Before the
Federal Communications Commission
Washington, D.C. 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

COMMENTS BY THE NATIONAL SPECTRUM MANAGERS ASSOCIATION

The National Spectrum Managers Association (NSMA) respectfully submits the following comments in response to the above-captioned Notice of Proposed Rule Making (NPRM or "Notice").

The NPRM solicits comments on a variety of proposed rule changes to accommodate the operation of C- and Ku-band satellite earth stations on board vessels ("ESVs"). Among the primary issues raised is the appropriate control of potential interference from ESVs to shared-band point-to-point microwave radio links, particularly while the ESV is in motion. The NPRM includes specific references to the discussions of this particular subject by the NSMA, and specifically solicits information from the NSMA as to any guidance it can share on the subject. These comments will provide the requested information, and also offer views on other issues related to shared-band ESV operations that are raised in the NPRM.

Fundamentally, the NSMA believes in the principles and value of frequency coordination, and believes that if shared-band ESVs can be successfully coordinated, their operation could be allowed as a greater use of the available spectrum. Our basic positions on C-band sharing by ESVs are summarized as follows:

- We support what the Notice describes as the "coordination approach" for ESVs, and oppose the "non-coordination approach".

- Should the "non-coordination approach" ultimately be allowed by the Commission, we strongly support spectrum limits on such operations, as they represent an uncontrolled potential for harmful interference to point-to-point microwave systems using the band on a primary co-equal basis. At the same time, given the fundamental principles of frequency coordination, such absolute spectrum limits may not be necessary for ESV operations using the "coordination approach" – but we do support the proposal to limit ESV coordination to frequency ranges that will actually be used.
- We believe the interference analysis methodology and interference protection objectives conventionally used for fixed (land-based) earth stations also apply to fixed ESV operations.
- We believe that to provide appropriate confidence in the analysis of potential interference from in-motion ESVs, there needs to be clearly-defined limits of their in-motion operation. To date, we have relied on our understanding of "deep-draft" as limiting the in-motion operation of ESV-equipped ships to what are defined in publicly available NOAA maps as "deep draft" port channels and sea lanes. We support the Commission's effort to define a minimum ship size or any other parameter that satisfies the purpose of allowing frequency coordinators the ability to specifically define the limits of in-motion ESV operations. As we are not maritime experts, we do not know whether the proposed 300-gross-ton minimum ship size satisfies this need.
- We support the "Critical Contour Point" methodology for the analysis of potential interference from in-motion ESVs to shared-band point-to-point microwave systems.
- We support the use of ITU-R radio regulations and recommendations involving the analysis of potential interference and frequency coordination for ESV operations.
- We do not have a firm recommendation on the appropriate interference objective for in-motion ESV operations, but suggest that until a consensus is reached, the objective currently used to assess long-term interference from earth stations to shared-band microwave systems offers an approach that is conservative.
- The minimum coordination distance from shore can be set as a fixed, conservative figure (the Notice proposes 300 kilometers), or it can be

determined using standard ITU-R methods and applying the technical parameters of the particular ESV operation and the appropriate interference protection objective. In either case, the distance from shore should be defined to start from the location(s) of any offshore microwave facilities.

- Details related to the content of ESV prior coordination notifications and "primary-secondary" interference protection procedures can follow the same practices as have been applied to coordinated ESV operations over the past seven years.
- Any non-FCC-licensed ESV operations within the defined coordination distance from shore should be held to the same standards of interference control as are applied to FCC-licensed operations.

Table of Contents

SECTION A. Background

1. The NSMA is an industry association comprised primarily of microwave and satellite earth station engineers, frequency coordinators, and other telecommunications professionals with interests in the various elements of spectrum management in the frequency bands above 1 GHz. Our focus, particularly as it involves the instant proceeding, is to aid the industry and the Commission, to the extent we can, in matters involving spectrum use and the control of potential RF interference, and to provide guidance to the industry on making the process of interference analysis and frequency coordination as effective and efficient as practicable.

2. The NPRM recognizes that the NSMA had extensive discussions on the subject of interference analysis methodology and frequency coordination procedures for C-band ESV operations during the 1997-2000 time frame. The NPRM specifically requests the NSMA provide the Commission with guidance on those issues for which the NSMA had reached reasonable consensus. We will provide that information, along with background information and views on the issues on which we did not reach consensus, in the sections that follow. Our comments will also address certain other coordination-related issues raised in the NPRM that in some cases relate to, and in other cases go beyond, the matters discussed earlier by the NSMA.

