**Before the**
**Federal Communications Commission**
**Washington, D.C. 20554**

| | | |
|---|---|---|
| In the Matter of | ) | |
| | ) | |
| Flexibility for Delivery of Communications by Mobile Satellite Service Providers in the 2 GHz Band, the L-Band, and the 1.6/2.4 GHz Bands; | ) | IB Docket No. 01-185 |
| | ) | |
| Review of the Spectrum Sharing Plan Among Non-Geostationary Satellite Orbit Mobile Satellite Service Systems in the 1.6/2.4 GHz Bands | ) | IB Docket No. 02-364 |

**REPORT AND ORDER**
**AND NOTICE OF PROPOSED RULEMAKING**

**Adopted:** January 29,2003 **Released:** February I0, 2003

Comment date **[30 days after Federal Register publication]**
Reply Comment date **[45 days after Federal Register publication]**

By the Commission: Chairman Powell, Commissioners Abemathy and Adelstein issuing separate statements; Commissioner Copps approving in part, dissenting in part and issuing a statement

**TABLE OF CONTENTS**

Heading Paragraph No.


I. INTRODUCTION ..... 1
II. BACKGROUND ..... 6
A. ATC Concept ..... 7
B. Flexibility Notice ..... 15
C. Other Proceedings ..... 17
III. DISCUSSION ..... 18
A. MSSATC Primary Proposal ..... 19
1. Proposed ATC Use of the Frequency Spectrum ..... 19
2. Operational Benefits ..... 23
3. Protecting the Public ..... 28
4. Strengthening Competition ..... 30
B. Alternative Proposals ..... 46
1. Same-Band, Separate-Operator Sharing ..... 47
2. Separate-Band, Separate-Operator Sharing ..... 56
3. Secondary Terrestrial Service ..... 59
4. Conclusion ..... 65
C. MSS ATC Service Rules ..... 66
1. "Ancillary" Service ..... 67

2. Substantial Satellite Service ..... 72
a. Geographic Coverage ..... 73
b. Coverage Continuity ..... 78
c. Commercial Availability ..... 85
3. Integrated Service Offering ..... 87
4. In-Band Operation ..... 89
5. Central Data Switching ..... 94
6. Other Proposed Requirements ..... 98
D. Technical Requirements and Rules for Terrestrial Operations ..... 103
1. 2 GHz MSS Band ..... 105
a. Intra-Service Sharing ..... 110
b. Inter-Service Sharing ..... 115
c. Conclusion ..... 127
2. L-Band ..... 128
a. Intra-Service Sharing – Protection of Adjacent Channel and Adjacent Beam MSS Operations ..... 130
(i) Effect of ATC Operations on Inmanat Satellites ..... 132
(ii) Effect of ATC Base Stations on Inmarsat MES ..... 148
(iii) Effect of ATC on Airborne Inmarsat Terminals ..... 158
(iv) Other Inmarsat Arguments ..... 162
b. Inter-service Sharing – Protection of Adjacent Service Systems ..... 170
(i) Systems Operating Within the 1525-1559 MHz and 1626.5-1660.5 MHz Bands of the L-Band Spectrum ..... 171
(ii) Systems Operating Within the 1626.5-1660.5 MHz Portion of the L-Band Spectrum ..... 175
(iii) Systems Operating Within the 1525-1559 MHz Band Portion of the L-Band Spectrum ..... 176
(iv) Systems Operating Adjacent to the 1626.5-1660.5 MHz Portion of the L-Band ..... 178
(v) Systems Operating Adjacent to the 1525-1559 MHz Band ..... 179
c. Technical and Operational Provisions for L-Band ATC ..... 185
3. Big LEO Systems ..... 189
a. Protection of In-band Systems in the 1610-1626.5 MHz Band ..... 194
b. Protection of Systems Operating in Bands Adjacent to 1610-1626.5 MHz ..... 197
c. Protection of Systems Operating in and Near the 2483.5-2500 MHz Band ..... 201
E. Statutory Considerations ..... 207
1. Section 303(y) ..... 207
a. Investment Incentives ..... 209
b. Consistency with International Agreements ..... 212
(i) L-Band ..... 212
(ii) Other Bands ..... 216
2. Section 309(j) ..... 219
a. Section 309(j)(1) ..... 220
b. Section 309(j)(3) ..... 227
c. Other Matters ..... 230
3. Section 332 ..... 231
F. Modification of Table of Allocations ..... 235
G. Licensing Requirements ..... 237
1. Modification of MSS Space-Station Authorizations ..... 237
2. Foreign-Licensed MSS Providers ..... 242

3. MSS ATC Handset Earth Station Licensing ..... 246
4. Construction Prior to MSS Operation ..... 249
H. Administrative Procedures ..... 251
1. Further Delay Unwarranted in the 2 GHz MSS Bands ..... 254
2. Further Delay Unwarranted in the Big LEO Bands ..... 259
IV. NOTICE OF PROPOSED RULEMAKING ..... 261
A. Background ..... 262
B. Big LEO CDMA Spectrum Proposals ..... 265
C. Comment Dates ..... 274
V. PROCEDURAL MATTERS ..... 218
VI. ORDERING CLAUSES ..... 282

Appendix A: List of Commenting Parties
Appendix B: Rules
Appendix C1: 2 GHz MSS Band Technical Analysis
Appendix C2: L-Band Technical Analysis
Appendix C3: Big LEO Band Technical Analysis
Appendix D: Final Regulatory Flexibility Act Certification
Appendix E: Initial Regulatory Flexibility Act Analysis
Appendix F Big LEO Bandplan

## I. INTRODUCTION

1. Today we decide to permit flexibility in the delivery of communications by Mobile Satellite Service (MSS) providers that operate in three sets of radio frequency bands: the 2 GHz MSS band,[1] the L-band[2] and the Big LEO bands?[3] Specifically, we permit MSS licensees to integrate ancillary terrestrial components (ATCs) into their MSS networks. Flexibility in this context differs from a so-called "flexible-use" allocation in which licensees can provide any service that appears in the U.S. Table of Allocations for the band either individually or in combination with other allocated services. We decide here to permit MSS operators to seek authority to integrate ATCs into their networks for the purpose of enhancing their ability to offer highquality, affordable mobile services on land, in the air and over the Oceans without using any additional spectrum resources beyond spectrum already allocated and authorized by the Commission for MSS in these bands. We will authorize MSS ATC subject to

[1] The term "2 GHz MSS band is used in this Order to refer to the 1990-2025 MHz uplink (Earth-to-space transmissions) and 2165-2200 MHz downlink (space-to-Earth transmissions) frequencies, originally allocated to MSS in the United States. See U.S. Table of Frequency Allocations, 47 C.F.R. § 2.106 (2002) (providing a precise frequency allocation list and stating various encumbrances on particular sub-bands). A companion item to today's decision alters the 2 GHz MSS band to 2000-2020 MHz for uplink transmissions and 2180-2200 MHz for downlink transmissions. *See Amendment of Part 2 of the Commission's Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services to Support the Introduction of New Advanced Wireless Services, including Third Generation Wireless Systems*, ET Docket No.00-258, Third Report and Order, Third Notice of Proposed Rulemaking. and Second Memorandum Opinion and Order, FCC 03-16 (adopted Jan. 30,2003) (*AWS Third Report and Order*).

[2] The "L-band" is a general designation for frequencies from 1 to 2 GHz. In the United States, the Commission has allocated L-band spectrum for MSS downlinks in the 1525-1544 MHz and 1545-1559 MHz bands and for MSS uplinks in the 1626.5-1645.5 MHz and 1646.5-1660.5 MHz bands. See 47 C.F.R. § 2.106.

[3] The term "Big LEO bands" is used in this *Order* to refer to the 1.6/2.4 GHz bands. In general, the Big LEO MSS systems rely on uplinks within the 1610-1626.5 MHz band and downlinks in the 2483.5-2500 MHz band.

conditions that ensure that the added terrestrial component remains ancillary to the principal MSS offering. We do not intend, nor will we permit, the terrestrial component to become. a stand-alone service. We believe that permitting MSS ATCs in this manner should (1) increase the efficiency of spectrum use through MSS network integration and terrestrial reuse and permit better coverage in areas that MSS providers could not otherwise serve; (2) reduce costs, eliminate inefficiencies and enhance operational ability in MSS systems; (3) provide additional communications that may enhance public protection; and (4) strengthen competition in the markets served by MSS.[4]

2. Our decision today balances the traditional goals of effective and efficient use of spectrum with preserving the optimal amount of spectrum for the provision of international satellite services. In this instance, we find that grant of ATC appears to best balance these competing public interest goals. Specifically, based on the record and our detailed technical analyses, we find that granting shared usage of the same MSS frequency band to separate MSS and terrestrial operators would likely compromise the effectiveness of both systems, particularly satellites already operating in the L-band and Big LEO band. In this case, making limited terrestrial authority available to licensed MSS operators in the form of ATC better serves the public interest than the more limited and technically difficult prospect of attempting to share the MSS spectrum, which would pose an unacceptable risk of harmful interference to the existing and planned operations of licensed MSS operators. At bottom, the Commission must choose between two alternatives. We could either prohibit MSS licensees from deploying MSS ATC in order to preserve, on principal, the initial service and operational rules for MSS. *Or* we could grant additional authority to the MSS incumbents to improve their services and efficient use of spectrum at the cost of giving the incumbents more operational authority than they had originally sought. Forced to choose, we believe granting, rather than withholding, access to spectrum resources represents the better course.

3. Consistent with this Order and the rules we adopt today, 2 GHz MSS, L-band and Big LEO operators may seek authority to integrate ATCs into existing and planned systems. We will authorize MSS licensees to implement ATCs, provided that the MSS licensee: (1) has launched and operates its own satellite facilities; (2) provides substantial satellite service to the public; (3) provides integrated ATC; (4) observes existing satellite geographic coverage requirements; and (5) limits ATC operations only to the authorized satellite footprint? As explained below, observing certain space-segment requirements constitutes the provision of substantial satellite service to the public and should ensure that MSS remains

[4] For an overview of historical and current MSS operations, *see generally. e.g., Establishing Rules and Policies for Use of Spectrum for Mobile Satellite Services in Upper and Lower L-Band,* Report and Order, 17 FCC Rcd 2704, 2708-13, ¶ 11-20 (2002) (discussing technical innovations in MSS, reviewing some of the "strides made in spectrum-efficient MSS technologies" within the L-band and noting that "MSS systems are particularly well suited for providing mobile communication services to areas that are not being adequately served by terrestrial radio facilities").

[5] As we have repeatedly indicated, we intend to authorize ATC *only* as an ancillary service to the provision of the principal service, MSS. We have established a number of gating requirements to ensure that ATC may only operate after the provision of MSS has commenced and during the period in which MSS continues to operate. *See infra* §§ III(C)(2)-(4); see *also infra* App. B. While it is impossible to anticipate or imagine every possible way in which it might be possible to "game" our rules by providing ATC without also simultaneously providing MSS and while we do not expect our licensees to make such attempts. we do not intend to allow such "gaming." For example, even if an MSS licensee were to enter an agreement to lease some or all of the access to its authorized MSS spectrum to a terrestrial licensee, such spectrum could only be used if its usage met the requirements to ensure it remained ancillary to MSS and were used in conjunction with MSS operations. i.e., that it met all of our gating requirements. The purpose of our grant of ATC authority is to provide satellite licensees flexibility in providing satellite services that will benefit consumers, not to allow licensees to profit by selling access to their spectrum for a terrestrial-only service.

first and foremost a satellite service. For planned, licensed MSS systems, licensees may seek ATC authorization prior to launch and operation, but shall not provide ATCs prior to meeting the above criteria, and must have complied with MSS implementation milestones imposed on licensees at the time of seeking authority.

4. To prevent harmful interference and achieve other important public interest goals, we limit ATC deployments to certain "core" spectrum within each MSS licensee's respective spectrum assignments. These core spectrum requirements vary by band due to the unique characteristics of each MSS system's spectrum assignment. In the 2 GHz MSS band, ATC is confined to each MSS operator's "Selected Assignment." In the L-band, ATC is confined to each operator's variable spectrum assignment acquired pursuant to the 1996 Mexico City Memorandum of Understanding and related Operating Agreements (Mexico City MoU). In the Big LEO band, ATC is confined to no more than 5.5 megahertz in each direction of transmission per licensee. We implement this decision through the addition of a footnote to the U.S. Table of Frequency Allocations in section 2.106 of our Rules.[6] We also establish procedures for the authorization of MSS ATC operations consistent with the terms and conditions of this Order.

5. Finally, we initiate a new rulemaking in response to a petition for rulemaking filed by Iridium Satellite LLC (Iridium)? In its petition, Iridium requests that we revise our current rules to require MSS systems operating in the 1615.5-1621.35 MHz band to use time division/frequency division multiple access (TDMA/FDMA) technology,[8] rather than code division multiple access (CDMA) technology? In effect, Iridium requests that we make 5.85 megahertz of MSS spectrum currently used by Globalstar L.P. (Globalstar), which uses CDMA technology, available to Iridium, which uses TDMA/FDMA technology. We tentatively conclude that a rebalancing of spectrum in the Big LEO band would serve the public interest and seek comment on the proposal in Iridium's petition and on various alternative uses for the Big LEO spectrum, including whether we should reallocate spectrum for unlicensed services, an additional commercial mobile radio service (CMRS) licensee or other services, or initiate a second processing round by which we could authorize new MSS entry.

## II. BACKGROUND

6. We initiated this proceeding to consider the proposals of two MSS operators, ICO Global Communications (Holdings) Ltd. (ICO) and the Mobile Satellite Ventures Subsidiary LLC (MSV), to

---

[6] 47 C.F.R. § 2.106; see *infra* App. B. This footnote to the allocation table allows MSS licensees to implement MSS ATC pursuant to rules and policies adopted in this Order.

[7] Petition for Rulemaking of Iridium Satellite LLC (filed. July 26, 2002) (Iridium Petition) (included in the record of IB Docket No. 02-364).

[8] TDMA is a transmission technique in which users of the same frequency band are provided alternating time slots for their transmissions in the system, thereby avoiding mutual interference.

[9] CDMA is a transmission technique in which the signal occupies a bandwidth larger than that needed to contain the information being transmitted. The signal is spread over a wide bandwidth. the power is dispersed, and a code is used to send and retrieve the information. The spreading, the variation in the code, and other technical parameters permit a number of users to operate on the same frequency simultaneously without causing mutual harmful interference.

integrate ATCs into their MSS networks using assigned MSS frequencies." ICO is one of five systems currently authorized to provide 2 GHz MSS in the United States." ICO submitted its proposal in *ex parte* filings in Docket No. 99-81,[12] in which we promulgated service rules for operators in the 2 GHz MSS band.[13] MSV is currently licensed to provide MSS in the L-band.[14] MSV submitted its proposal in the

[10] *Flexibility for Delivery of Communications by Mobile Satellite Service Providers in the 2 GHz Band, the L-Band, and the 1.6/2.4 GHz Band,* IB Docket No. 01-185, Notice of Proposed Rulemaking, 16 FCC Rcd 15532 (2001) *(Flexibility Notice).* During the course of this proceeding, New ICO Global Communications (Holdings) Ltd. (referred to in the *Flexibility Notice)* merged with ICO Global Ltd. to form ICO Global Communications (Holdings) Ltd. (referred to in this Order as "ICO"). *See* Letter from Cheryl A. Tritt to Magalie Roman Salas, Secretary, Federal Communications Commission, File Nos. SAT-T/C-20000531-00097 and SATAMD-20000612-00107 (December 13.2001). Also during the course of this proceeding. Motient Services, Inc. (Motient), the U.S.-licensed L-band MSS operator, and TMI Communications and Company, Limited Partnership (TMI), a Canadian-licensed L-band MSS provider, combined their MSS systems into a jointly-owned subsidiary. MSV. See *Motient Services Inc. and TMI Communications and Company, LP/Mobile Satellite Ventures Subsidiary LLC.* Order and Authorization, 16 FCC Rcd 20469 (Int'l Bur. 2001). Due to the substantial commonality of interest among Motient. TMI and MSV, we will refer to the three parties collectively as MSV in this Order unless otherwise indicated.

