caused the interference. This mechanism also addresses MTN's fears of frivolous and undocumented interference complaints, and of unauthorized access to its data.[38]

Telenor offers a proposal in lieu of frequency coordination: that ESV operators have available a database of FS frequencies in use at various sites, so they can choose non-interfering frequencies along a particular route; and that FS operators have a database of ESV frequencies in use in a particular region -- but without information on vessel positions -- so they can determine whether a particular ESV might be causing interference.[39] Both parts of this proposal greatly underestimate the complexity of predicting and identifying interference events. Moreover, the first part amounts to letting ESVs do their own unilateral frequency coordination on the honor system, while the second part fails to give FS operators the information they most need to identify an interference source, especially in congested coastal areas where both FS links and ocean-going vessels proliferate.

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[38] MTN at 14, 30-31. *Similarly*, Stratos at 11-12, Telenor at 8-9.

[39] Telenor at 9.

(c) Periodic renewal of frequency coordination

Long-term departures from coordination parameters, as when a vessel is permanently rescheduled to operate from a port that has not been coordinated, pose a grave threat of interference. The threat can be limited (although not eliminated) with a requirement that ESVs periodically refresh their frequency coordinations. Pinnacle Telecom Group proposes treating all ESV operations as temporary-fixed, in the belief this would force renewal of frequency coordination every six months.[40] While we think the temporary-fixed designation is wrong (except in port; see Section C, below), we nonetheless support a rule mandating renewal of frequency coordination every six months, as the best way to cut off coordination errors resulting from long-term changes in the vessel's operation.

(d) ESV frequency limitations

The Commission proposes that ESVs not be permitted to "impose constraints on the operation or development" of the FS.[41] To meet growing demand, FS operators must be able to add needed links, or add frequencies to existing links, without fear of ESV interference. But ESV transmit beams mark out large swaths of area along the coast and many miles inland. If all ESVs exercise uncontrolled access to all of the shared C-band spectrum, new FS links may be impossible unless some ESVs change satellite transponders or curtail service. That kind of disruption benefits no one.[42]

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[40] Pinnacle Telecom Group at 5.

[41] Notice at para. 45. ESV provider Stratos agrees, in part because Stratos foresees the need to expand its own C-band FS operations in the Gulf of Mexico. Stratos at 8.

[42] *Accord*, Broadband Maritime at 5 (concerned about disruption of service due to complaints of interference).

FS expansion has long been hindered by the practice of licensing and coordinating every FSS earth station for the full geosynchronous arc and the full band of frequencies, regardless of actual service requirements. (In contrast, FS links are limited to frequencies and azimuths needed.[43]) We understand the original intent was to provide for redundant or contingency operation in the event of satellite or transponder failure. Since the practice was adopted almost 40 years ago,[44] the lifespan and reliability of domestic communications satellites have greatly increased, lessening the need to protect redundant spectrum at the expense of other services.

We ask that ESV coordination and operation be limited to bandwidth actually needed, or at most to 36 MHz in each direction on each of two satellites per operator, and to the azimuths and elevations needed to access those satellites. The frequency coordinators agree that limiting the coordination of ESVs to spectrum actually needed will limit the impact on future FS coordination.[45] To the extent that ESVs can agree on a limited number of transponder bands, the FS can seek to avoid those.

Inmarsat and Telenor both support the 36 MHz limit, but with important conditions.[46] Several providers want ESVs free to operate anywhere in C-band,[47] while some would apply the

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43 47 C.F.R. Sec. 101.141(a)(3) & note 3 in table; 47 C.F.R. Sec. 101.109(b).

44 *Communications Satellite Corp.*, 8 F.C.C.2d 1001, 1003 (1967).

45 National Spectrum Managers Ass'n at 17; Pinnacle Telecom Group at 3.

46 Inmarsat at 19; Telenor at 8.

47 MTN at 16; Inmarsat at 19; Stratos at 13.

limit only to a particular vessel, rather than to all of the ESVs operated by a given provider.[48] Any of these qualifications would largely defeat the purpose of the 36 MHz maximum, at least near land.[49] We agree with Stratos that ESVs should have access to all of C-band more than 300 km from shore.[50] We also agree with SES Americom that there is no need to limit downlink bandwidth, provided ESV receivers will operate on a non-protected basis.[51]

Inmarsat proposes that, if the Commission does constrain ESVs to a portion of C-band, then it should also bar a new FS link in that portion if it would constrain ESV operation.[52] This condition is inconsistent with the basic premises of the proceeding, and the FWCC cannot accept it.[53] But we would support a rule that requires a new FS link to coordinate outside the ESV portion of the band if at all possible, and to use the ESV portion only if no other coordination is feasible.[54]

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[48] Telenor at 8; Stratos at 13. MTN (at 16) opposes both limitation on number of satellites and restriction to a portion of C-band.