3. The focus of our comments is on coordination-related issues involving ESV operations sharing frequencies with point-to-point microwave systems.

SECTION B. The Results of Past NSMA Discussions

4. The subsections that follow provide information on past NSMA discussions on a variety of ESV-related coordination issues, and offer consensus positions in those cases where they exist, and the different points of view on issues where consensus was not achieved. As the FCC's *Crescomm Order* classified ESV operations as secondary, and secondary operators have to accept all interference from primary operations, our discussions did not address interference from 4 GHz point-to-point microwave systems to ESV downlinks. Our focus was strictly on the potential for 6 GHz ESV uplink transmissions to interfere with shared-band point-to-point microwave systems.

Frequency Coordination and the General Scope of ESV Operations

5. Based on the original proposal for C-band ESV operations described to the NSMA, it was instantly clear to the frequency coordinators that there are three distinct and separately-treatable aspects to such operations: the fixed operation at a port, the in-motion operation into and out of a port, and operation sufficiently distant from shore so as not to require frequency coordination.

6. For any given fixed ESV uplink operation, the interference analysis is exactly the same as for any of the other land-based earth stations operating on fixed or temporary-fixed basis. On the other hand, the in-motion aspect of ESV operations obviously presented unique technical challenges in terms of interference analysis and frequency coordination, and merited our more careful deliberation.

7. The main concern of frequency coordinators in the NSMA, given the unique in-motion aspect of C-band ESV operations, is that any analysis of interference to shared-band microwave facilities could be made effective and reliable. One key to that is that the limits of the in-motion ESV operations must be clearly definable and independently confirmable by other frequency coordinators. Without that, any interference analysis could be suspect, and assurances of ESV non-interference would be questionable at best.

8. One factor naturally presented itself as stable, identifiable and independently confirmable as a limit of in-motion operations: the “deep draft” nature of the ships for which ESVs were originally proposed. “Deep draft”, to us (admittedly not maritime experts), meant that the motion of the ships within a reasonable distance from shore is limited to deep-draft channels and sea lanes, the limits of which are clearly marked on publicly available NOAA maps.

9. Therefore, the NSMA reached general agreement that in order to be “coordinatable” with confidence, ESV operations needed to involve ships limited to those deep-draft channels and sea lanes, so that the geographic limits of in-motion operation can be identified and used in the interference analysis. While we are not maritime experts, we question whether the 300 gross-ton limit proposed in the NPRM is sufficient

to restrict vessels to only these deep draft channels. Vessels small enough to traverse inland waterways were never contemplated.

Frequency Coordination and Interference Protection for Fixed ESV Operations

10. As described above, the NSMA believes that fixed ESV operations (i.e., while the vessels are in port and docked at identified locations) represent fundamentally nothing different, at least from a potential interference point of view, from the more conventional land-based satellite earth stations. The same familiar cross-service interference analysis and frequency coordination process can be applied.[1] The analysis of potential interference from such earth stations uses a standard set of coordination data, and considers both the short- and long-term microwave interference protection objectives.

11. The only coordination-related issue is the ongoing treatment of fixed ESV operations in terms of interference protection from subsequently-coordinated microwave facilities. Should frequency coordinators provide interference protection for fixed ESV operations as they would any other previously-coordinated land-based earth station? Or should there be the type of protection similar to that afforded to "temporary-fixed" earth stations? Or should there be no protection afforded at all to fixed ESV operations?

12. Conventional land-based satellite earth stations, once successfully coordinated, achieve "permanent" interference protection rights with respect to subsequently proposed microwave facilities. Temporary-fixed earth stations for which coordination is completed have protection rights for the duration of their operation, and if that exceeds six months, it is standard practice for the responsible coordinator to issue "prior coordination notification (PCN) renewal notifications" every six months. Earth station operations that are considered purely "secondary" are subject to requirements to take immediate actions to avoid causing any harmful interference to a newly proposed microwave system that presents a frequency interference conflict.