[11] *See The Boeing Company,* Order and Authorization, 16 FCC Rcd 13691 (Int'l Bur. 2001) *(Boeing 2 GHz MSS License); Celsat America, Inc.,* Order and Authorization, 16 FCC Rcd 13712 (Int'l Bur. 2001) *(Celsat 2 GHz MSS License); Constellation Communications Holdings, Inc.*, Order and Authorization, 16 FCC Rcd 13724 (Int'l Bur./OET 2001) *(Constellation 2 GHz MSS License), authorization declared null and void, Mobile Communications Holdings, Inc. and ICO Global Communications (Holdings) Limited for Transfer of Control: Constellation Communications Holdings, Inc. and ICO Global Communications (Holdings) Limited for Transfer of Control.* Memorandum Opinion and Order, DA 03-285 (Int'l Bur., rel., Jan. 30,2003) *(Constellation/MCHI Nullijication Order); Globalstar, LP.*, Order and Authorization, 16 FCC Rcd 13739 (Int'l Bur./OET 2001) *(Globalstar 2 GHz MSS License), authorization declared null and void, Globalstar, L.P., for Modification of License for a Mobile-Satellite Service System in the 2 GHz Band,* Memorandum Opinion and Order, DA No. 03-328 (Int'l Bur., rel., Jan. 30,2003) *(Globalstar Nullification Order); ICO Services Limited,* Order, 16 FCC Rcd 13762 (Int'l Bur./OET 2001) *(ICO 2 GHz MSS Order): Iridium LLC,* Order and Authorization, 16 FCC Rcd 13778 (Int'l Bur. 2001) *(Iridium 2 GHz MSS License); Mobile Communications Holdings, Inc.*, Order and Authorization, 16 FCC Rcd 13794 (Int'l Bur./OET 2001) *(MCHI 2 GHz MSS License), authorization declared null and void. Constellation/MCHI Nullification Order,* DA 03-285; *TMI Communications and Company. Limited Partnership*, Order, 16 FCC Rcd 13808 (Int'l Bur. 2001) *(TMI 2 GHz MSS Order).*

[12] Letter from Lawrence H. Williams and Suzanne Hutchings. ICO Global Communications (Holdings) Ltd., to Chairman Michael K. Powell, Federal Communications Commission, IB Docket No. 99-81 (tiled Mar. 8,2001) (ICO Mar. 8 *Ex Pane* Letter); see *also* Letter from Cheryl A. Tritt, Counsel to ICO Services Limited to Magalie Roman Salas. Secretary, Federal Communications Commission. IB Docket 99-81 (April 20.2001) (ICO April 20, 2001 *Ex Pane* Letter).

[13] See *Establishment of Policies and Service Rules for the Mobile Satellite Service in the 2 GHz Band,* IB Docket No. 99-81. Report and Order. 15 FCC Rcd 16127 (2000) (2 *GHz MSS Rules Order).*

[14] In 1989. the Commission authorized Motient's predecessor in interest, American Mobile Satellite Corporation, to construct, launch and operate an MSS system in the upper L-band. *Amendment of Pans 2, 22 and 25 of the Commission's Rules to Allocate Spectrum for and to Establish Other Rules and Policies Pertaining to the Use of Radio Frequencies in a Land Mobile Satellite Service for the Provision of Various Common Carrier Services,* GEN Docket No. 88-1234, Memorandum Opinion, Order and Authorization, 4 FCC Rcd 6041 (1989) *(MSV License), tentative decision on remand*, 6 FCC Rcd 4900 (1991), *final decision on remand.* 7 FCC Rcd 266 (1992). *aff'd sub nom. Aeronautical Radio. Inc. v. FCC.* 983 F.2d 275 (D.C. Cir. 1993). Beginning in 1999, the Commission granted TMI blanket authority to provide MSS to mobile terminals located in the United States. See *Satcom Systems. Inc./TMI Communications and Company, LP.*, Order and Authorization, 14 FCC Rcd 20798 (1999), *affd sub nom. AMSC Subsidiary Corp. v. FCC.* 216 F.3d 1154 (D.C. Cir. 2000), *modified,* Order and Authorization, 15 FCC Rcd (continued....)

context of an application for authority to launch and operate a next generation L-band satellite system." Other MSS licensees subsequently proposed similar plans.[16]

## A. ATC Concept

**7.** The various proposals for ATC are conceptually different and would rely on different techniques to increase spectrum efficiency by carrying more communications traffic within the same licensed MSS spectrum.

**8.** MSV, a geostationary MSS operator, would take advantage of the geographic areas that are not served by specific MSS channels because of intra-system interference concerns." These areas are a necessary product of the frequency and geographic intra-system sharing that occurs within their multi-beam satellite systems. By way of background, MSV's next generation system uses satellites that can produce a large number of relatively small "spot-beams" on the surface of the earth. These spot-beams can be small enough to provide satellite coverage to an area on the earth's surface 400 to 500 km across. Figure 1 demonstrates a sample frequency reuse plan for a geostationary MSS system.

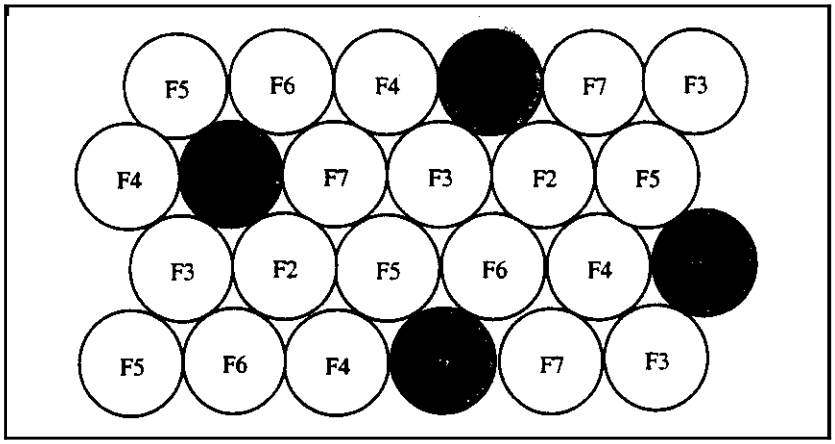
(Continued from previous page)
24467 (Sat. Radiocomm. Div., Int'l Bur. 2000); *see* also *TMI Communications and Company, LP.*, Order and Authorization, 15 FCC Rcd 18117 (Sat. Radiocomm. Div., Int'l Bur. 2000).

[15] Application of Motient Services Inc., File Nos. SAT-LOA-19980702-0. SAT-AMD-20001214-00171 & SAT-AMD-20010302. See Public Notice, Report No. SAT-00066 at 2 (rel. Mar. 19,2001) (*MSV Application*). MSV later indicated that it would seek to use the same ATC network with its current-generation MSS system. See Letter from Carson E. Agnew, President and Chief Operating Officer, and Peter D. Karabinis, Chief Technical Officer, Mobile Satellite Ventures. to Marlene H. Dortch, Secretary, Federal Communications Commission, IB Docket 01-185 at I (filed. Dec. 16.2002) (MSV Dec. 16,2002 *Ex Parte* Letter).

[16] See, *e.g.*, Globalstar Comments at 2-20; Letter from Cheryl A. Tritt, Counsel. ICO Global Communications (Holdings) Ltd. to William F. Canton, Acting Secretary, Federal Communications. IB Docket 01-185 at 6-10 (filed Mar. 8,2001) (ICO Mar. 8,2001 Ex *Pane* Letter).

[17] Letter from David S. Konczal, Counsel, Mobile Satellite Ventures Subsidiary, LLC to Marlene Dortch, Secretary, Federal Communications Commission, IB Docket No. 01-185 at 4-6 (filed Jan. 11,2002) (MSV Jan. II, 2002 *Ex Parte* Letter).

**Figure 1: Example of a Seven-Fold Frequency Reuse Plan**

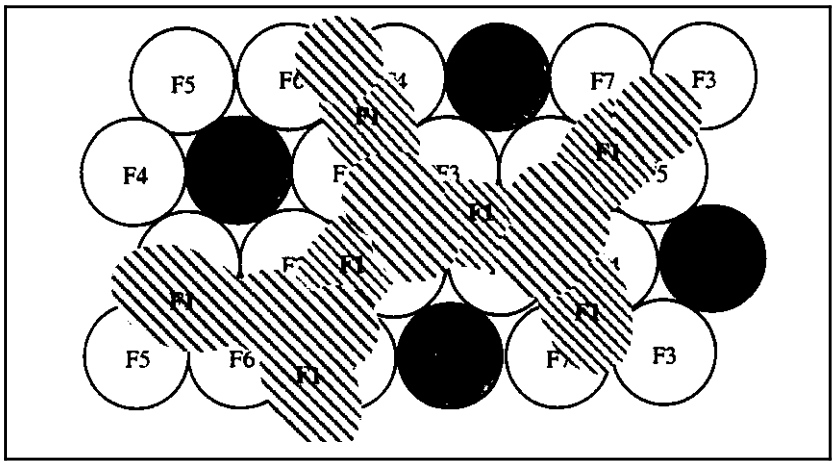



This diagram demonstrates frequency reuse. Here, a spot-beam operating on frequency F1 is surrounded by spot-beams operating on one of six other frequencies (F2 to F7). The distance between spot-beams operating on F1 is sufficient to prevent communications in one F1 beam from causing significant amounts of interference into the closest other spot beam that operates on the same F1 frequency. Because a total of seven frequencies are used in this example, the figure shows a "seven-fold" frequency reuse plan. Frequency reuse plans involving different numbers of frequencies are possible.

9. In the context of MSS, deploying this type of frequency reuse plan leaves areas on the surface of the Earth in which the MSS system is not using a specific MSS frequency, such as frequency F1 as shown in the diagram. The idea behind MSV's ATC is that a terrestrially based communication can occur on frequency F1 in those areas in which the satellite is not using frequency F1 provided that sufficient discrimination exists between the terrestrial transmitters and the MSS satellite beams that use the same frequency. Figure 2 demonstrates a sample frequency reuse plan for a geostationary MSS ATC system.[18]

[18] This sample MSS ATC diagram is based on the proposal of MSV. For additional information on MSV's proposal, see MSV Jan. 10,2002 *Ex Parte* Letter at 18-19.

**Figure 2: Example of Possible Additional Frequency Reuse through ATC**




After deployment of **MSS** ATC, a spot-beam operating on frequency F1 is surrounded by spat-beams operating on one of six other frequencies (F2 to F7) and terrestrial cells also operating on F1. The distance between spot-beams operating on F1 and the terrestrial cells, which also operate on FI, is sufficient to prevent harmful interference from occurring in the F1 **MSS** beams.

10. ATC implementation for the non-geostationary orbit (NGSO) MSS systems, such as that of Globalstar and ICO tend to be more complex both because the NGSO satellites move with respect to the Earth's surface and because multiple MSS satellites may be visible at one time. Like the GSO systems, however, the NGSO use multi-beam antennas and assign selected MSS frequencies to selected satellite antenna coverage beams.

11. Globalstar, for example, would assign separate frequencies to MSS and ATC operations varying the assignments on a timed basis.'' The ATC services that are planned for **urban** areas would cause co-frequency MSS services to be unavailable in areas of the United States where the satellite beam coverage included a co-frequency ATC city. These restricted frequency MSS areas would vary as the satellites move in orbit and as the coverage areas change. Globalstar also indicates that by assigning some frequencies to ATC in selected cities while assigning different frequencies to the MSS operations would reduce the loss of MSS coverage area. They also indicate that MSS operators could reserve some spectrum for MSS-only operations.

12. ICO, an NGSO MSS service provider, plans to control the amount of bandwidth assigned to both the MSS system and the ATC based upon traffic load." According to ICO, this concept allows reuse of the MSS spectrum by the ATC in urban areas, while still allowing the satellite to utilize the same spectrum to provide service in rural areas.

13. While MSS ATC systems could operate on unused frequencies within a satellite beam MSS ATC operators will choose in some cases to operate on some frequencies that are being used within the satellite beam. **As** a conceptual matter, MSS ATC will generally operate by using certain MSS channels or spectrum on a terrestrial basis over a limited geographic area, such as an urban market. Since the satellite signal generally would be very weak as compared to signals from nearby terrestrial base stations

[19] See Globalstar Supplemental Comments at **5**.

[20] ICO Mar. 8, 2002 *Ex Parte* Letter, App. B at 2-3.

on the same channel, the channel can be used to provide terrestrial service in place of the satellite service in this geographic area. In areas away from the terrestrial base station (perhaps 20 kilometers or more), the signal from the MSS satellite would be much greater than the signal from the terrestrial transmitter on the same channel, and the user would receive the signal from the MSS satellite. There might be a zone on some channels where neither the terrestrial or satellite signal is able to overcome the interference from the other signal, although satellite signals on other channels still would be available for use.

**14.** The principal proponents of MSS ATC – MSV, ICO and Globalstar – ask that we permit them to re-use their assigned MSS frequencies to operate terrestrial base stations for the purpose of extending their communications services to urban areas and in buildings where the satellite signal is attenuated. They intend that the terrestrial services offered would be ancillary in nature with MSS remaining their primary service offering." They state that ATC will allow them to more efficiently and dynamically use the spectrum resources assigned to their systems and add that permitting ATC in urban areas will increase their customer base so that they can offer lower-cost services generally.[22] They also contend that a larger customer base will result in economies of scale that will reduce handset manufacturing costs, permitting production of more affordable handsets. They state that if they are permitted to offer ancillary terrestrial services to overcome technical difficulties in penetrating urban areas, they will have a better opportunity for successful development of commercial MSS systems that will serve rural and unserved markets and will be able to use their licensed satellite spectrum more efficiently. In the ***Flexibility Notice,*** we incorporated by reference both the ICO and MSV proposals.[23]

## B. Flexibility Notice

**15.** In the ***Flexibility Notice,*** we stated that the potential long-term benefits of MSS merit consideration of approaches to achieve flexibility in the delivery of communications by MSS operators." We asked whether and how we might bring flexibility to MSS spectrum either by: (1) permitting 2 GHz and L-band MSS operators to provide service in areas where the MSS signals are attenuated by integrating terrestrial operations with their networks using assigned MSS frequencies, as has been proposed by two operators, or (2) opening up portions of the *2* GHz and L-bands for any operator to provide a terrestrial service that could either be offered in conjunction with MSS or as an alternative mobile service.[25] In addition, we sought comment on whether we should consider permitting terrestrial operations in the Big LEO bands due to the similarity between these systems and 2 GHz MSS operations."

16. On March 6. 2002, we asked for additional technical discussion concerning a way to implement the alternative proposal discussed in the *Flexibility Notice,* which would open portions of the

---

[21] *MSV Application of* 6-9; ICO Mar. 8, 2002 *Ex Pone* Letter at I, 6-10.

[22] *MSV Application of* 12-13; ICO Mar. 8, 2002 *Ex Pane* Letter at 11-13.