[49] In an exceptional case where an ESV can demonstrate need for greater bandwidth, it has access to the waiver procedures under Section 1.3 of the Commission's Rules.

[50] Stratos at 13.

[51] SES Americom at 4-5.

[52] Inmarsat at 20.

[53] Notice at para. 45 (ESVs shall not cause harmful interference to, claim protection from, or otherwise impose constraints on the operation or development of the FS).

[54] This provision should resolve Stratos's contention that identifying certain parts of the band for ESVs would complicate FS coordination. Stratos at 14-15.

(e) License term

The Commission proposed license terms of two years for non-coordinated operation and 15 years for coordinated operation.[55] The ESV proponents variously reject any license term of less than 15 years,[56] request a four-year term for non-coordinated ESVs,[57] and request terms of longer than two years for operation on a non-interference basis.[58]

The two-year license term provides a needed mechanism for ongoing enforcement, given the transient nature of ESV operation. As noted in our first-round comments, we do not expect FS operators will oppose renewal where the ESV licensee has complied with the conditions of frequency coordination and applicable Commission rules.

(f) Vessel size

The Commission proposes that ESVs be allowed only on vessels of 300 gross tons or larger.[59] Some ESV proponents oppose this restriction,[60] while others support it.[61]

The Commission originally permitted ESV service on a record that sought authority primarily to serve ocean-going cruise ships.[62] And indeed, the vessels coordinated to date have

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[55] Notice at paras. 68, 70.

[56] MTN at 13, 15 (for coordinated operation).

[57] Inmarsat at 18.

[58] Broadband Maritime at 3.

[59] Notice at para. 54.

[60] Intelsat at 6-7; SES Americom at 5.

[61] MTN at 21; Inmarsat at 20; Broadband Maritime at 3.

[62] Petition for Rule Making of Crescomm Transmission Services, Inc. in RM-7912 at 7, 8 (filed Dec, 12, 1991) (identifying "cruise lines" as the only specific ESV application). *See*

all been large: cruise ships, U.S. Navy aircraft carriers, and a moveable oil platform.[63] But the proposed 300 gross ton minimum would include far smaller vessels. The particular number of 300 gross tons may derive from the rules requiring certain radio equipment on ships of that size or larger.[64] But that is not a suitable criterion for ESVs.

A 300 gross ton vessel is only the size of a small ferryboat.[65] Although there is doubtless a market for broadband service on small vessels -- perhaps even ferryboats -- the ubiquity of these vessels in coastal and inland waterways poses an unacceptable threat to the FS. We ask the Commission to limit ESV operation to deep draft vessels that operate in coastal waters or major waterways by restricting ESVs to ships larger than 5,000 gross tons.[66] This should include all ocean-going cruise ships. Smaller vessels operating inland or in close-in coastal waters will have access to terrestrial broadband service via Advanced Wireless Systems ("3G").

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also Comments of Crescomm Transmission Services, Inc. (filed April 129, 1992) (same). Apart from satellite providers, Crescomm's main support came from companies providing communications to cruise ships.

[63] National Spectrum Managers Ass'n at 15.

[64] *See generally* 47 C.F.R. Secs. 80.851-81.

[65] For example, the three classes of vessel used for New York City's Staten Island Ferry are 3,335, 2,109, and 499 gross tons, respectively. The smallest of these -- still well over the Commission's proposed minimum for ESVs -- carries only foot passengers and no cars. http://www.nyc.gov/html/dot/html/masstran/ferries/statfery.html#facts

[66] The National Spectrum Managers Association supports a limitation to deep-draft vessels, agrees that vessels small enough to traverse inland waterways were never contemplated, and questions whether the proposed 300 gross ton limit is high enough to restrict vessels to deep-draft channel. National Spectrum Managers Ass'n at 6-7.

(g) Coordination criteria

DISTANCE. The Commission proposes a coordination distance for C-band of 300 km,[67] the same distance supported by both the U.S. Government[68] and WRC-03.[69] Stratos favors either 300 km or 100 km, if the latter included Stratos's offshore FS installations.[70] MTN argues for a 100 km coordination distance, but rests that position on the supposed "long history of operations without incident of interference"[71] -- a claim we disputed in Section B.2, above.