[1] One exception: As described, ESV 4 GHz downlinks have not been included in the process and, with secondary rights, the ESV operators have agreed to accept any interference from point-to-point microwave systems.

13. The fundamental differences in these three approaches, as they might apply to shared-band ESV fixed operations, involve whether the ESV operation, once coordinated, might need to be modified to avoid interference with any subsequently coordinated microwave systems and, if so, how frequently might such modifications be necessary. If a fixed ESV operation were effectively treated as "co-primary" in the band, no subsequent modifications are necessary. If it were treated as "temporary-fixed", modifications might be necessary every six months, as the PCN renewals were issued, and at which time accommodation of recently-proposed microwave systems would be needed for the PCN renewal to be accepted by other coordinators. If fixed ESV operations were treated as purely secondary, modifications would be necessary to resolve frequency conflicts with subsequently-proposed point-to-point microwave systems.

14. Therefore, the NSMA believes that the coordination process is entirely dependent upon the allocation status of ESVs, primary or secondary. However, we believe that a coordination regime can be developed to accommodate the status chosen.

ESV In-Motion Interference Analysis Methodology

15. NSMA discussions on ESV operations were kicked off in February 1997 with a presentation on what is called the "Critical Contour Point Method" for identifying the worst-case ESV in-motion position from the point of view of potential microwave interference. Once that worst-case position was identified (for each potentially-affected microwave receiver), the analysis of ESV interference could apply the same familiar algorithms as any fixed, land-based earth station.

16. The advantage of the Critical Contour Point Method is that, coupled with an appropriate microwave interference protection objective, the analysis is fairly simple and may be easily replicated and confirmed by microwave coordinators receiving an ESV PCN.[2]

[2] Note that the Critical Contour Point Method alone does not necessarily address the "time-versus-level" distribution of potential interference to microwave systems. When the method was proposed, it was coupled with a single interference protection objective intended to provide appropriate protection.

17. NSMA discussions on, and mathematical modeling of, in-motion ESV interference levels versus time resulted in discussions of applying an objective more protective than the short-term objective (see later), and in alternative interference analysis methodologies being considered. As mentioned in the NPRM, the ITU developed recommendations SF.1585 and SF.1649 provide an extension to the NSMA discussions on alternate methodologies.[3] The NSMA supports these documents as acceptable approaches to analyzing ESVs.

18. All in-motion ESV frequency coordination notifications to date have relied on the Critical Contour Point Method for the analysis of potential interference to microwave systems. The only variation in the coordination process has been the application of particular in-motion ESV microwave interference protection objective, which is the subject of the section that follows.

Microwave Interference Protection Objectives for In-Motion ESV Operations

19. Clearly the most complex and contentious issue related to ESVs sharing frequencies with microwave systems is the appropriate interference protection objective (or set of objectives) to avoid harmful interference from in-motion ESV uplink transmissions to microwave receivers in the same general area.

20. The initial ESV frequency coordination efforts (including the first 17 ports of interest) applied the conventional short-term, -131 dBW/4kHz objective, proponents for which argued that the inherent nature of ESV in-motion operations served to characterize the potential microwave interference exposures as short-term, and the default minimum coordination distance, 100 kilometers, had been referenced in the FCC's Crescomm Order as the minimum coordination distance from shore.

[3] The alternate method proposed within the NSMA was termed the Contour Integration Method (CIM). The analysis considered the motion, at an assumed minimum speed, for an ESV (or multiple ESVs) along the worst- case linear trajectory. This method requires the speed, number of trips, number of ships, and operational contour of the ESVs to be specified. The method calculates an interference distribution over time at the victim microwave receiver, which could then be compared to either a time varying interference objective between the long- and short-term objectives, or examined using the Fractional Degradation in Performance (FDP) approach. The ability to model the ESV's motion throughout the contour in a reasonably accurate (or representatively conservative) manner is critical to the CIM method.

21. A counter-argument was presented by other frequency coordinators that, as in-motion ESVs represented a unique issue in terms of potential interference, they should be subject to the long-term –154 dBW/4kHz objective. The logic behind this position is that a conservative approach is best, and that applying the long-term objective would clearly limit potential ESV microwave interference to a level no higher than considered acceptable (on a long-term basis) from any of the thousands of existing earth stations transmitting in the C-band.