[23] *Flexibility Notice,* 16 FCC Rcd at 15534, ¶ 5 & n.7.

[24] *Id.* at 15533. ¶ 2.

[25] *Id.* at 15533, ¶ 3.

[26] *Id.* at 15533, ¶ 4.

MSS bands for any operator to provide a terrestrial service." We sought comment concerning whether, from a purely technical point of view, MSS operations in the 2 GHz MSS, L- and Big LEO bands could be "severed" from terrestrial operations in each band. Specifically, we asked commenters to elaborate on their earlier discussion of whether it would be "technically feasible for one operator to provide terrestrial services and another operator to provide satellite services in the same MSS band."[28]

### C. Other Proceedings

17. We note that we do not reach decisions here on issues raised in the Flexibility Notice concerning the relocation of incumbents from the 2 GHz MSS bands.[29] Specifically, in the Flexibility Norice, we sought comment on the implications of permitting ATCs for existing broadcast auxiliary service (BAS) and fixed service (FS) relocation programs established to implement MSS in the 2 GHz band.[30] We recognize that our decisions here will require us to revisit our existing BAS and FS relocation policies; however, we will consider possible revisions to our current relocation procedures based on the outcome of other proceedings involving our overall spectrum-management plan in the 2 GHz frequencies:' and our actions today are not intended to prejudice the outcome of those proceedings.

## III. DISCUSSION

18. Below, we consider the MSS ATC proposals and alternative approaches as proposed in the Flexibility Notice and in the record, and conclude that permitting ATC in the MSS bands serves the public

---

[27] Commission *Staff Invites* Technical *Comment on* the Cenain Proposals *to* Permit Flexibility in the Delivery of Communications by Mobile *Satellite* Service Providers in the 2 *GHz* Band, The L-Band. And The *1.6/2.4 GHz* Band, IB Docket No. 01-185, Public Notice, 17 FCC Rcd 4418 (2002) (Severability Norice). The responses to the Severability Notice shall be referred to as "Supplemental Comments" throughout this Order.

[28] *Severability* Notice, 17 FCC Rcd at 4419.

[29] See Amendment of Section 2.106 of the Commission's Rules *to* Allocate Spectrum ar 2 *GHz* for Use by the Mobile-Satellite Service, ET Docket No. 95-18, First Report and Order and Further Notice of Proposed Rule Making, 12 FCC Rcd 7388 (1997), *aff'd on* recon., Memorandum Opinion and Order and Third Notice of Proposed Rule Making and Order, 13 FCC Rcd 23949 (1998), *further proceedings*, Second Report and Order and Second Memorandum Opinion and Order, 15 FCC Rcd 12315 (2000), *further* recon. pending (2 *GHz* Allocation and Relocarion Proceeding).

[30] Flexibility Notice, 16 FCC Rcd at 15560-62, ¶¶ 72-76. BAS providers maintain that we should suspend and restructure the BAS relocation scheme if we permit introduction of ATCs. See Meredith Corporation Reply at 1-4; NAB Reply at 1-10, 16; 2 GHz Broadcast Group at 1-6; SBE Comments at 3-5; SBE Reply at 4.5. ICO urges us to leave in place relocation policies for FS users. ICO Comments at 51; ICO Reply at 13-15.

[31] See AWS Third *Report* and Order, FCC 03-16 (reallocating up to 30 megahertz of spectrum from the 2 GHz MSS bands for terrestrial services); *Amendment* of Parr 2 of *the Commission's* Rules *to Allocate Spectrum* Below 3 *GHz* for Mobile and Fixed Services *to* Support *the Introduction* of New Advanced Wireless Services. including Third Generation Wireless *Systems*, ET Docket No. 00-258, Memorandum Opinion and Order and Further Notice of Proposed Rulemaking. 16 FCC Rcd 16043, 16057-58, ¶¶ 32-34 (2001) (Advanced Services *Further* Norice) (seeking comment on changes that would have to be made in the 2 *GHz* Allocarion and Relocarion Proceeding should the Commission reallocate some portion of the 2 GHz MSS band for other uses, including advanced wireless services); *Improving Public Safety Communications* in the 800 *MHz* Band, WT Docket No. 02-55, Notice of Proposed Rule Making, 17 FCC Rcd 4873, 4904, 156 (2002) (*800 MHz* Notice) (seeking comment on relocating BAS and FS incumbents should the Commission use portions of the 2 GHz MSS band as replacement spectrum for displaced 800 MHz licensees, in an overall effort to improve public safety communications).

interest. MSS licensees in each of the three bands at issue in this proceeding are either operating or building satellite system under authority that the Commission has granted to them. We find that MSS licensees may achieve greater efftciencies in their use of assigned spectrum through MSS ATC and that there would be operational and other benefits that would serve the public interest. We further find that it would be inadvisable or impracticable to adopt other alternatives that would either compromise the operations of MSS licensees or require us to take away the authority that has been granted to MSS licensees. Therefore, we conclude below that the public interest is best served by permitting MSS licensees flexibility to improve MSS by having the option of deploying MSS ATC to improve spectrum efficiency and achieve other public-interest goals, particularly given that our technical analyses demonstrate that we cannot grant to a third party the right to use licensed MSS spectrum for terrestrial use without impacting the rights of the existing satellite licensees. In addition, we discuss the conditions we impose on MSS operators that wish to integrate ATCs into their networks? We then address technical issues related to each band in which we permit ATC. Finally, we consider certain statutory, allocation and licensing issues.

## A. MSS ATC Primary Proposal

### 1. Proposed ATC Use of the Frequency Spectrum

19. Proponents of ATC state that allowing additional MSS flexibility will increase efficiency within spectrum already allocated for MSS. though in some cases ihey differ on the precise methods by which they would achieve these gains. First, according to these parties, ATC would allow satellite operators to serve new customers that they cannot currently reach?' Second, these parties claim ATC would permit satellite operators to divert some communications traffic from the satellite to the terrestrially-based system, which would free existing satellite capacity for other potential users.[34] Third, these parties note ATC would allow an operator to reuse spectrum several more times within relatively small geographic areas than previously possible.[35] Because ATC must operate within bands already allocated to MSS, these parties argue that ATC reuse of the MSS spectrum represents an efficiency gain.[36]

20. Some commenters dispute the anticipated gains in spectrum efficiency that the proponents envision in the MSS bands from ATC.[37] As explained in greater detail below, we do not agree with these

---

[32] MSS ATC may not commence operation without a grant of authority pursuant to the licensing and service rules we adopt today, which, among other things, require the MSS ATC applicant to demonstrate that it provides substantial satellite service to the public and that it will operate MSS ATC only in the spectrum segments we authorized for ATC operations. See, *e.g., infra* App. B (adopting 47 C.F.R. § 25.143(j), which requires licensing prior to operation).

[33] Constellation Comments at 5, 1 0 MCHI Comments at 8-11; ICO Comments at 23; MSV Comments at 15-17.

[34] Constellation Comments at 5, 10; MCHI Comments at 8-11.

[35] See, *e.g.*, Loral Comments at 9; Globalstar Bondholders Comments at 27.

[36] Constellation Comments at iii, 5; MCHI Comments at ii. 2, 10-11; ICO Comments at iii. 23-25, 31-36; MSV Comments at i, 16-20 Globalstar Comments at vi, 27-28.

[37] Voicestream Reply at 3 (noting that both the ATC and 'alternate' proposals would "improve spectrum efficiency").

claims?' MSS ATC proponents do not seek additional spectrum, but rather greater authority to use spectrum previously licensed for their use in satellite systems in additional ways. As such, the potential efficiency gains of ATC – whether obtained through increased frequency reuse within a satellite beam or through improved MSS reception in urban areas – are real. Indeed, granting MSS operators the ability to provide more and better services to both existing and potentially new subscribers with the same amount of spectrum necessarily improves the efficiency with which they can use the spectrum and, we believe, may ultimately provide a service that is more valuable to consumers. Thus, we find that authorizing ATC will provide MSS operators with the possibility of achieving greater efficiencies within MSS spectrum than possible today by stand-alone MSS space stations or divided control of the MSS space and ground segments."

21. Using frequency-reuse techniques, MSS ATC has the potential to transmit more information to more individual users within a given amount of spectrum than MSS alone. While the exact configuration of each MSS ATC will vary depending on the MSS licensee's system parameters, MSS ATC, in essence, allows licensees the flexibility to achieve greater use of their licensed satellite spectrum than possible under our current MSS service rules. Because terrestrial channels can be re-used many more times over a much smaller area than the satellite use of the same channel, the MSS licensee can achieve higher frequency re-use by deploying MSS ATC than by a satellite-only system. MSS ATC will generally operate by using certain MSS channels or spectrum on a terrestrial basis over a limited geographic area, such as an urban market, that currently may not receive satellite signals due to terrain obstacles or other blockages. In areas away from the terrestrial base station, of course, the signal from the MSS satellite would remain much greater than the signal from the terrestrial transmitter on the same channel, and the user would continue to receive the signal from the MSS satellite. In areas near the terrestrial base station, an MSS ATC subscriber would communicate with the terrestrial base station in a manner that would not interfere with satellite channels that might penetrate the urban terrain." In either case, the MSS licensee would make more efficient use of its licensed satellite spectrum by incorporating greater frequency reuse into its system.

22. Our conclusions about the benefits of permitting MSS the flexibility to provide ATC remain true even if fewer MSS licensees exist in the future than exist today. The question is not whether terrestrial services represent a more efficient use of spectrum than satellite services, but rather whether allowing MSS licensees to improve the efficiency of their licensed systems better serves the public interest than the status quo.[41] We conclude that permitting MSS licensees to enhance spectrum efficiency

---

[38] See *infra* § III(C) (6). In any case, we also conclude that granting terrestrial rights in MSS spectrum to non-MSS operators is not possible without undermining the authority already granted to MSS licensees. See *infra* § III(B).

[39] For a comparison of ATC versus other delivery methods, see § III(B) *infra*.

[40] In theory, there could be a zone on some channels where neither the terrestrial, nor satellite signal is able to overcome the interference from the other signal; however, satellite-coverage rules adopted today require that subscribers must be able to obtain MSS satellite service even in areas near the terrestrial base stations, provided that terrain does not block the satellite signal. Moreover. satellite systems often use different frequencies in different pans of their coverage areas to avoid self-interference. MSS operators have indicated that they will deploy their ATC on frequencies that are not being used by the satellite in that geographic area; thus, no interference zone would occur in these situations.

[41] *Report of Gregory L. Rosston, Ph.D.*, Stanford University. Stanford Institute for Economic Policy Research. Deputy Director, ICO Reply Comments, App. A. at A-3 ("If consumer welfare is enhanced by granting spectrum flexibility. it is irrational to withhold that flexibility solely to prevent an existing licensee from benefiting").

through ATC represents a superior choice to continuing with the regulatory status quo.

### 2. Operational Benefits

23. The record demonstrates that the integration of an ATC into authorized and existing MSS systems would have several benefits. First, MSS ATC will use more intensive and more efficient frequency reuse techniques to allow MSS licensees to conduct terrestrial mobile operations. By filling gaps in the MSS coverage area and increasing MSS network capacity, MSS ATC should not only permit customers in underserved or unserved terrestrial markets to use ATCenabled MSS handsets when in urban areas or inside buildings, but also allow MSS operators to develop new and innovative service offerings that satellite-only MSS systems cannot offer today.[42] MSS operators may choose to deploy a variety of new services through ATC-enabled MSS systems, including ubiquitous digital telecommunications and broadband services, interoperable nationwide public-safety systems, and other services that take advantage of the unique coverage and capacity characteristics of ATC-enabled MSS.[43] While the market will ultimately determine the precise mix of new offerings, we expect, at a minimum, that the expanded coverage and improved efficiency resulting from MSS ATC may enhance competition in some of the important niche markets that MSS serves, including the maritime, aeronautical, commercial-transportation and public-safety markets that rely on MSS for service to more remote and underserved locations.[44]

24. Second, for various reasons, improved coverage in urban areas should significantly expand the consumer market that MSS is capable of serving.[45] This larger consumer market would, in turn, allow providers to order larger production volumes, which further reduce the costs of producing phones.[46]

---

[42] By "handset." we refer in this Order to all types of communications terminals operated by an individual user and capable of transmitting voice, data, or both. In other words, the terms "phone," "handset" and "terminal" are used interchangeably to refer to end-user devices.

[43] *See. e.g.*, MSV Comments at 9-10; ICO Comments at 21; Globalstar Bondholders Reply at 12

[44] See MSV Comments at 5-11; MSV Reply at 3; Globalstar Comments at 2-4; Globalstar Bondholder Comments at 12-15; ICO Comments at 7: Loral Comments at 3-5.

[45] See. *e.g.*, Globalstar Bondholders Reply at 17 ("ATC authority will allow users to purchase smaller, less expensive phones. . . [and] will expand dramatically the subscriber market and thus will further drive down the price of phones through economies of scale."); ICO Comments at 19-21 ("ATC . . . will solve the market size and product investment problems . . . by making MSS more attractive to 'traditional' MSS market segments, and by creating brand new markets based on seamless service offerings – offerings that simply cannot be provided either by an MSS network that fails to provide reliable service in dense urban areas or by a terrestrial operator that can only offer limited geographic coverage."); MSV Comments at 11-14 ("A market exists for the truly continent-wide service that MSV proposes to offer with its integrated satellite and terrestrial system. . . . The inability of MSS carriers to provide service in urban and indoor environments has prevented MSS providers from developing a critical mass of customers."); Constellation Comments at 8 ("Allowing MSS systems to extend their services into urban areas will have a positive impact on the telecommunications market. . . . [T]he new service capabilities unique to integrated satellite/terrestrial system architecture . . . will allow a more rapid rollout of new advanced or specialized services on a nationwide basis.").

[46] See. *e.g.*, Globalstar Bondholders Reply at 17. Globalstar distinguishes between *dual-mode* MSS ATC handsets and *dual-band* CMRS-MSS handsets. Globalstar claims that dual-mode MSS ATC will be smaller and cheaper than dual-band CMRS-MSS handsets because the dual-mode MSS ATC handsets only need to operate in one frequency band whereas the dual-band CMRS-MSS handsets must operate in two frequency bands. See *id.* ("CMRS-MSS (continued....)

25. Third, an integrated MSS ATC would permit operators to offer all services over a single telephone number." According to Globalstar, consumers who use existing phones that are capable of operating on either terrestrial CMRS or MSS networks requires consumers to use two numbers – one for their MSS mode and a second number for the terrestrial mode.[48] The customer may also receive two separate bills, one from each service provider.[49] An integrated MSS ATC, however, would eliminate the complications and disincentives for customers that dual networks create, which arise from using two different frequency bands and from having two different vendors to achieve integrated, ubiquitous mobile coverage.

26. Fourth, an integrated MSS ATC likely would eliminate operational complications and associated transaction costs MSS operators may incur in separately negotiating terrestrial roaming agreements in limited geographic areas across the footprint of their satellites." While parties opposing ATC assert that MSS providers could enter alternative arrangements with terrestrial service providers,[51] MSS operators contend that such arrangements may be unlikely to occur in practice?' Under both the present system and our alternative proposal to permit a third-party operator to conduct terrestrial operations in the licensed MSS bands, an MSS licensee that wishes to offer an integrated satellite and

(Continued from previous page)

phones are larger and more expensive than single-band MSS-ATC phones will be. This is due in large part to the small production runs and redundant circuitry needed for CMRS-MSS phones to receive different terrestrial and satellite frequencies. In contrast, MSS-ATC phones will require only a single circuit and thus will be smaller and less expensive to produce than CMRS-MSS phones. Thus, ATC authority will allow users to purchase smaller, less expensive phones. In addition; ATC authority will expand dramatically the addressable subscriber market and thus further will drive down the price of the phones through economies of scale."). While we recognize that not all MSS providers may decide to include all MSS and ATC functions within a single handset, the option of doing so offers significant potential benefits.