The Commission should adopt the proposed 300 km distance. If the ESV proponents prove to be correct that ESVs in the 100-300 km band are not a potential source of interference, then coordinations at those distances will routinely proceed without any need for responses from FS operators. In that event, a few years' experience may warrant the Commission's reopening the issue. Until actual field data are available, however, we urge the Commission to err, if at all, on the side of caution.

OBJECTIVE. The Commission did not propose a specific interference objective. The parties disagree on the appropriate level.[72] We urge the Commission to take a neutral position at the outset by adopting the presently used *de facto* long-term objective of -154 dBW/4kHz, and

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[67] Notice at para. 74.

[68] Notice at para. 14 & n.28.

[69] Notice at para. 15 (WRC-03 adopted 300 km as the distance beyond which C-band ESVs can operate without the consent of the local administration).

[70] Stratos at 15-16.

[71] MTN at 19-20.

[72] *See, e.g.*, Pinnacle at 3, 4; National Spectrum Managers Ass'n at 10; MTN at 20.

short-term objective of -131 dBW/4kHz. These values are permissive compared to those generally required by the FS.[73]

(h) Non-FCC-licensed ESVs

The Commission has jurisdiction over ESVs on U.S.-registered vessels in U.S. waters. But most of the current C-band ESV are foreign-registered vessels.[74] The Commission lacks jurisdiction to require these to have U.S. (or any other) licenses.[75] It does, however, have full authority to hold ESVs on foreign-registered vessels in U.S. waters to the same non-interference standards as ESVs authorized by the Commission;[76] and of course it has authority over U.S.-licensed ESV hubs. The Commission can and should enforce its non-interference rules against

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[73] Broadband Maritime questions whether FS receivers need desired-to-interference ratios (C/I ratios) of 20 dB. Reply Comments of Broadband Maritime at 2-3 (filed March 22, 2004). Actually, much larger values of C/I are needed to protect these receivers. The Commission requires 6 GHz FS equipment using bandwidths of 10 MHz or more to achieve spectrum efficiencies of at least 4.5 bits/second/Hertz. 47 C.F.R. Sec. 101.141(a)(3). These capacities can be achieved only with higher level digital modulations such as 64-QAM, 128-QAM, etc. Modulations employing a higher number of states require a correspondingly larger C/N or C/I. A 64-QAM receiver requires a C/N of about 24 dB for a bit error ratio of 10^{-3}, which is barely acceptable for voice communication and unacceptable for data. Thus, even an ideal 64-QAM receiver would be unable to operate at a C/I of 20 dB. FS links are typically designed to operate with fade margins of 35 dB or more to ensure that atmospheric multipath fading does not reduce the C/N to the 24 dB level for more than a few seconds per month. As a consequence, FS/FS coordination can be achieved only if the interference from other FS transmitters produces an unfaded C/I of 60 dB or more, depending on the particulars. Frequency coordination has been carried out successfully in the FS for many years on this basis.

[74] Notice at para. 101.

[75] 47 U.S.C. Sec. 306.

[76] "Section 301 of this title [requiring licensing] shall not apply to any person sending radio communications or signals on a foreign ship while the same is within the jurisdiction of the United States, *but such communications or signals shall be transmitted only in accordance with such regulations designed to prevent interference as may be promulgated under the authority of this chapter*." 47 U.S.C. Sec. 306 (emphasis added). *See* Notice at para. 101.

foreign vessels served by U.S. hubs by holding hub operators responsible for the vessels' compliance.[77] In the words of the Notice, the Commission should require the ESV network operator to terminate transmissions from, or refuse service to, ESVs that are not compliant with Commission rules.[78]

We strongly endorse the proposal in the Notice that the Commission prohibit the U.S. licensee of an ESV network from communicating with any ESV station within the specified minimum distances if the ESV is not part of the ESV network licensed by the Commission -- or, in the case of a vessel of foreign registry, is not the subject of a bilateral agreement between the United States and the country of registry.[79] We believe this is consistent with ITU Recommendation 37.[80]

The Notice also asks whether this proposal is "too restrictive" for the case of a foreign ESV whose country of registry has no bilateral agreement with the United States operating through a U.S. hub.[81] We think it is both appropriate and necessary to apply the same constraints

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[77] *Accord*, Inmarsat at 25; Stratos at 22.