22. Proponents of both positions generally agreed that there probably is a single objective between those two extremes that would provide completely appropriate protection for microwave systems. Determining that middle ground, however, was easier said than done. Exhaustive mathematical modeling was performed by the proponents of each objective (representing two of the major frequency coordination firms, each of which, by the way, is also involved in microwave coordination). The results of the modeling differed by just enough to suggest a compromise figure, except we realized such a compromise would perhaps be more politically- than technically-based, and we did not take that action.

23. In the more recently ESV PCNs issued by the frequency coordinator that has been the primary proponent of the short-term microwave interference protection objective, that coordinator has chosen to apply the conservative, long-term objective. While not abandoning the argument that the long-term objective may be overly conservative, the subject coordinator has taken this course of action to eliminate potential “objectives-related” objections from other coordinators, and it has helped smooth the successful completion of coordination.

24. The NSMA believes that suitable interference criteria and methodology are being developed within the ITU-R. The NSMA will develop their coordination recommendations based upon the final results of those discussions.

Minimum ESV Coordination Distance From Shore

25. In applying any acceptable interference analysis methodology for shared-band ESV operations, we agree there should be an associated "minimum distance from shore" within which the interference analysis is applied.

26. Coordination must be required for earth station operation when the ESV is within some distance from shore, the "coordination distance." Typically, ES coordinators would use ITU Appendix S-7 to calculate the earth station coordination contour. This distance is computed in accordance with FCC and ITU Regulations, where applicable. Coordination distance is a function of the earth station power-bandwidth transmitted in the horizontal plane in any given direction and the assumed antenna gain and permissible level of interference associated with the victim station. The NSMA feels that the 300-kilometer coordination contour proposed for C-band may not be appropriate for certain areas in the Carribean and Gulf of Mexico where many of these ESVs will operate. The NSMA believes that the ITU rules should be used on a site-by-site (area-by-area) basis to ensure that the proper distances from shore are considered.

27. In determining the coordination area for an in-motion ESV, it is generally only necessary to select a few points on the periphery of the defined geographical area of in-motion operation and construct an envelope of the related coordination contours, applying in the process the calculated coordination distance (based on the objective applied) and using a default minimum coordination distance of 100 kilometers.

28. In addition, and related to this aspect of the issue, the NSMA has clear consensus on the position that recognizes the existence of off-shore microwave operations, primarily in the Gulf of Mexico, and that where such operations exist, the "coordination distance from shore" figure should be applied from the position(s) of any offshore microwave operation.

Automated Controls on ESV Interference

29. In the NSMA discussions, there was strong sentiment in several quarters (if not general NSMA consensus) in favor of requiring some form of GPS-controlled

automatic power shut-down mechanisms to control interference from an in-motion ESV that might be operating outside the geographic boundaries that were defined during frequency coordination. The suggestion here was to apply a GPS-related (or equivalent) control that would automatically terminate ESV up-link transmission if the ship went beyond the in-motion contour limits defined during frequency coordination. This would serve to prevent "uncoordinated" levels of potentially harmful interference to shared-band microwave systems. Such a system could also automatically terminate transmission if ship speed dropped below a specified figure outside a port but within the coordination distance from shore (i.e., should the ship stop at an offshore anchorage, assumed not to have been included in the coordination as a point of fixed ESV operation). This latter consideration may be important if some minimum ship speed were a factor in ESV in-motion interference analysis and frequency coordination.

30. Proponents of this type of automated "shut-down" control mechanism also suggested that it could be used to terminate up-link transmission if the operating parameters of that transmission (e.g., frequency range, power) were inconsistent with the parameters specified during frequency coordination.

31. Those in the NSMA who disagreed with the proposal for any automated controls based their position on the fact that any operator who failed to respect the conditions of the related FCC license (and underlying coordination) would face FCC enforcement that could include loss of the license – and that normal obligations of licensees should be sufficient to serve the intended purpose.

ESV PCN Data Content

32. The FCC regulations specify the minimum data content for PCN for satellite earth stations, and the NSMA has supplemented the regulations with related recommendations that serve to improve the coordination process. In the case of ESVs, the NSMA recognized that much of the necessary data for a proposed ESV operation would be identical to a PCN for a fixed earth station, but that additional information would be needed to appropriately identify and describe the details of the in-motion aspect of the operation.