[47] Globalstar Bondholders Reply at 16.

[48] Moreover, if a customer receives a call from a terrestrially based network while using the satellite phone, the phone cannot notify the customer of the incoming call. Globalstar Bondholders Reply at 16 (citing Globalstar Comments at 14; Globalstar Bondholders Comments at 35); Globalstar Bondholders Supplemental Comments at 3. We note that technological and logistical limitations, rather than any express regulatory barrier in our rules, appear to be the principal reasons preventing the use of a single telephone number within a satellite-terrestrial handset.

[49] Globalstar Bondholders Feb. 8,2002 *Ex* Pane Letter at 6; Globalstar Bondholders Supplemental Comments at 3.

[50] Globalstar Bondholders Supplemental Comments at 3 (identifyingdifficulties in roaming and joint marketing efforts).

[51] Stratos Comments at 10-11 ('The economies of scale favor using already existing terrestrial service providers and their substantial investment. as opposed to expending new resources to create new terrestrial mobile networks that use MSS spectrum."); Inmarsat Comments at 26 (asserting that MSS providers could enter into contractual agreements with CMRS providers who operate in other bands to "to create a more robust service, and to provide in-building service and coverage of areas where MSS signals may be blocked by buildings or terrain").

[52] Globalstar Comments at 15, 33, 35-36; Globalstar Supplemental Comments at 5 (claiming "there is absolutely no chance that two different operators of two separate mobile systems could successfully" coordinate with multiple terrestrial carriers); Celsat Supplemental Comments at 3 (arguing that it is "highly unrealistic for the Commission to expect MSS and terrestrial competitors can jointly coordinate these complex systems without substantial cost measured in terms of inefficient operations, huge administrative expenses and constant friction."); ICO Comments at 4. 30, 31; ICO Reply at 6; Constellation Comments at 20; Constellation Reply at 5; Constellation Supplemental Comments at 6 (noting that "[c]oordination would not be practical between each MSS licensee and potentially hundreds of different terrestrial licensees.").

terrestrial service at retail to a consumer must negotiate separate terresmal roaming contracts with terrestrial licensees that would cover various portions of the MSS licensees' footprint?' Given the presence of more than one terrestrial competitor in most regions, the MSS operator benefits from operating in as few additional bands as possible.[54] For a roaming agreement to be valuable to an MSS operator, therefore, the MSS licensee would prefer to enter agreements with those terrestrial licensees within, or relatively near, the same set of frequency bands throughout the MSS operators' geographically dispersed service area.[55] An existing MSS operator is concerned that terrestrial licensees in the desired terrestrial roaming band may have an incentive to hold out roaming privileges from the satellite licensee to derive as much value as possible from their rights to the terrestrial spectrum within their licensed geographic area.[56] Existing operators also are concerned that terrestrial and satellite licensees have little incentive to negotiate due to the high transaction costs associated with assuring coverage of such a widely dispersed geographic coverage area, and due to what may be viewed as the limited roaming revenues to be derived from the current MSS customer base.[57]

27. While roaming agreements may or may not be feasible, we are unconvinced that their availability should be a basis for not permitting ATC. Some MSS operators indeed may decide that reliance upon roaming agreements with existing terrestrial providers is preferable to building out their own ancillary terrestrial facilities. Nothing in the action we take today would preclude this option. By granting ATC, however, we give MSS operators another choice. Integrated ATC could permit an MSS operator to achieve network efficiencies by deploying the most efficient architecture for a particular geographic and market environment.[58] As Boeing has observed, moreover, these benefits would not be confined to users of the MSS systems' terrestrial components. Instead, the integrated nature of ATC will "permit MSS subscribers, rural and maritime, to benefit from larger market economies of scale for equipment, service offerings and geographic coverage."'[59] These additional capabilities reflect how a grant of terrestrial rights to MSS licensees results in more efficient use of spectrum and benefits not only MSS licensees but also consumers. Urban penetration capability, lower-priced phones, unified numbering, unified billing, and reduced transaction costs could reasonably be expected to result in lower retail prices and greater consumer demand for MSS. In addition, granting MSS licensees the option of deploying ATC has the potential, among other things, to encourage innovation in mobile telecommunications, broadband services and interoperable public-safety systems.

---

[53] See, *e.g.*, Globalstar Comments at 15; Constellation Comments at 2 0 Celsat Supplemental Comments at 3; Constellation Supplemental Comments at 6; ICO Supplemental Comments at 1-2.

[54] The fewer bands an MSS handset is required to use, the less expensive and complex the handset is to produce. See. *e.g.*, Globalstar Comments at 20.22; MSV Comments at 10, 14-15; Celsat Comments at 5; ICO Comments at 32-36; Constellation Comments at 10, 19, 34-35; Globalstar Bondholders Reply at 16-17, 42; Globalstar Supplemental Comments at 3; MSV Supplemental Comments at 6.

[55] See. *e.g.*, Globalstar Bondholders Reply at 17

[56] See, *e.g.*, Globalstar Comments at 35; Globalstar Bondholders Reply at 17-18.

[57] See, *e.g.*, Globalstar Comments at 10 n.1 I, 2 0 ICO Comments at 22

[58] ICO Comments at 23; accord *Report* of *Gregory L. Rosston, Ph.D.*, Stanford University. Stanford Institute for Economic Policy Research, Deputy Director, ICO Reply Comments, App. A. at A-6.

[59] Boeing Reply at 4.

### 3. Protecting the Public

28. MSS systems have the ability to offer instant global communications for civilians, public-safety organizations, and the military in areas where terrestrial facilities do not exist or do not function.[60] These services also permit lawenforcement, aid agencies and the public to communicate from remote locations on the land, on the sea or in the air through a single telephone number.[61] MSS operators point out the industry's role protecting the public, including the industry's vital role in ensuring reliable communications to protect the welfare of our nation and the lives of its citizens.[62]

29. We believe that ATC-enabled MSS systems may provide additional communications options and, therefore, offer our nation greater protection in times of crisis or disaster than traditional MSS systems alone.[63] By offering ubiquitous coverage with instant, nationwide interoperability, ATC-enhanced MSS may make the public, law enforcement and public-safety organizations easier to reach in the field, regardless of location. Accordingly, MSS ATC may enhance the nation's overall ability to maintain critical telecommunications infrastructure in times of crisis or disaster.[64]

---

[60] *See, e.g.*, Globalstar Comments at 6; MSV Comments at 10-11; ICO Comments at iii, 2, 7, 13, 20-21; Stratos Comments at i, 2; Globalstar Bondholders Reply at vii, 5; MSV Supplemental Comments at 2.

[61] The Commission has repeatedly noted the ability of MSS systems to protect public safety. ***See, e.g.*, *Amendment of Section 2.106 of the Commission's Rules to Allocate Spectrum at 2 GHz for Use by the Mobile-Satellite Service.*** Notice of Proposed Rulemaking, 10 FCC Rcd 3230, ¶ 7 (1995) ("MSS can provide nationwide public safety coverage. . . . [and] MSS could satisfy important requirements that cannot be economically satisfied by other means.'); ***Establishing*** Rules ***and Policies for the Use of Spectrum for Mobile Satellite Service in the Upper and Lower L-band.*** Notice of Proposed Rulemaking. 11 FCC Rcd 11675.11681 ¶ 12 (1996) ("MSS can . . . meet rural public safety needs and provide emergency communications to any area in times of emergencies and natural disasters."). If a crisis does occur, MSS systems allow military, law-enforcement, aid and relief agencies to overcome incompatibilities in the various units' communications systems. See Globalstar Reply at 6.

[62] MSV Comments at 10 ("Motient currently provides service to hundreds of federal. state, and local governmental agencies, including critical public safety organizations like the Federal Emergency Management Agency, U.S. Coast Guard, and local fire and police departments."); MSV Reply at 9-11 (describing the public safety, industrial, and maritime uses of the MSS services that Motient provides using its U.S.-licensed geostationary L-band satellite); Globalstar Reply at 5 ("MSS systems make communications available in emergency situations where terrestrial phone service is not available, either because there is no phone service at the site of the emergency or because the impact of the emergency disrupted existing terrestrial phone service"); ICO Comments at 13-15 (describing the MSS role in providing service in response to the terrorist events of September 11, 2001 as well as in other disasters such as earthquakes, hurricanes, tornadoes. cyclones, floods, forest fires, and refugee migrations) (citations omitted); Globalstar Bondholders at 9-12 (describing the "unparalleled functionality, flexibility, and availability to emergency, law enforcement, and public safety personnel" through Globalstar's MSS services) (citations omitted).

[63] Globalstar Comments at 6 (noting that "[e]mergencies can occur anywhere, inside buildings, on city streets, and in wilderness areas ...[and] increasing the usability of MSS phones in more locations through ATC makes MSS a better service for public safety and emergency response organizations."); MSV Comments at 10 (MSS ATC may provide opportunities to establish the type of reliable, ubiquitous, interoperable communications network for which Federal. state and local public-protection organizations have been searching); ICO Comments at iii ("A revitalized MSS industry is virtually the only economically and technically efficient way to bring broadband service to rural Americans, and will arm public safety, military, maritime, and recreational users with primary redundant communications services that are even more essential in today's environment.").

[64] MSS ATC may also alleviate "clogged wireline and terrestrial networks during a man-made or natural disaster." Globalstar Bondholders Comments at 8; ***accord*** Loral Comments at 2 ("MSS can play a unique and crucial public (continued....)

4. Strengthening Competition

30. MSS operators already possess licenses to use the spectrum allocated for MSS. Our actions today do not grant additional spectrum, but rather grant MSS licensees the ability to modify their licenses to offer a new terrestrial service that is ancillary to MSS.[65] The Commission has granted regulatory flexibility to terresmal and space-station spectrum licensees after finding that flexibility can promote competition and innovation without consuming additional spectrum resources.[66] The record demonstrates that a similar type of regulatory flexibility is warranted here because it is infeasible as a practical matter for a terrestrial service to share the MSS licensees' spectrum in the same place at the same time without unacceptably risking harmful interference to the existing and planned operations of MSS incumbents and compromising the operations of the MSS licensees.

31. Our decision to grant MSS ATC rests on a sound principle of spectrum management: namely, that the Commission should permit incumbents the option of deploying more efficient, more cost-effective uses of spectrum when granting the additional rights to third parties is impracticable or infeasible. In general, we will grant the rights to incumbents when granting rights to third parties would create an unacceptable risk of harmful interference that impinges on the expectations of Commission licensees. Indeed, as we explain below, authorizing third-party use of the MSS spectrum would impinge on the authority the Commission previously granted the MSS licensees. Significantly, moreover, we do not permit MSS licensees to provide any type of service that the allocation permits, but rather permit the incumbents to deploy MSS ATC subject to several conditions designed in part to ensure the allocation

(Continued from previous page)
safety role by providing a critical alternative for communications when traditional landline and terrestrial wireless systems are not functioning or are overwhelmed.");Globalstar Bondholders Reply at 9-10 n.23 ("the inimitable importance of the MSS industry to homeland security is a sufficient public interest justification to warrant strengthening the MSS industry through a grant of ATC authority.").

65 *Flexibility Notice,* 16 FCC Rcd at 15533, ¶ 2

66 *See Amendment of the Commission's Rules to Permit Flexible Service Offerings in the Commercial Mobile Radio Services.* WT Docket No. 96-6, First Report and Order and Further Notice of Proposed Rule Making, 11 FCC Rcd 8965 (1996) *(CMRS Flexibility Report and Order)* (granting terrestrial CMRS carriers authority to provide fixed services in mobile service bands);*Amendment of Parts 21 and 74 to Enable Multipoint Distribution Service and Instructional Television Fixed Service Licensees to Engage in Fixed Two-Way Transmissions,* MM Docket No. 97-217. Report and Order, 13 FCC Rcd 19112 (1998) (allowing Multipoint Distribution Service (MDS) and Instructional Television Fixed Service (ITFS) licensees to deploy two-way systems), *recon.,* 14 FCC Rcd 12764 (1999), *further recon.,* 15 FCC Rcd 14566 (2000); *Amendment of Part 2 of the Commission's Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services to Support the Introduction of New Advanced Wireless Services, including Third Generation Wireless Systems,* ET Docket No. 00-258, First Report and Order and Memorandum Opinion and Order, 16 FCC Rcd 17222 (2001) *(Advanced Services First Report and Order)* (adding a mobile allocation to the 2500-2690 MHz band); *Establishment of Rules and Policies for the Digital Audio Radio Satellite Service in the 2310-2360 MHz Frequency Band,* IB Docket No. 95-91, GEN Docket No. 90-357, Report and Order, Memorandum Opinion and Order, and Further Notice of Proposed Rulemaking, 12 FCC Rcd 5754, 5810-12, ¶¶ 138-142 (1997) (considering whether and how to permit Satellite Digital Audio Radio Service (SDARS) licensees to use in-band, ground-based repeaters to fill gaps in their satellite coverage); *see also XM Radio. Inc.*, Order and Authorization, 16 FCC Rcd 16781 (Int'l Bur. 2001) (granting special temporary authority for SDARS licensee to use terrestrial repeaters); *Sirius Satellite Radio, Inc.*, Order and Authorization, 16 FCC Rcd 16773 (Int'l Bur. 2001) (same).

remains first and foremost a satellite service!'

32. While sound spectrum management principles support grant of MSS ATC, granting additional flexibility in the provision of MSS to the public also has the advantage of reinforcing the potential public-interest benefits of MSS itself. For example, the Commission has recognized the potential of MSS to provide ubiquitous service to consumers. ATC will enhance this benefit by making MSS networks more commercially available through truly nationwide coverage.[68] ATC also may create a "self-reinforcing s iral" of increased subscription, reduced handset-production and per-minute prices, and greater cash flow! According to the Globalstar Bondholders, for example, the increased economies of scale that come with providing services to urban customers via ATC will allow MSS operators to serve a broader subscriber base.[70] We find that permitting ATC will allow MSS operators the opportunity to take advantage of a number of network, spectrum and economic efficiencies that may help defray the substantial capital costs required to create and operate a satellite system." These efficiencies could, in turn, reduce the marginal cost of serving subscribers and permit MSS operators to serve more customers?' By taking advantage of potential integration of services, MSS operators may also obtain economies of scale: larger customer bases could provide the opportunity to support larger production volumes and, therefore, lower costs for handsets and other equipment.[73] Also, integrating terrestrial services into MSS may reduce the transaction costs of administering separately owned satellite and terrestrial systems."

---

[67] Accordingly. the regulatory flexibility to provide ATC in MSS spectrum differs markedly from a "flexible-use" allocation, where a licensee could provide whatever services are allocated for the band without restriction, condition or limitation on the overall mix of service offerings they provide.

[68] ICO Comments at 5-15; MSV Comments at 9-10 Loral Comments at 1-4; Globalstar Bondholders Comments at iv-v, 3-4, 7-22; MCHI Comments at 6-8; MSV Reply at 6.

[69] See, *e.g.*, MSV Reply at 9 ("theviability that accompanies spectrum flexibility is the result of additional revenue and added efficiency from the critical mass of subscribers that are possible with terrestrial operations").