[78] Notice at para. 101. The coordinators concur. National Spectrum Managers Ass'n at 17-18; Pinnacle Telecom Group at 6.

[79] Notice at para. 102.

[80] *See* Recommendation 37 (WRC-03), Annex 1, Section A ("The ESV licensing administration or the licence-holder should contact, in advance of ESV operations within the minimum distances, the concerned administration(s) to obtain agreements that will establish the technical bases for avoiding unacceptable interference to the terrestrial facilities of the concerned administration or administrations.")

[81] Notice at para. 102.

to foreign vessels as to U.S. vessels, and to enforce through the hub operator if necessary. We see no other reliable way to protect U.S. FS operators from interference.

C. ESVs Docked in Port Are Temporary-Fixed Earth Stations.

Some ESV providers seek to have in-port ESVs coordinated as fixed earth stations.[82] We disagree. Intelsat argues there is no difference between coordinating ESVs in port and coordinating fixed earth stations.[83] But there is a great operational difference: A fixed earth station remains in place, while a given location at the port is actually occupied by an ESV only intermittently.

This issue was settled in a prior ruling that ESVs docked in port are temporary-fixed earth stations under Section 25.277.[84] The Commission correctly noted that a temporary-fixed license is appropriate for earth stations that remain at a single location for less than six months, and MTN had not shown its ships would remain in port that long.[85] Section 25.277 requires re-coordination each time an ESV docks,[86] and cessation of operation if the Commission or an FS

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[82] MTN at 11-12; Inmarsat at 11-12; Intelsat at 6.

[83] Intelsat at 5-6.

[84] Maritime Telecommunications Network, Inc., File Nos. SES-STA-20000128-00108; SES-STA-20000817-01448; SES-STA-19990120-02064; SES-LIC-19980911-01272 *et al.*; SES-AMD-19981204-01992 *et al.*, 15 FCC Rcd 23210 at para. 24 (2000), *recon. denied*, 16 FCC Rcd 11615 at para. 27 (2001).

[85] *Id*. An earth station at sea that is genuinely fixed in place for more than six months (such as a stationary oil platform) may be entitled to licensing as a fixed earth station. SES Americom at 8-9. But the Commission cannot allow this principle to extend to moving earth stations that stop only temporarily, such as vessels in port.

[86] 47 C.F.R. Secs. 25.277(c), (d).

licensee notifies the ESV of harmful interference.[87] Inmarsat's request for coordination of 3700-4200 MHz downlink frequencies would likewise be handled on a temporary-fixed basis.[88] These provisions are fully consistent with the principle that ESVs not cause harmful interference to the FS.[89]

This matter has been fully litigated, and the ESV proponents have not presented any new policy or technical grounds that would justify reopening it now. Moreover, because the issue was not raised in the present Notice, the Administrative Procedure Act bars the Commission from disturbing the prior ruling.[90]

D. Past Investments by ESV Providers Have No Bearing on This Proceeding.

In seeking continued C-band authority, Telenor asks the Commission to take into account the "huge investment" ESV operators have already made in C-band equipment.[91]

As noted above, the FWCC has no objection to C-band operation more than 300 km offshore, where Ku-band coverage may be inadequate. If that use of C-band proves to be

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87 47 C.F.R. Sec. 25.277(e).

88 Inmarsat at 11.

89 Notice at para. 45. The coordination required for temporary-fixed licensing also addresses Inmarsat's concern about 3700-4200 MHz interference from FS transmitters into ESVs while docked in port. Inmarsat at 11.

90 47 U.S.C. Sec. 553.

91 Telenor at 6.

necessary, as Telenor and other ESV proponents claim,[92] then their prior investments in C-band equipment will continue to generate returns.

In no event, however, can investments by ESV operators play any part in decisions concerning ESV authority in C-band.

The sole U.S. provider has never offered ESV under license. Instead it has relied on a string of Special Temporary Authorities (STAs).[93] These state:

> Any actions taken as a result of this Special Temporary Authority are solely at Maritime Telecommunications Network, Inc.'s own risk.[94]

Previous to the STAs, MTN's predecessor operated under Part 5 experimental licenses, whose governing rules provide:

> [T]he authority to use the frequency or frequencies assigned is granted upon an experimental basis only and does not confer any right to conduct an activity of a continuing nature[.][95]

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[92] Telenor at 4-5, 6 n.11; MTN at 7-9; Stratos at 9-10; SES Americom at 3.