33. First, we believe that any PCN for an ESV should make it clear that it involves operation on a ship, even in those cases that may only proposed fixed operation in any given port. When, as is more common, both fixed and in-motion operations are proposed, they should both be included in the same PCN. (Issuing separate PCNs for the fixed and in-motion operations might inappropriately lead other coordinators to assume the fixed operation is actually land-based when it is not.) If multiple fixed operating locations are proposed at a given port, each should be separately identified.

34. Second, a PCN for a fixed- and in-motion ESV operation should include all of the data required by the FCC and any additional information generally recommended for earth station coordination by the NSMA. Any differences in proposed frequency use between the fixed and in-motion operations should be clearly identified.

35. Third, the ESV PCN should include a map clearly identifying the contour limits of the in-motion operation, out to a distance from the shoreline of at least 100 kilometers (or otherwise agreed-to "minimum coordination distance from shore"). The PCN should further identify, by latitude and longitude, all endpoints and intermediate breakpoints along the contour.

36. Fourth, when the Critical Contour Point method is used, the PCN should individually identify, by latitude and longitude, the point along the in-motion contour that represents the worst-case potential interference to each microwave receiving station (by name and/or call sign) within the coordination area.

37. Fifth, the PCN should include all details related to the "clearance" of individual cases of potential interference that appear to miss the objective when calculated on a "free-space" basis.

In-Motion ESVs and Subsequently Proposed Microwave Systems

38. As the FCC's Crescomm Order granted ESV in-motion operations "secondary" status in the frequency band, they have been subject to requirements to

adjust their frequency use to avoid any cases of harmful interference to subsequently-proposed point-to-point microwave systems.

39. While such "primary-secondary" coordination does not represent a process unfamiliar to coordinators in the NSMA, we did include it in our discussions of overall ESV coordination issues. The consensus conclusion we formed was that the process should basically include the following: (1) the initiator of a microwave PCN within the coordination distance of ESV operations should include the ESV coordinator in the PCN distribution, and further should include in the PCN an alert that there may be a potential frequency conflict; (2) if the conflict could not be resolved by the ESV coordinator, that coordinator would advise the ESV operator that a modification in the ESV's frequency use would be necessary, as of the operational date provided by the microwave coordinator; and (3) the ESV coordinator would also distribute a PCN advising other microwave coordinators of the modified ESV operation.

40. We recognize that, depending on the conclusions drawn as a result of this rulemaking proceeding, this procedure may or may not apply to in-motion ESV operations.

Microwave Operators' Ability to Identify ESV Interference

41. In the NSMA discussions on ESV operations, differing points of view were expressed on the ability of microwave operators to determine that interference may have been experienced as a result of an in-motion operation of a shared-band ESV.

42. On one hand, there was the opinion that the inherent in-motion operation would make the interference difficult if not impossible to identify, and that the "offending ESV" would be out of interference range too quickly to be reliably identified.

43. On the other hand, there was the argument that the majority of ESV operations were on commercial cruise ships, whose operating schedules are not only regular but details of which are also readily available. The theory here is that if a microwave operator were to experience noticeable interference every Friday at 4 pm,

and the cruise ship schedule said that's when a ship was regularly entering or leaving the nearby port, those facts could be relatively easily correlated and focus quickly drawn on the cruise ship as the possible source of the problem.

44. The NSMA discussions did not reach a resolution on this issue, which we realize may be further complicated by ESV operations on vessels for which operating schedules may not be readily available, and perhaps for good reason, as may be the case with the US Navy.

SECTION C. ESV Frequency Coordination Experience

45. It is probably useful in these comments to share with the Commission our understanding of the experience frequency coordinators have had with ESVs over the past seven years.

46. As noted by the NPRM, NSMA discussions on ESV frequency coordination began in February 1997. The first PCN for an ESV operation was issued shortly after and, over time, PCNs for ESV operations have been issued by two different frequency coordinators (both well represented in the NSMA) for upwards of 20 coastal ports in the US and its territories, along with one for the middle of the Gulf of Mexico. The vessels of interest have included large cruise ships and US Navy aircraft carriers operating out of ocean ports in the US and its territories, and one operation involving a movable oil platform well offshore, in the middle of the Gulf of Mexico.