[70] See Globalstar Bondholders Comments at v. During the course of this proceeding, the Official Creditors Committee of Globalstar, L.P. (Globalstar Creditors) began to represent the interests of the Unofficial Bonholders Committee of Globalstar, L.P. (Globalstar Bondholders) as well as other Globalstar creditors. See Letter from Tom Davidson, Counsel for the Official Creditors Committee of Globalstar, L.P. to Michael K. Powell, Federal Communications Commission, IB Docket No. 01-185, I & n.1 (March 22,2002). Because the Globalstar Creditors and the Globalstar Bondholders share a substantial identity of interest, *id.* (endorsing the positions that the Globalstar Bondholders had taken in this proceeding as of March 22, 2002), we will refer to both entities as the Globalstar Bondholders unless context indicates otherwise.

[71] Of course, the authority to conduct in-band terrestrial operations in licensed satellite spectrum also brings with it new attendant costs, including the potentially considerable expense of constructing terrestrial towers and other, ATC-related infrastructure.

[72] These efficiencies constitute "'economies of scope," which are defined as the savings from providing two or more services on an integrated basis compared to the sum of the costs of providing each on a stand-alone basis. See Graham Bannock, *et al*, Penguin Dictionary *of Economics* 130 (Penguin Books, 5" ed., 1992).

[73] Globalstar Comments at 16; ICO Comments at 19-20; Constellation Comments at 10; Globalstar Bondholders Reply at 17.

[74] Transaction costs are "those costs other than price which are incurred in trading goods and services. These costs can be substantial, particularly in markets where the good being traded is heterogeneous and complex." David W. (continued....)

33. The opponents of ATC, however, raise several policy objections to granting additional flexibility to MSS licensees. Nearly all of the arguments that flexibility in the provision of MSS will cause anticompetitive harm rest on the assumption that ATC-enabled MSS will prove more profitable than MSS alone.[75] These commenters speculate that MSS licensees offering ATC will focus primarily on terrestrial services and allow their satellite component to degrade.[76] According to AT&T Wireless, terrestrial services would independently produce the vast majority of MSS providers' profits, while the satellite operations would draw little or no revenue and generate most of the system's costs?' According to AT&T Wireless, such an imbalance would provide strong economic incentives for MSS providers to supplant MSS with terrestrial service as their primary or even sole service?' Indeed, AT&T Wireless expresses skepticism that additional flexibility will work in reviving what are portrayed as struggling MSS providers[79] and adds that, even if ATC succeeds in ensuring the survival of a few MSS providers,[80] ATC would eventually "hasten the demise of MSS itself by reducing or eliminating MSS providers' incentives to provide satellite service through the introduction of the opportunity to move from the difficult MSS market to the far more lucrative terrestrial wireless market."[81] Although most opponents agree that authorizing flexibility will increase the revenues of the MSS licensees by allowing MSS licensees to capture high-revenue, urban users that MSS generally cannot now reach, some commenters remain skeptical that MSS licensees will actually reinvest their new-found revenues in comparatively less profitable MSS space stations!'

(Continued from previous page)
Pearce, *MIT Dictionary of Modem Economics* 432 (MIT Press, 4th ed., 1997). In the case of "severed" satellite and terrestrial systems, the costs include contract negotiation and enforcement, possibly with many terrestrial providers, as well as the costs involved in resolving what are likely to be many complex issues about coordination and interference.

[75] See, *e.g.*, Stratos at 2-3, 7-9; Indium Comments at 8; AT&T Wireless Comments at 5-6; Verizon Wireless Reply at 8.

[76] See, *e.g.*, Voicestream Reply at 22 (claiming the availability of satellite services could be eviscerated); Stratos Comments at 2-3.7-9 (arguing that terrestrial use will overwhelm the MSS bands); Indium Comments at 4, 8 (it is in ICO's long-term interest to spend a few billion dollars constructing, launching and operating a minimalist MSS constellation in order to gain free access to $30-$40 billion worth of nationwide spectrum).

[77] AT&T Wireless Comments at 5; AT&T Wireless Reply at 5-8.

[78] AT&T Wireless Comments at 5; AT&T Wireless Reply at 5-8.

[79] AT&T Wireless Comments at 2.

[80] See, *e.g.*, AT&T Wireless Comments at 16 (stating that "there is no reason to believe that. . . subsidizing MSS providers . . . would actually sustain MSS operations in the long run.''); CTIA Comments at 12 ("it is unlikely that MSS licensees would realize sufficient revenues from providing service in highly competitive urban wireless markets to cross-subsidize service in rural areas" due to the highly competitive market for terrestrial wireless services).

[81] AT&T Wireless Reply at 4; see *also* CTIA Comments at 12 (asserting that authorizing MSS flexibility may "actually harm coverage in rural markets" as MSS operators invest disproportionately in their terrestrial component of their networks).

[82] See. *e.g.*, Voicestream Reply at 13 ("Common sense suggests that MSS licensees would reinvest in the profitable [terrestrial]enterprise to generate yet additional profits," rather than the unprofitable MSS enterprise); Iridium Comments at 2, 8 (asserting that grant of ICO's ATC proposal would result "in the de facto reallocation of [MSS] spectrum for terrestrial use, by ICO and its affiliate Nextel" and that "[a]s a practical matter, the ICO satellite system (continued....)

34. We recognize these parties' economic assumptions, but do not find their arguments to oppose the grant of **ATC** persuasive. **As** an initial matter, **ATC** cannot be provided without continued provision of **MSS** under the terms specified in this decision and can only be provided in **the MSS** licensees' authorized frequency bands. If an **MSS** licensee using **ATC** were to disregard the rules and conditions adopted in this Order, we would cancel its **ATC** authorization and, if circumstances warrant, cancel its **MSS** license as well. We also have the authority to impose monetary forfeitures and other penalties. **ATC** authority wholly depends on **MSS** licensees' fulfillment of their construction, launch and operation requirements, and the continuing provision of substantial satellite service to the **public.**[83] Therefore, an **MSS** licensee that allowed its **MSS** offering to degrade could lose its **MSS** license, the fundamental prerequisite for offering the very type of terrestrial authority that some **ATC** opponents view as so uniquely **profitable.**[84]

**35.** While we are committed to ensuring **MSS** licensees observe our **MSS ATC** service rules by using a variety of enforcement mechanisms, up to and including license cancellation, we do not believe that our active intervention to ensure substantial satellite service consistent with the **MSS ATC** service **rules** adopted in this Order will prove necessary. As at least one economic expert has stated on the record, "the significant upfront and sunk costs of satellite systems increase the likelihood that the licensees would continue to operate their satellite **systems."**[85] Unlike marginal costs, sunk costs cannot be avoided by discontinuing or degrading service. In addition, **MSS** licensees, most of which have limited customer bases and capitalization, would appear unwise to abandon satellite services merely for the opportunity to compete only in the market for terrestrial mobile services where much larger, **better** financed competitors already engage in "competitive, intense [and] aggressive" price competition." Indeed, the competitive nature of terrestrial **CMRS** suggests that, even if **MSS** licensees were under no obligation to maintain their **MSS** systems, providing ubiquitous **MSS** would help distinguish their service offerings from larger, more established terrestrial **CMRS** incumbents. Finally, **some** commenters claim that, over the longer term, additional investment in satellite infrastructure might not occur because the money spent on construction, launch and operation could be more profitably invested elsewhere!' We disagree. Capital will be available for investment in satellite infrastructure regardless of the opportunities

(Continued from previous page)
will be ancillary to the Nextel terrestrial network, regulatory constraints notwithstanding");Boeing Comments at 7 ("[p]ermitting MSS operators to offer ancillary terrestrial services opens the door to potential abuse . . . . *As* the terrestrial component grows, an effect could be that the MSS component of the service would provide less and less of the overall system capacity. essentially vacating the spectrum to the terrestrial component.");Cingular/Verizon Joint Comments at 15-16 (asserting that terrestrial wireless service would not be ancillary to MSS).

[83] ***See, e.g.***, 47 C.F.R. **§§ 25.143(e)(3),** 25.161

[84] ***See, e.g.***, Constellation Comments at 29 ("If it is shown that an MSS system has degraded and the operator has made **no** plans to restore the system to its full coverage capabilities, the Commission can revoke the authorization for ancillary terrestrial operations.").

[85] ***See Report of Gregory L. Rosston. Ph.D.***, Stanford University, Stanford Institute for Economic Policy Research, Deputy Director. ICO Reply Comments, App. A. at A-8; Constellation Comments at 29 ("MSS operators have every commercial incentive to maintain high service availability"); Celsat Reply at I I ("MSS providers will have no economic incentive to convert their 2 GHz MSS systems into terrestrial-only systems.").

[86] ***Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993,*** Seventh Report, FCC 02-179, 17 FCC Rcd 12985. 13012 (2002)(***Seventh CMRS Competition Report).***

[87] ***See, e.g.***, CTIA Comments at 12;CTIA Reply at ***I***;AT&T Wireless Comments at 3, 9-13; AT&T Wireless Reply at 13-17;Cingular/Verizon Comments at 16-23;Cingular/Verizon Reply at 17-22.

available elsewhere as long as that capital can earn the market rate of return.[88] For these reasons, we believe that ATC. instead of acting as a deterrent to satellite investment, will increase the likelihood that MSS operators will provide efficient satellite service to consumers.[89]

36. Despite the views of some commenters, moreover, the projected but unknown relative volume of traffic on one system component or another is not a decisive factor in our analysis of the public interest benefits of MSS ATC. We recognize that, even with a satellite constellation operating at full capacity, terrestrial operations can reuse communications channels more intensively than satellite operations because terrestrial cells can be much smaller than the geographic area covered by satellite spot beams." As a result, even though ATC is restricted to portions of the spectrum that is available to MSS, larger traffic volumes can be supported by MSS combined with ATC than by MSS alone due to higher frequency reuse in the MSS ATC system. If a preponderance of terrestrial traffic were to occur on an integrated MSS ATC system, however, it could simply reflect various factors, such as higher population densities in urban areas or differences between satellite and terrestrial technologies, and the concentration of users need not imply that provision of satellite service is being degraded or diminished.

37. We also disagree with assertions that MSS ATC will allow MSS licensees to competitively harm terrestrial or satellite incumbents." At the outset, the possibility that a Commission action might harm a competitor does not render the action contrary to the public interest. *On* the contrary, where, as here, the ostensible harm comes from increased competition, the public will benefit by receiving additional competitive choices in the marketplace. Some commenters, however, portray ATC as an anti-competitive subsidy to ailing MSS providers that would distort the market because MSS operators would not be required to acquire terrestrial mobile rights at auction?' Some commenters suggest that, as a result, MSS operators would have an unfair or anti-competitive advantage in the provision of satellite. or terrestrial services. Other parties appear to argue that ATC-enabled MSS could be used as a financial resource to act anti-competitively with respect to wireless incumbents?' At least two ATC proponents,

---

[88] In other words. relative rates of return between investments in different types of infrastructure are not directly relevant to our analysis and, in any case, would be highly speculative.

[89] ICO enthusiastically endorses ATC in pan to help financially "bolster an important telecommunications service at a critical point in its development." ICO Reply at 5; see also, *e.g.*, Constellation Comments at 3, 7, 9-10 (asserting that, by offering more competitive services in urban areas, MSS operators will improve their finances and increase investor confidence).

[90] These small terrestrial cells in which frequencies are reused are sometimes referred to as pico-cells

[91] See, *e.g.*, Boeing Comments at 12-13; Boeing Reply at 7-8; Inmarsat Comments at 12-30; Inmarsat Reply at 7-25; Aviation Industries Parties Comments at 5-6, 8-1I; AT&T Wireless Comments at 2; AT&T Wireless Reply at 9-1 I; Iridium Comments at 2.

[92] See, *e.g.*, AT&T Wireless at 4; see *also* Voicestream Reply at 2, 14 (asserting that authorizing ATC without conducting auctions or imposing additional fees would give MSS licensees a competitive advantage that "would distort competition in the mobile telecommunications sector"); P&FF Comments at 13-14 ("Competitors of potential MSS systems are legitimately concerned that a decision to grant permission for ATC systems would allow MSS/ATC providers to compete unfairly for the same customers* because MSS/ATC would not be required to pay for terrestrial rights at auction); see also MSTV/NAB Comments at 16 (asserting that it would be "grossly unfair" to authorize ATC when, unlike many terrestrial wireless operators, MSS providers did not purchase spectrum at auction).

[93] See, *e.g.*, Voicestream Reply at 14 ("MSS licensees obviously would have an enormous cost advantage if they could . . . be excused by the Commission from paying any [auction] fees."); P&FF Comments at 14 ("it is at least (continued....)

however, respond that "[t]here will be no subsidy."[94] Motient and TMI, for example, assert that they will create new value by offering a more attractive retail offering: an affordable, nationwide, high-speed communications service with greater reliabillty, more extehsive coverage and more features than is currently available to urban, suburban or rural consumers?'

38. The arguments that ATC will be used as an anti-competitive subsidy in the provision of MSS are unconvincing. These concerns appear to be based on the idea that MSS operators would have an unfair competitive advantage over wireless incumbents because the wireless incumbents obtained some of their licenses through auctions whereas the MSS incumbents will have received ATC authority without bidding in an auction. Commenters allege that, if the Commission were not to accept applications for ATC that might produce mutually exclusivity, which might, in turn, result in an auction, the MSS incumbents will have the incentive and ability to distort the competitive market in CMRS. These comments involve two separate arguments: (1) that receiving ATC authority pursuant to this proceeding gives MSS licensees an incentive to set prices below levels that would be established if ATC flexibility were obtained by payment (i.e., in an auction); and (2) that the potential financial benefits of obtaining ATC authority without payment facilitates MSS licenses' ability to engage in predatory pricing against terrestrial wireless incumbents.

39. First, we do not believe that allowing MSS licensees the right to obtain ATC without bidding in an auction creates an incentive to price below competitive levels. As a preliminary matter, terrestrial CMRS and MSS ATC are expected to have different prices, coverage, product acceptance and distribution; therefore, the two services appear, at best, to be imperfect substitutes for one another that would be operating in predominately different market segments. Even if the two services were perfect substitutes, however, permitting greater flexibility in the delivery of MSS services would not confer an unfair advantage on the MSS licensees. While PCS licensees and some cellular licensees obtained licenses through auctions, other cellular licensees did not obtain their licenses through auctions but purchased them in secondary markets, and some cellular licenses were originally obtained through a license lottery or by other means that did not require payment. There is no evidence to show that those who did not purchase licenses in an auction obtained subscribers by charging lower prices than those who obtained their licenses through an auction. According to a Commission study:

> [the] telecommunications experience in the U.S. has . . . been consistent with the theory that historic costs don't alter pricing. For example, within a given market, the prices charged by cellular operators who obtained their licenses via comparative hearings of lotteries are not lower than the prices of those firms that purchased their cellular licenses in the secondary market, or firms that obtained PCS licenses in an auction. Similarly, where a U.S. cellular license has been bought at a significant cost from a party that

(Continued from previous page)
theoretically possible that firms . . . use the MSS/ATC route as a means [for] acquiring the necessary spectrum at greatly reduced cost, thereby placing them at a competitive advantage over CMRS providers").

[94] MSV Reply at 9.