[93] Notice at 9. MTN also has a waiver to allow mobile shipboard operation on a non-interference basis, but the waiver itself does not confer operating authority. *Mobile Satellite-Based Communications Services*, 11 FCC Rcd 10,944 (Internat'l Bur.& Office of Engineering and Technoloy 1996).

[94] MTN has received 15 grants or extensions of Special Temporary Authorizations to operate ESVs over the past 7 years. The Commission has warned MTN repeatedly that reliance on these STAs is at its own risk. *E.g.*, *Maritime Telecommunications Network, Inc.*, 15 FCC Rcd 23210 at para. 29 (Internat'l Bu. 2000) (actions under STA at MTN's own risk). *See also* Order on Reconsideration and Memorandum Opinion and Order, DA 01-1283 (released May 24, 2001) (same); Grant of STA Extension, July 20, 2001 (File No. SES-STA-20010706-01270) (same); Grant of STA extension, Sept. 24, 2001 (File No. SES-STA-20010918-01710) (same).

[95] 47 C.F.R. Sec. 5.83(a).

The warnings are plain. A provider that buys capital equipment for a radio communications business founded on experimental licenses and STAs takes a fully-disclosed risk. The Commission is under no duty to save the company from its own business decisions. If subsequent regulatory decisions strand an investment, that is simply not the Commission's concern. The FS industry should not have to put up with unwarranted interference just to help ESV managers look good to their investors.

We can assume the ESV investment decisions were prudent even in light of the regulatory uncertainties. But for the Commission to consider the ESV investment as a factor in this rulemaking may well encourage irresponsible behavior by others. Service providers will soon learn the trick: obtain an STA by promising non-interference, invest heavily, and then justify a long-term, potentially interfering authorization by pointing to the investment. The Commission should not play along with the gambit.

E. ESV Is Not a "New Technology" under Section 7.

MTN cites Section 7(a) of the Communications Act as requiring the Commission to encourage the provision of ESV service.[96] Section 7 indeed calls for the encouragement of "new technologies and services to the public."[97] But ESV is neither a new technology nor a new service. Geosynchronous satellite technology is almost forty years old. The only thing new here is the location of the customers. The Commission notes correctly that earth station equipment on

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[96] MTN at 2-3. *See also* MTN at 10.

[97] "It shall be the policy of the United States to encourage the provision of new technologies and services to the public. Any person or party (other than the Commission) who opposes a new technology or service proposed to be permitted under this chapter shall have the burden to demonstrate that such proposal is inconsistent with the public interest." 47 U.S.C. Sec. 157(a).

board ship is substantially the same as that on land, except that it is stabilized against the roll of the ship.[98] MTN can hardly claim the stabilization mechanism amounts to a new communications technology. Nor are the types of service that ESVs make available to shipboard customers any different from those widely available to customers on land. The Notice lists telephone calls, e-mail, Internet, television, and radio.[99] None of these is new with ESV.

In any event, even if ESV deployment were able to qualify as a new technology or service under Section 7, the FS would still be entitled to demonstrate it is "inconsistent with the public interest."[100]

The FWCC has never opposed ESVs outright. We ask only that they be made subject to rules that prevent interference to the FS and allow for reasonable growth in FS facilities. We have no objection to Ku-band ESVs, or to C-band operation more than 300 km offshore, or even to C-band operation closer in, if frequency coordinated and otherwise subject to the controls described above. But ESV deployment without such rules threatens vital public safety and critical infrastructure communications, and for that reason is contrary to the public interest under Section 7.

CONCLUSION

The FWCC agrees in principle that ESV is a valuable technology capable of providing useful services to ships at sea. For reasons of cost and coverage, ESV proponents prefer to

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[98] Notice at para. 27.

[99] Notice at para. 23. The Notice also mentions unspecified maritime services for government operators. *Id.*

[100] 47 U.S.C. Sec. 7(a).

communicate with satellites that use C-band frequencies. But those same frequencies are also allocated to the Fixed Service, which uses them extensively for vital public safety and critical infrastructure communications.

The introduction of ESVs into a congested, shared band will impose costs on someone -- if not on ESV providers for measures to prevent interference, then on FS operators, who will lose business because of the interference, or else have to purchase and install new equipment (if possible) to move to other bands. Considering that ESVs are both latecomers to the band and the beneficiaries of their own operations, it seems reasonable to ask that they bear the costs of containing the damage they would otherwise cause.

Respectfully submitted,

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March 24, 2004

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