47. With the exception of the microwave interference protection objective, the ESV interference analysis methodology and frequency coordination process followed in each case was consistent with all of the elements of the issue that the NSMA was able to reach general consensus. With respect to the microwave interference protection objective, the initiators of most of the early PCNs for ESV operations applied the short-term –131 dBW/4kHz interference objective, but objections were lodged by some other coordinators that the long-term –154 dBW/4kHz objective was more appropriate. The related FCC licenses were filed over and above those objections. In more recent ESV coordination, however, the original proponents of the short-term objective, without necessarily abandoning their technical position on the matter, have pragmatically chosen

to use the stricter, long-term objective in order to avoid other coordinators' possible objections and smooth the application process.

SECTION D. Other Coordination-Related Issues Raised in the NPRM

48. The NPRM raises several coordination-related ESV issues previously unaddressed by the NSMA. The subsections that follow provide our input on those issues.

"Coordination Approach" versus "Non-Coordination Approach"

49. The NPRM proposes two alternative approaches for interference control for ESV operations: a "coordination approach" and a "non-coordination approach", each subject to different proposed licensing and operational conditions.

50. The NSMA has serious concerns with the "non-coordination approach". In particular, we have a concern with a statement in the NPRM to the effect that, should the "coordination approach" be undertaken and the coordination process not be successfully completed, an ESV operator could proceed under the "non-coordination approach". Perhaps we are misinterpreting the intent here, but it sounds like if an attempt at ESV coordination was met with unresolvable objections of interference to microwave facilities, operation could proceed under an alternative regulatory regime and microwave operators would simply have to face the risk of unacceptable interference, and only potentially correctable on a post facto basis via an interference complaint. We find this approach unacceptable, and recommend that the best control mechanism on interference is to avoid it in advance via the interference analysis and coordination process.

51. We recognize that the NPRM proposes significant restrictive conditions for ESVs operated under the "non-coordination approach". However, even with those conditions, if our interpretation of the overall proposal here is reasonably correct, we must oppose the proposal for the "non-coordination approach", at least in so far as it might be applied to shared-band ESV operation.

Spectrum Limitations on In-Motion ESV Operations

52. The NPRM proposes specific spectrum limitations for in-motion ESV operations. According to the Commission's proposal, there would be different spectrum limits for "coordinated" and "non-coordinated" ESV operations, effectively capping the spectrum that could be used for any given ESV operation.

53. While the NSMA recognizes the intent of this proposal is to limit the spectrum-availability impact of ESV operations vis a vis the point-to-point microwave systems using the band on a primary basis, we must ask the following question, particular to ESV operations using the "coordination approach": if ESV coordination can be successfully completed for any range of the available spectrum in the 6 GHz band, and even coordinated ESV operations are treated as "secondary" in the shared band, why impose an absolute spectrum limit?

54. While questioning the imposition of an absolute spectrum limit on coordinated ESV operations, however, the NSMA does support a spectrum limitation in the following sense. While the more conventional land-based satellite earth stations are allowed by FCC regulation to coordinate and protect themselves on a full-band (and full-arc) basis whether or not they may immediately use or need that capability, the complexity of ESV operations suggests they should be coordinated only for that spectrum which they will actually use. As most ESV operations appear to require considerably less spectrum than the full band provides, this approach should serve to appropriately limit the impact on future point-to-point microwave system coordination.

55. As described earlier, the NSMA opposes ESV operation on a "non-coordinated" basis, but if the Commission pursued that approach, we definitely support a spectrum limit on that type of operation.

Treatment of Non-FCC-Licensed ESV Operations

56. The NPRM seeks comment on the treatment of ESVs that operate within a network where the hub is located outside of the United States and is licensed by a foreign country. To the extent those ESVs are on ships of foreign registry, how should

they be treated when they operate within the minimum distances? The NSMA believes that, as suggested in the Notice, Section 306 of the Communications Act can be applied so that such operations should be held to the same standards of interference control as those US operations.

Respectfully submitted,

Daniel J. Collins
President

c/o Pinnacle Telecom Group, LLC
14 Ridgedale Avenue – Suite 262
Cedar Knolls, NJ 07927

February 23, 2004