[95] *id.* Proponents envision different types of new services. For example, ICO envisions new, comprehensive "telematics" services that will provide motorists with location information not only on open roads, but also in parking garages and urban canyons. ICO Comments at 21. Similarly. Constellation asserts that integrated ATC will allow MSS to offer "true nationwide commercial transportation tracking services on a single platform. eliminating the need for commercial vehicles to carry multiple transceivers for multiple networks." Constellation Comments at 8.

obtained it at no cost, we have not observed any increase in consumer prices.%

Based on these considerations, we find that MSS licensees do not have an incentive to forgo recovery of the value of spectrum and price below competitive levels merely because the spectrum was obtained without an auction?' Pricing that does not include recovery of the market value of an asset such as spectrum represents a loss (compared to the price that could be sustained in the marketplace) that MSS operators would have to bear regardless of how much, if anything, they spent on acquiring the asset initially?' MSS operators would be no more likely to sacrifice any possible commercial advantage generated by ATC than any other commercial advantage that they might possess."

**40.** Second, we find that, even if the two services were perfect substitutes, the potential financial benefits of obtaining ATC flexibility by grant rather than payment would not facilitate MSS licensees' ability to engage in predatory pricing against wireless incumbents and that MSS operators would face market discipline if they attempted to do so. Predation is a rare phenomenon in the modern U.S. economy, in part because there is a very high risk that such behavior will be unsuccessful.'" As the Supreme Court explained in *Matsushita* Electric *Industrial* Co. *v.* Zenith *Radio Corp:*

> [T]he success of such [predatory] schemes is inherently uncertain: the short-run loss is definite, but the long-run gain depends on successfully neutralizing the competition. Moreover, it is not enough simply to achieve monopoly power, as monopoly pricing may breed quick entry by new competitors eager to share in excess profits. The success of any predatory scheme depends on maintaining monopoly power for long enough both to

---

[96] See Evan Kwerel & Walt Strack, Auctioning Spectrum Rights 4 (FCC, Feb. 20, 2001), available *at* <http://wireless.fcc.gov/auctions/data/papersAndStudies/aucspec.pdf> (last visited, Dec. 27,2002).

[91] Indeed, the D.C. Circuit recently characterized arguments that reduced acquisition costs for an asset would lead to anti-competitive practices as "a foolish notion that should not be entertained by anyone who has had even a single undergraduate course in economics." *Fresno* Mobile Radio, *Inc.* v. FCC, 165 F.3d 965,969 (D.C. Cir. 1999) (citing Armen A. Alchian & William R. Allen, *Exchange & Production* 222 (3rd ed. 1983)("[O]nce [an item] is acquired, [its cost is] irrelevant to any future decision."). The D.C. Circuit added that "a moment's reflection would bring one to the realization that the use to which an asset is put is based not upon the historical price paid for it, but upon what it will return to its owner in the future. Would anyone be less interested in earning a return on money he had inherited than on money he had worked for? Of course not!" Fresno *v.* FCC, 165 F.3d at 969.

[98] As an illustration of why MSS operators would set the price of their terrestrial services at an identical level whether they obtain ATC authority by a grant or by payment, suppose that an MSS operator obtains ATC authority by payment. Further suppose that such an MSS operator correctly calculates that he would maximize the profits of his firm by setting a pricep for ATC services that undercuts the price charged by terrestrial incumbents by a certain amount. The exact same price p would be profit-maximizing even if the MSS operator obtains ATC authority by grant because the costs of providing ATC service - in particular the value of the additional spectrum resources made available by ATC– are the same under either a payment or grant scenario. Thus, an MSS operator that obtains ATC authority by grant would have no incentive to make price cuts beyond those that would be made by an MSS operator that obtains ATC authority by payment.

[99] For instance. the market value of the spectrum is reflected in the stock price, which is the market value of the firm. To the degree that prices fail to reflect the full value of the spectrum, earnings will decline and so will the market value of the firm.

[100] See, *e.g.*, Ronald L. Koller, *The Myth of Predatory* Pricing, Antitrust Law and Economics Review 3: 105-23, (1971); John E. Kwoka, Jr. *et al.*, *ed.*. *The Antitrust Revolution* 151 (Harper Collins College Publishers, N.Y., 1994).

> recoup the predators' losses and to harvest some additional gain.. ..For this reason, there is consensus among commentators that predatory pricing schemes are rarely tried, and even more rarely successful.[101]

In addition to the high odds against predation actually being successful under any circumstances, we believe that several specific circumstances of the wireless industry make predatory activity on the part of MSS operators highly unlikely. The first circumstance involves the imperfect substitutability between terrestrial services and MSS ATC. Only a limited portion of customers desiring terrestrial service are likely to be interested in supplementary MSS services, which suggests that the two services will not be competing in the same market segment. With different anticipated prices, coverage, product acceptance and distribution, the two services appear to be imperfect substitutes as far as customers are concerned therefore, predatory pricing, which generally requires extensive and direct competition, would be highly unlikely under these circumstances.

41. The second circumstance involves the fact that MSS operators are not dominant incumbents in the terrestrial wireless marketplace. Alleged predators are almost always dominant incumbents in the market in which predation is alleged because firms in such a position have the greatest incentive and ability to engage in predatory behavior."' MSS operators, therefore, do not fit the economic profile of likely predators. As indicated above, MSS ATC is unlikely to compete directly with terrestrial CMRS for the same customer base except for those consumers requiring the enhanced services, and thus is not expected to be dominant in the same market segment. Also, wireless cellular and PCS have already built out systems and provide service to large portions of the U.S. population. An MSS operator with ATC authority would be unlikely to prove able to take large numbers of subscribers away from the wireless operators even at predatory price levels. Also, MSS operators face structural disadvantages that terrestrial wireless operators do not. Due to our requirement that MSS operators provide substantial satellite service as a precondition for providing terrestrial services. any MSS operator choosing to provide terrestrial service must raise hundreds of millions of dollars before providing service to its first terrestrial subscriber.[103] By contrast, terrestrial operators can construct their networks incrementally city-by-city,

---

[101] *Matsushita Electric Indus. Co. v. Zenith Radio Corp.*, 475 U.S. 574.589 (1986) (citing Robert Bork, *The Antitrust Paradox*, 149-155 (1978)). The Commission dismissed similar arguments in *Applications of Voicestream Wireless Corporation, Powertel, Inc, Transferors, and Deutsche Telekom AG. Transferee*, 16 FCC Rcd 9799,9829, ¶ 89 (2001) (noting that "[i]f the [applicants] were to attempt to engage in predatory pricing, it is highly unlikely that it would be able to maintain such an artificially low price for a sufficiently long period of time to drive competitors out of business."); *see also Brooke Group Ltd. v. Brown & Williamson Tobacco Corp.*, 509 U.S. 209,224 (1993) ("Without [recoupment], predatory pricing produces lower aggregate prices in the market, and consumer welfare is enhanced. . . .[U]nsuccessful predation is, in general. a boon to consumers.").

[102] *Kwoka et al., supra*, at 15 I (identifying the predator as the dominant firm in each theory of rational predation discussed). For examples of alleged predation by dominant firms. *see, e.g., Standard Oil Co. of New Jersey v. United States*, 221 U.S. 1 (1911); *United States v. Aluminum Co. of Am.*, 148 F.2d 416 (1945); *Am. Tobacco Co. v. United States*, 328 U.S. 781 (1946); *Matsushita Elec. Indus. Corp. v. Zenith Radio Corp.*, 475 U.S. 574 (1986); *United States v. AMR Corp.*, 140 F. Supp. 2d 1141 (2001). For a discussion of an unusual instance in which a non-dominant firm was alleged to engage in predatory behavior, *see Kwoka et al., supra*, at 260; *Brook Group, Ltd. v. Brown & Williamson Tobacco Corp.*. 61 U.S.L.W. 4699 (1993).

[103] Based on industry reports, filings with the Securities and Exchange Commission and agency experience, Commission staff estimates that MSS licensees have spent at least $2.8 to $4.4 billion to construct and launch NGSO MSS systems and at least $1.7 billion to construct and launch a GSO MSS system. *See, e.g., Form 10-K. Globalstar Telecommunications Limited and Globalstar, LP.*. Dec. 31, 2001, at 32; John M. Bensche, *Revisiting Valuation on the Big LEO Satellite Sysrenis*, Lehman Brothers, 11 (May 29. 1998). Due to inflation, increased (continued....)

with expansion funded, in part, by revenues from existing subscribers.[104] This difference exposes MSS providers to substantial risk that the economy or the mobile satellite communications market could change dramatically between the time an MSS provider forms its business plan and years later when the MSS provider actually commences service.[105]

42. Based on the reasoning above, MSS licensees are highly unlikely to try to use additional flexibility in the provision of MSS to act antisompetitively in the market and are very likely to fail if they tried. Even in the unlikely event that such anti-competitive conduct did occur, it can be resolved through regulatory and judicial remedies. We, therefore, do not find persuasive claims that financial advantages caused by permitting ATC will be used to cut prices below competitive levels.

43. A few commenters argue that granting additional flexibility will, at least in the 2 GHz MSS band, "most likely result in the monopolization of the . . . band and the *de facto* reallocation of that spectrum for terrestrial use by ICO and its affiliate, Nextel Communications."[106] According to these commenters, common ownership in both ICO and Nextel will cause these companies to act in concert and, as a result, exploit competitive advantages that other stand-alone MSS providers cannot match.'[107] Some commenters speculate that, as a result of these presumed synergies between Nextel and ICO, investors will not fund new MSS entrants and ICO will "monopolize" perhaps 50 megahertz or more of highly valuable nationwide spectrum for its existing terrestrial network.'[108]

44. We do not believe that our primary proposal will specially benefit ICO or Nextel by, for example, providing them unique opportunities that other companies would not also enjoy. ICO and Nextel are separate corporations, neither under the control of the other and each with limited overlapping ownership. Although some investors may own both ICO and Nextel stock, the corporate officers and management have fiduciary responsibilities to their own stockholders. many of whom may not own stock

(Continued from previous page)
capital costs, rising insurance fees and other expenses, future MSS systems are likely to cost as much or more than the incumbent systems did.

[104] Globalstar Comments at v.

[105] The United States' economic downturn and the dramatic growth and extension of terrestrial mobile networks, due in large part to economies of scale, could not have been adequately forecast when the Commission began its Big LEO allocation proceeding nearly a decade ago.

[106] Iridium Comments at 2-3; accord Voicestream Reply at 15 ("ICO would have an enormous (and completely artificial) advantage in the new market that the Commission would be establishing (terrestrial-satellite vs. satellite-only)" because "ICO's affiliate, Nextel. already owns and operates a nationwide terrestrial network, and to provide its terrestrial services, . . . ICO/Nextel would only need to add radios (tuned to MSS spectrum) to existing cell sites.").

[107] Iridium Comments at 2 (claiming that "[w]ithout an existing terrestrial infrastructure and customer base (such as is possessed by Nextel) or a business plan targeting a separate market niche (and supported by deep corporate 'pockets'), it is all but inconceivable that funding will be available for new MSS entrants"): id. at 3 (claiming that no rational investor "would seek to compete against Nextel's entrenched position in this market.").

[108] See. *e.g.*, Voicestream Reply at 16 ("in authorizing MSS AT[C], the Commission would effectively allow. . . ICO/Nextel to monopolize the satellite market"); Iridium Comments at 2-3.

in both companies.[109] Therefore, ICO and Nextel would be required to independently consider their corporate interests regarding the joint provision of ATC services. Moreover, with respect to the 2 GHz band, whether through our case-by-case review of consolidation transactions or through our ability to open new processing rounds or reallocate spectrum if 2 GHz MSS licensees fail to meet their milestones, we do not intend to allow monopolization of the band. Even if ICO and Nextel currently intended to capitalize on their business strengths and cooperate in offering MSS ATC, nothing would prevent other CMRS and MSS operators from also doing so. For instance, nothing prohibits MSS providers from affiliating with terrestrial providers, through stock ownership, joint ventures, or other means, if a business relationship proves advantageous in the provision of integrated mobile services and as long as such arrangements comply with our rules and policies governing transfers of control.[110] Nor is there any bar on other MSS providers obtaining adequate funding if their business plans appear sound to lenders. Accordingly, we are not persuaded by Voicestream's claim that every MSS licensee except ICO "would be required to build terrestrial networks from scratch."[111] In any case, adopting a generally applicable policy that produces benefits for one class of similarly situated licensees where that is not the intent of the policy is not, without more, improper. arbitrary or otherwise contrary to the law or public interest.

**45.** Finally, some commenters also challenge the premise that the Commission has allocated the proper amount of spectrum for MSS use.[112] The Commission, however, has allocated MSS spectrum to achieve multiple objectives, including encouraging service to rural areas and enhancing public protection."[113] While, concurrent with adoption of this Order, the Commission has reduced the amount of MSS spectrum through reclaiming the spectrum of MSS providers that do not meet their milestones[114] and

---

[109] According to ICO, Nextel remains a publicly traded corporation, and any arrangement between ICO and Nextel regarding ATC would require approval by Nextel's independent board members due to overlapping ownership interests among principals of the companies. ICO Reply at 7 n.28.

[110] By analogy, we note that significant cross-ownership has emerged between satellite radio broadcasters and terrestrial audio radio broadcasters. SDARS. which provides radio broadcasts without locally originated programming to consumers via satellite, appears in many respects to compete directly with segments of the terrestrially based broadcast market, and one of the larger shareholders of the SDARS provider XM Radio is Clear Channel Communications Inc., which owns approximately 1,170 terrestrial radio outlets across the country. Brian Steinberg, *XM Satellite Radio's Ads Generate Some Heavy Static,* Wall St. J. (Feb. 1, 2002).

[111] Voicestream Reply at 15. In any case, we note that any entrepreneur seeking to take first advantage of a business opportunity remains subject to considerable risk, no matter how promising the opportunity may appear initially. Success by "first movers" may well pave the way for others to follow – a process that promotes competition and serves the public interest. As an additional safeguard, of course, the Commission's regulatory process, the various agencies responsible for antitrust enforcement and the threat of civil penalties should offer ample protection against what we believe to be the remote and speculative possibility of monopolization.

[112] See. *e.g.*, TDS Comments at 12 ("it would make more sense. . . to. . .reallocate [the MSS spectrum] through auctions" to existing terrestrial wireless carriers); CTIA Comments at 14 ("If anything, there is too much spectrum allocated for MSS today").

[113] *See* discussion *supra* at § IV(A).

[114] The Commission's rules provide for cancellation of a space station license when the licensee fails to meet a milestone. See 47 C.F.R. § 25.160. We use a "fairly bright line test" to determine whether an extension is warranted and grant extensions "only when delay in implementation is due to circumstances beyond the control of the licensee." See, *e.g.*, *Amendment of the Commission's Space Station Licensing Rules and Policies,* Notice of Proposed Rulemaking and First Report and Order, 17 FCC Rcd 3847, 3882, ¶ 105 & n.141 (2002) (citations omitted). We recently sought comment on how we might strengthen even these requirements. *Id.* at ¶¶ 104-106.

through reallocating MSS expansion spectrum,"' a wholesale revision of our spectrum-management priorities is not warranted here. MSS continues to have the potential to provide ubiquitous, highquality voice and data telecommunications services to the American public.[116] Indeed, the Commission has held that MSS services "will . . . complement wireless service offerings through expanded geographic coverage"'' and has found that satellites "may offer cost advantages over wireline access in rural and remote areas, where sparsely populated areas cannot provide the economies of scale to justify the deployment costs of wireline networks."[118] The Commission has also found that these advantages may prove particularly relevant to the maritime and aeronautical markets, for which MSS is an important. and sometimes the only, transmission path.[119] In each of these areas, more flexible rules for MSS may serve to enhance the benefits MSS offers to the public by improving the efficiency with which these services are delivered. Of course, nothing in our decision today limits our continuing spectrum-management obligation to ensure that the spectrum is used efficiently and effectively.

### B. Alternative Proposals

46. In our *Flexibility Notice,* as an alternative to MSS ATC, we requested comment on the possibility of making some MSS spectrum available for use by any entity to provide terrestrial services. either in conjunction with MSS systems or on their own.[120] In the *Severability Notice,* we sought supplemental comment on whether "it is technically feasible for one operator to provide terrestrial services and another operator to provide satellite services in the same MSS band.''[121] Under this approach, portions of the spectrum currently designated for 2 GHz MSS and L-band systems would be made available for use by terrestrial operations, separated from the MSS operations in the bands, and could be assigned by auction. Iridium proposes that we create a secondary terrestrial service (STS)

---

[115] *See AWS Third Repon and Order,* FCC 03-16, ET Docket No. 00-258 at ¶ 3

[116] *See 2 GHz MSS Rules Order,* 15 FCC Rcd at 16144-46, ¶¶ 32-34; *Establishmenr of Policies and Service Rules for the Mobile Satellire Service in the 2 GHz Band,* IB Docket No. 99-81, Notice of Proposed Rulemaking, 14 FCC Rcd 4843, 4846, ¶ 4 (1999) (2 *GHz MSS Rules Norice);Amendment of the Commission's Rules to Establish New Personal Communications Services,* Memorandum Opinion and Order, 9 FCC Rcd 4957,4995-96, ¶¶ 94-97 (1994); see *also, e.g.*, TMI Oct. 7,2002 *Ex Pane* Letter Attach. 1 at 5 ('The FCC has repeatedly – 1997. 1998, 2000 and 2001 –found that the current spectrum allocation for MSS best serves the public interest") (citations omitted).

[117] *2 GHz MSS Rules Notice.* 14 FCC Rcd at 4843, ¶ 2

[118] *Extending Wireless TelecommunicationsServices to Tribal Lands,* Report and Order and Further Notice of Proposed Rule Making, 15 FCC Rcd 11794, 11799, ¶ 13 (2000) *(Tribal Lands Repon).*

[119] *Establishing Rules and Policies for the Use of Spectrum for Mobile Satellire Services in the Upper and Lower L-Band,* Report and Order. 17 FCC Rcd 2704, 2708, ¶ 11 (2002)("MSS systems are particularly well suited for providing mobile communication services to areas that are not being adequately served by terrestrial radio facilities");*Mobile Satellite Services Subsidiary.* Memorandum Opinion and Order. 17 FCC 12894, 12895. ¶ 4 (2002)(noting "the importance of safety-related communications [provided by MSS for] the integrity of maritime safety and distress communications");*Vistar Data Communications*, Order and Authorization. 17 FCC 12899, 12901, ¶ 8 (2002) (same).

[120] *Flexibility Norice.* 16 FCC Rcd at 15548, ¶ 37.

[121] *Severability Notice.* 17 FCC Rcd at 4419

allocation across all MSS bands with frequency blocks available to all through competitive bidding.'"

### 1. Same-Band, Separate-Operator Sharing

**47.** Almost all commenters argue that an approach that does not require sharing between non-related parties would better serve the public interest than same-band, separate-operator sharing. While severed operations might theoretically be possible with an extremely limited number of users,[123] MSS ATC proponents maintain that it is not, as a practical matter, advisable for one operator to provide terrestrial services and another operator to provide satellite services in the same MSS band, over the same geographic areas, due to the high likelihood of interference.[124] These parties note that same-band operation by separately owned and operated terrestrial and satellite licensees would likely require network exclusion zones that would restrict traffic over large territories,[125] diminish spectrum efficiency and network capacity for both satellite and terrestrial-based systems,[126] and increase the likelihood of interference to both satellite and terrestrial users.[127] For example, Globalstar argues that the only feasible method to manage MSS ATC interference is to offer terrestrial service in selected locations on selected channels, reusing the channels outside the relatively small boundaries of the terrestrial service area.[128] Globalstar adds that, for operators that use CDMA coding, severing the MSS bands into terrestrial and satellite components would increase the likelihood of interference to a number of important services immediately adjacent to MSS, including radio astronomy, Global Positioning System (GPS), the Global Navigation Satellite System (GLONASS) and Instructional Television Fixed Service (ITFS).[129] Celsat argues that it is unrealistic to expect that MSS and terrestrial competitors can jointly coordinate these complex systems without substantial cost measured in terms of inefficient operations, large administrative expenses and constant friction between the forced joint venturers.[130]

---

[122] Iridium Comments at 5-8 & Supplemental Comments at 2-4.

[123] See *infra* § III(D).

[124] See, *e.g.*, ICO Supplemental Comments at 11-19; Globalstar Supplemental Comments at 4-7; MSV Supplemental Comments at 6-9.

[125] See, *e.g.*, Constellation Supplemental Comments at 3.

[126] See ICO Supplemental Comments at 11; Celsat Supplemental Comments at 4; Globalstar Supplemental Comments at 6.

[127] For example, Inmarsat, which has claimed that integrated MSS ATC operations would cause unacceptable interference to existing MSS systems, asserts that separately owned and operated satellite and terrestrial operations in the MSS spectrum "would exacerbate an already unacceptable interference threat into the Inmarsat system caused by proposed integrated terrestrial operations." See Inmarsat Supplemental Comments at 3.

[128] Globalstar Supplemental Comments at 5. According to Globalstar, terrestrial and satellite services require complex coordination "on the fly" between the satellite and terrestrial modes and, through dynamic frequency assignment, a single operator could offer both satellite and terrestrial services in certain locations while maintaining universal satellite coverage. Furthermore, according to Globalstar, there is no chance that two different operators of two separate mobile systems could successfully accomplish such coordination.

[129] Globalstar March 13,2002 *Ex Parte* Letter Attach. I at 10 (noting that CDMA MSS operators "require all of the licensed spectrum in order to coordinate with these services").

[130] Celsat Supplemental Comments at 3

**48.** Other commenters dispute these statements. AT&T Wireless, for example, states that spectrum is currently authorized for co-frequency use by independent, disparate users (including satellite and terrestrial) in a wide variety of contexts, contradicting the MSS operators' contention that the provision of different services by unaffiliated providers would be unworkable."' Meanwhile, other commenters, such as Cingular/Sprint, take an equally dim view of same-band sharing regardless of whether a single MSS operator administers spectrum-sharing within a unitary network or whether the MSS licensee coordinates spectrum sharing with one or more separately owned and operated networks. Accordingly, Cingular/Sprint contend that "the central question before the Commission is not the technical feasibility of having a separate ATC operator, but the practical feasibility of doing any spectrum sharing between satellite and terrestrial networks."[132] According to Cingular/Sprint, the sharing of the MSS band between satellite and terrestrial operations, while technically possible, is not practically viable."' Based on a technical study performed by Telcordia Technologies (Telcordia Study), Cingular/Sprint conclude that the MSS satellite uplink can tolerate only a small number of active ATC co-channel headsets because of the total EIRP radiated into the sky by the ATC terminals within the MSS beam and argue that "it is technically feasible for separate-operators to share the MSS band in the provision of satellite and terrestrial services, and there would be no loss of spectral efficiency if two different firms as opposed to one firm operated the satellite and terrestrial systems."[134]

**49.** We conclude that same-band, separate operator sharing is impractical and ill-advised. As a preliminary matter, we find that references to sharing arrangements in other bands, while illustrative that sharing may be possible, particularly where both services operate in limited geographic areas on a fixed basis, do not address how parties to this proceeding can overcome the technical hurdles to workable sharing arrangements between two mobile services. The feasibility of any given satellite-terrestrial sharing arrangement in any given frequency band depends upon inter-related factors including: propagation characteristics of the frequency band, mobility of the communication end points, geographic separation between users, anticipated operating power, protection of adjacent spectrum users from interference, extent of system deployment across territory. and other particulars. Because of these

---

[111] See Letter from Douglas I. Brandon, Vice President, AT&T Wireless, to William F. Caton, Acting Secretary, Federal Communications Commission at 3 & n.5 (filed April 1, 2002)(AT&T Wireless Apr. 1 2002 Ex Pane Letter) (citing *Amendment* of Pam 2 and *25 of the Commission's Rules to Permit* Opemrion *of NGSO FSS Systems* Co-Frequency *with* GSO and Terrestrial *Systems* in *the* Kit-Band *Frequency* Range, ET Docket No. 98-206, First Report and Order and Further Notice of Proposed Rule Making. 16 FCC Rcd 4096, 4218¶ 326 (2000) (citing, *inter* alia, Amendment to Parrs *1*, 2, *87* and *101* of *the Commission's* Rules *to* License Fixed *Services* at *24 GHz*, WT Docket No. 99-327, Report and Order, 15 FCC Rcd 16934 (2000); *Amendment of the* Commission's Rules Regarding *the 37.0-38.6 GHz* and *38.6-40.0 GHz* Bands, ET Docket No. 95-183, Report and Order and Second Notice Proposed Rule Making, 12 FCC Rcd 18600.18636 (1997)).

[132] Cingular/Sprint May 13, 2002 *Ex* Parte Letter at 2.

[133] Id. at 15. Cingular/Sprint provide a technical study performed by Telcordia Technologies (Telcordia Study) to support their claim that ATC and dynamic frequency assignment would be less spectrum efficient than providing MSS and terrestrial services by separate operators in the same frequency band. The study investigates prospects for sharing spectrum between the MSS and ATC by analyzing the four interference paths between the MSS system and the ATC system: ATC base station to MSS downlink, MSS terminal to ATC base station, MSS satellite to ATC terminal and ATC terminal to MSS uplink. According to Telcordia, interference paths along three of the paths is generally confined to the areas near the ATC base station. and thus is easier to manage. Telcordia concludes that the most difficult sharing situation occurs between ATC handheld transmitters and MSS satellite receivers because the power from the ATC transmitter will reduce the capacity of the MSS systems.

[134] *Id.*. Attach. A at 2.

variables, each proposed satellite-terrestrial band-sharing arrangement is different. Satellite and terrestrial licensees, for example, might prove able to coordinate geographically discrete, fixed, point-to-point operations in the higher frequency bands where rain fade, atmospheric absorption and other factors limit the distance that frequency transmissions can travel."' But the same parties might experience great difficulty in coordinating ubiquitous, mobile, multipoint-to-multipoint operations in the lower frequency range such as 1-3 GHz.

***50.*** Accordingly, the various proceedings that AT&T Wireless cites in support of same-band, separate-operator sharing are inapposite to the present case.[136] In the ***MVDDS Order,*** for example. the Commission concluded, after several years of study, that sharing is possible between geostationary DBS satellites, which provided links to fixed earth stations, and MVDDS systems, which employ highly directional fixed antennas. Yet the mere existence of other sharing arrangements in other bands by other operators with other system geometries, other deployment patterns, other terminal types and other power levels – without more – says nothing about whether and how parties to this proceeding might overcome the particular technical hurdles to workable sharing arrangements applicable to this case. The potential for sharing between stationary services that use highly directional fixed antennas in the bands around 12 GHz has little, if any, relevance to the prospects for sharing among two or more highly sensitive mobile systems that rely on omnidirectional antennas in the bands below 3 GHz, which has far more favorable propagation characteristics than the 12 GHz band.

51. AT&T Wireless also cites the ***Government Transfer*** Bund ***Order*** as support for the proposition that the Commission has authorized same-band sharing between terrestrial and satellite services."' In that decision, however, the Commission actually rejected same-band sharing between terrestrial fixed services and fixed satellite services (FSS) and, after a limited transition period, adopted a permanent freeze on any additional co-primary FSS earth stations in the band.[138] Indeed, many of the

---

[135] By way of example, we would generally not expect satellite transmissions from a single, geostationary orbit satellite directly over the United States to a single, fixed earth station in New York generally to interfere with terrestrial transmissions from a fixed location in Virginia to another fixed location in Maryland, particularly in bands in the 40 GHz range.

[136] ***See*** AT&T Wireless Apr. I, 2002 ***Ex Pane*** Letter at *3* & n.5 (citations omitted)

[137] ***Id.*** at n.5 (citing ***Amendment of the Commission's Rules with Regard to the 3650-3700 MHz Gov'r Transfer Band.*** ET Docket No. 98-237: ***The 4.9 GHz Band, Transferred from Federal Gov't Use,*** WT Docket No. 00-32, First Report and Order and Second Notice of Proposed Rulemaking, 15 FCC Rcd 20488, 20498, ¶ 20 n.64 (2000) (***3.7/4.9 GHz Governmenr Transfer Band Order)).***

[138] ***3.7/4.9 GHz Government Transfer Band Order.*** 15 FCC Rcd at 20497-20501, ¶¶ 18-29. In declining to permit same-band, co-primary terrestrial and satellite operations, the Commission held that:

> [I]n this band, allowing FSS on an unrestrained co-primary basis would impede any potential widespread use of the band for terrestrial services. Due to the weak signals that are received in the FSS. coordination with higher-powered terrestrial operations would result in potentially large geographic areas where terrestrial services could not operate to avoid interference to FSS. The size and shape of these "exclusion zones" may be different for each FSS earth station site because factors such as shielding, antenna orientation and terrain elevation will vary from site to site. These coordination requirements and the presence of exclusion zones would significantly increase transaction costs and create a disincentive for deployment of new terrestrial operations. Thus, we find that unrestrained deployment of FSS earth stations could hinder or greatly inhibit the opportunities for terrestrial operations in the band.

(continued....)

same considerations that led the Commission to reject same-band, separate-operator sharing in the *Government Transfer* Bund *Order* – onerous coordination requirements, large and variable exclusion zones, high transaction costs and disincentives for investment – persuade us to decline to adopt the alternative, same-band, separate-operator sharing proposal posed in our *Flexibility Notice.*

52. MSS ATC represents a more efficient alternative than same-band, separate-operator sharing. Even if MSS ATC were not the more efficient alternative in the abstract, we do not make decisions in a vacuum. Ultimately, we must decide whether or not to authorize MSS ATC in light of the license-rights of the MSS incumbents and, in most cases, within the context of already operational MSS services. While we agree with those commenters that suggest it may be theoretically possible for two different firms to own and operate the satellite and terresmal portions of a single system, we believe that, in reality, no two operators are likely to succeed in organizing themselves to manage the highly complex coordination process required between both the MSS and the terrestrial component at the same time in the same band in the same region. To optimally balance the frequency usage of the terrestrial and satellite portions of the system, the ATC portion must be operated in a manner that controls the ATC terminal-to-MSS uplink interference while still providing ATC service. For NGSO MSS systems, this coordination most likely would need to be accomplished on a dynamic basis to accommodate the motion of the satellite constellation. And, for L-band MSS systems, this coordination must include the ability to permit emergency preemptive, priority message traffic.[139] While it may be an operational challenge for a single operator to assign effectively channels between the satellite and terrestrial operations, multiple operators would find achieving efficiently this type. of coordination much more difficult.

53. We disagree with the Cingular/Sprint conclusion that there would not be a loss of spectral efficiency if non-affiliated system operators operated separate MSS and terrestrial systems in the same band. We do agree with Cingular/Sprint that the greater potential for interference exists from the ATC mobile terminals to the MSS receivers. Indeed, we place several technical limitations on ATC systems to avoid ATC interference to MSS systems in the allocation. We also agree that power control must be taken into account when considering the aggregate uplink power of the ATC network.'" The added power control will reduce the effect of ATC terminals on the MSS satellite receiver and result in minimal MSS capacity loss. We apply certain other limitations on ATC to protect MSS systems from receiving interference (e.g., limitations on the number of base stations permitted to transmit on a given channel in the L-band) and it is questionable whether a limitation on base station deployment, for example to reduce interference to MSS, would provide a gain in spectrum efficiency for a non-affiliated terrestrial network.

54. Our experience in other bands and the technical analysis below supports the MSS ATC

(Continued from previous page)

Id. at 20497. ¶ 18. Furthermore, the Commission limited any mobile operations in the band to base stations. because, unlike mobile terminals, base stations operate from fixed locations that may facilitate sharing in certain circumstances.

[139] *See infra* § III(D)(2)(a)(iv).

[140] Cingular/Sprint, for example, indicate that power control must be taken into account when calculating the interference because "the interference into the MSS uplink is the sum of contributions from multiple ATC terminals." Cingular/Sprint May 13,2002 *Ex Pone* Letter, Attach. A (Telcordia Study) at 20. The Telcordia Study, however, includes only the 'range compensation' factor that accounts for the difference between the transmit power of a terminal at the cell boundary and the average terminal power within the ATC cell. The ATC terminals near the cell boundary will be commanded, by the power control system. to transmit at a higher power level (because of the greater distance from the terminal to the base station) than the users near the base station itself. The result is that the 'average' ATC terminal will transmit a power somewhat less than it is maximally capable of. In our analysis, we also consider additional margin to compensate for structural attenuation. See *infra* §§ III(D)(1) & III(D)(2).

proponents' technical arguments. Same-band satellite and terrestrial operations have created technical problems in other bands.[141] While these technical problems have not always proved insurmountable. particularly where only stationary deployments are involved,[142] the problems grow more complex where, as here, both the proposed satellite service and the proposed terrestrial service are planned as *mobile* services with widespread deployments.[143] In certain MSS bands at issue in this proceeding, moreover, international agreements[144] and permissive domestic licensing policies[145] make establishing long-term

[141] *See. e.g., Allocation and Designation of Spectrum for Fixed-Satellite Services in the 37.5-38.5 GHz, 40.5-41.5 GHz and 48.2-50.2 GHz Frequency Bands; Allocation of Spectrum to Upgrade Fired and Mobile Allocations in the 40.5-42.5 GHz Frequency Band; Allocation of Spectrum in the 46.9-47.0 GHz Frequency Band for Wireless Services; and Allocution of Spectrum in the 37.0-38.0 GHz and 40.0-40.5 GHz for Government Operations,* Further Notice of Proposed Rulemaking, IB Docket No. 97-95, 16 FCC Rcd 12244 (2001) (V-Band Further Notice) (describing the difficulties of sharing between ubiquitous fixed terrestrial wireless systems and satellite systems, discussing agreements to dedicate separate spectrum to the two services and seeking comment on possible solutions where separation was not possible); *Advanced Services First Report and* Order, 16 FCC Rcd at 17223, ¶ 3 (noting that the possibility of the shared use of the band by MSS is "sharply diminished by the introduction of terrestrial mobile services in the 2.5 GHz band and rejecting a proposal that would allow MSS to share frequencies in the 2.5 GHz band with terrestrial mobile and fixed services principally because "sharing between terrestrial and satellite systems would present substantial technical challenges").

[142] *Amendment of Pans 2 and 25 of the Commission's Rules to Permit Operation of NGSO FSS Systems Co-Frequency with GSO and Terrestrial Systems in the Ku-Band Frequency Range,* Memorandum Opinion and Order and Second Report and Order, ET Docket No. 98-206, 17 FCC Rcd 9614 (2002) *(MVDDS Order)* (concluding, after several years of study. that sharing is possible between geostationary DBS satellites and MVDDS systems, which use fixed, highly directional antennas stationary co-frequency terrestrial and satellite operations), *modified by,* Erratum, 17 FCC Rcd 5849 (PSPWD, rel. Aug. 14.2002); *see also* ICO Supplemental Comments at 13-14 & nn.13-14 (describing M M D S proceeding).

[143] *See, e.g.,* Globalstar Supplemental Comments at 5 & Attach. 1 at 1-43.

[144] In the L-band, for example, the amount, specific frequencies and geographic location of the spectrum in which the five MSS operators in the region of the United States must operate can vary annually. In 1996, the five MSS operators and their respective administrations agreed to a framework by which they could negotiate future sharing arrangements for L-band spectrum in Region 2. This agreement, the 1996 Mexico City Memorandum of Understanding (Mexico City MoU), provides for annual coordination to divide the spectrum on the basis of. among other things, each satellite system's actual usage and realistic projections of future usage. Although annual meetings were to have taken place under the terms of the Mexico City MoU, these meetings have not occurred since the parties last agreed to a complex spectrum-sharing arrangement in London in 1999; therefore, the parties continue to operate under the 1999 assignments pending further negotiations. The following operators currently share L-band spectrum: MSV (United States); TMI (Canada); Inmarsat (United Kingdom); Solidaridad (Mexico); and Volna-More (Russia). In addition, the Multi-functional Transport Satellite (MTSAT-1R) from Japan is expected to commence L-band MSS operations sometime in 2003. To permit full operations, however, the Japanese system will need to obtain L-band MSS spectrum from the spectrum currently assigned to the five MSS operators that were parties to the 1996 Mexico City MoU. Although the parties to the Mexico City MoU have not yet established a meeting date to negotiate a new operating agreement that accounts for the needs of the new MTSAT system, the Japanese administration is expected to participate in the next available negotiation session under the principles of the Mexico City MoU. *See, e.g.,* MSV Supplement Comments at 8; Inmarsat May 21,2002 *Ex Pane* Letter, Attach. I at 3; Inmarsat Supplemental Comments at 13-14; *see also* National Space Development Agency of Japan, Future Launch Schedule. *available at* <http://www.nasda.go.jp/projects/mission-in-progress_e.html> (last visited Nov. 12, 2002).

[145] Coordination between co-frequency communications systems, for example, requires knowing fairly precise technical information about the configuration and operation of any systems operating in the relevant band. In the 2 GHz MSS band, however, only one of eight MSS licensees currently knows its precise operating frequencies. In the (continued....)

coordination plans extremely difficult and – together with the need to prevent and resolve recurrent concerns about mutual interference – would require the Commission's active and continued oversight over many years and still may not prove successful.[146]

55. Based on the record and our analysis, we find that establishing shared usage between MSS and terrestrial services would likely compromise effectiveness to such a degree that neither service would prove cost-effective, and therefore would probably not be deployed. Therefore, we decline to adopt same-band, separate-operator sharing as an alternative to permitting MSS licensees in each of the three MSS bands at issue in this proceeding the option of adding ATCs in determining how they conduct their MSS operations.

2. Separate-Band, Separate-Operator Sharing

56. In our Flexibility Notice and again in our Severability Public Notice, we sought comment on whether "it is technically feasible for one operator to provide terrestrial services and another operator to provide satellite services in the same *MSS band*."[147] Though we did not propose a separate-band, separate-operator configuration, several commenters construed the Flexibility Notice and the Severability Public Notice to propose reallocating spectrum from MSS to terrestrial mobile use. In general, these commenters view the principal MSS ATC proposal as not truly same-band sharing but rather as band segmentation (*i.e.*, separate band, separate operator). For example, Verizon Wireless argues that MSS operations can be "severed from terrestrial operations by reallocating the terrestrial and satellite spectrum into separate frequency bands.[148] Similarly, AT&T Wireless states that MSS licensees propose to segment the band themselves in the same way that it would be segmented for nonaffiliated providers because ATC and satellite components cannot operate co-frequency in the same cell regardless of whether MSS and terrestrial wireless service are provided by a single or by different providers.[149] According to these commenters, therefore, if "severability" is actually accomplished by segmentation, then there is no reason why the technical requirements for a non-affiliated terrestrial service should be any more complex

(Continued from previous page)
2 *GHz MSS* Rules Order. the Commission divided the 2 GHz MSS uplink (1990-2025 MHz) and downlink (2165-2200 MHz) bands into distinct segments of equal bandwidth (Selected Assignments) to be based on the number of authorized systems. See *2 GHz MSS* Rules Order, IS FCC Rcd at 16138, ¶ 16. An additional segment was reserved for MSS system expansion. Id. Under the Selected Assignment approach, each 2 GHz MSS operator must voluntarily identify its selected spectrum after the first satellite in its system reaches its intended orbit. *Id.* On October 15,2002, ICO notified the Commission that it had selected the first 3.88 MHz segment from the band edge at 1990 MHz (*i.e.*, 1990-1993.88 MHz) and the third 3.88 MHz segment from the downlink band edge at 2165 MHz (*i.e.*, 2172.76-2176.64 MHz). See Letter from Cheryl A. Tritt. Counsel to ICO Satellite Services G.P., to Marlene H. Dortch, Secretary, Federal Communications Commission. File No. 188-SAT-LOI-97, IBFS File No. SAT-LOI-19970926-00163 *et al.* (Oct. 15.2002). Four more 2 GHz MSS licensees must choose their Selected Assignments under our 2 GHz MSS service rules and licensing orders.

[146] See. *e.g.*, Celsat Supplemental Comments at 3 (concluding that the prospect of separately owned and operated MSS and terrestrial mobile operations is "highly unrealistic" because "any Commission program of independent terrestrial operations would force MSS operators to somehow determine the location of all terrestrial users in real time and then to attempt to control millions of terrestrial calls on an on-going, real-time basis *in perpetuity* for their terrestrial competitors") (emphasis in original).

[147] *Severability Notice* at 2.

[148] Verizon Wireless Supplemental Comments at 1

[149] See, *e.g.*, AT&T Wireless April 1, 2002 *Ex Parte* Letter at 3.

than for a single operator.[150]

57. Most of the MSS licensees addressing this issue disagree at great technical length with the terrestrial operators' statements."' The MSS licensees state that they will implement their MSS ATC systems through shifts of frequency that would vary over time.[152] They contend that they do not intend to separate the two types of systems into different channels in the type of permanent way that the terrestrial carriers and their representatives claim that they will.[153]

58. We need not resolve the debate over whether MSS ATC will use a "dynamic" or "static" frequency-assignment mechanism to achieve greater frequency reuse. The Commission has identified MSS as an important component of our overall mix of spectrum allocations. The "separate-band, separate-operator" approach, however, would, in essence, reallocate spectrum from MSS to other uses. We believe that reconsideration of the spectrum-management decision to allocate resources to MSS is unreasonable and unwarranted. Nevertheless, to the extent parties believe that this basic spectrum-management decision should be altered, the Commission has initiated other proceedings to comprehensively address the proper amount of spectrum to allocate to MSS, some of which are resolved today. In this Order, we simply conclude that, within the spectrum currently allocated for MSS, some MSS licensees may find that they can achieve greater spectrum efficiency, greater capacity and more robust service by using MSS in combination with MSS ATC than through MSS alone.

### 3. Secondary Terrestrial Service

59. In response to the *Flexibility Notice*, Iridium proposed a secondary terrestrial service (STS) in the MSS bands at issue in this proceeding.'" Under Iridium's STS proposal, the Commission would maintain the primary allocation for MSS in the 2 GHz MSS, L- and Big LEO bands, but establish a new, secondary allocation for terrestrial mobile services. The Commission would not limit eligibility for these new STS licenses to the MSS incumbents and, after opening a filing window, would use competitive bidding to resolve any mutually exclusive applications.[155] Iridium claims that its STS proposal would expand the number of potential parties that might implement terrestrial mobile services in the primary MSS bands beyond the number of MSS systems able to implement ATC under our primary proposal.[156]

60. We believe that Iridium's proposal for a primary MSS allocation and an STS allocation suffers from several problems. Most important, MSS and terrestrial mobile services cannot as a practical matter share the same band unless all of the components that might potentially cause interference,

---

150 See, *e.g.*, *id.* at 8.

151 See. *e.g.*, ICO Supplemental Comments at 6-19; Globalstar Supplemental Comments at 4-7, Technical Appendix at 1-42; MSV Supplemental Comments at 6-9.

152 Constellation Supplemental Comments at 3.

153 See. *e.g.*, ICO Reply at 9-11; Globalstar Reply at 8-10; MSV Reply at 7, 10, 23-24.

154 Iridium Comments at 5-8; Iridium Supplemental Comments at 2-4

155 See Iridium Supplemental Comments at 4-6 (explaining various adjustments needed in the 2 GHz MSS service rules to limit uncertainties and other problems necessary to successfully implement a competitive bidding process in the band).

156 Id. at 2

including the terrestrial base stations, the mobile earth terminals and the MSS satellites, are capable of responding dynamically to interference.[157] As discussed below, the potential for interference between MSS and terrestrial mobile systems is, in fact, so great that we believe only a single type of operator – in this case, the incumbent MSS licensees – would possess both the ability and incentive to coordinate operations in a manner that avoids interference.[158]

61. Iridium also suggests that imposition of secondary status on in-band terrestrial systems would ensure that the satellite systems are adequately protected against harmful interference.[159] Establishing a secondary allocation, however, does not itself adequately protect primary licensees against interference. Iridium recognizes as much when it states that MSS licensees must first achieve a "high degree of comfort" that STS will not interfere with their operations before any new STS licenses could be issued.[160] But it does not identify an interference threshold by which the Commission might measure whether the MSS licensees have achieved comfort.[161] Lacking the necessary technical information in the record, we are concerned how coordination among primary and secondary licensees, alone, could ever result in the operational parameters necessary to make STS workable – the same parameters that Iridium acknowledges would be necessary for STS operations to be successful.[162] Significantly, moreover, primary service users are not required to coordinate with secondary operations.

62. Iridium recognizes that the precise technical parameters of each secondary allocation would be difficult to establish and would vary widely depending on the exact system architectures, operational configurations, coding techniques, power levels and other parameters that each MSS licensee and each in-band secondary terrestrial system chose to use.[163] Complicating matters further, Iridium envisions each

---

[157] See discussion *supra* at Section III(B)

[158] See discussion infra at Appendix C1-3

[159] See, *e.g.*, Iridium Supplemental Comments at 6 ("By imposing secondary status on the terrestrial systems, the Commission ensures that the satellite systems are protected.").

[160] Iridium Comments at 6; see also Iridium Supplemental Comments at 3 (claiming. twice. that it is "'essential" that MSS systems not experience interference from secondary terrestrial operations); Iridium Supplemental Comments at 4 (demanding "absolute primary status" for incumbent MSS systems if its STS proposal were to be implemented) (emphasis added); Indium Comments at 6 (noting that "great care must be exercised in fashioning the technical rules that would govern this new STS").

[161] Iridium Supplemental Comments at 6 (specifics to be worked out in the inter-party coordination process or possibly Commission-established technical parameters); see *also* ICO Supplemental Comments at 14 n.15 (noting that Iridium has "neither provided any specific plan to operate any independent terrestrial system in MSS spectrum nor offered any technical analysis demonstrating the feasibility of such as system") (citation omitted).

[162] See, *e.g.*, ICO Supplemental Comments at 14; Globalstar Comments at 14-15; Globalstar Bondholders Comments at 33-34; Globalstar Bondholders Supplemental Comments at 2; Celsat Comments at 8; Constellation Comments at 16; ICO Reply at 1, 7-8; Celsat Reply at 16-17 n.44; MSV Reply at 13-15; CTIA Reply at 14; Globalstar Reply at 11.

[163] Iridium Supplemental Comments at 5; see *also* Iridium Supplemental Comments at 5 (conceding that STS would involve "potentially complex issues"); Iridium Supplemental Comments at 3 (noting that "[o]bviously . . . [STS] may theoretically complicate . . . coordination").

potential STS licensee as occupying more bandwidth than would be assigned to any one MSS licensee.[164] As a result, each new STS licensee would need to coordinate its proposed secondary operations with at least two primary MSS systems.[165] Because each primary MSS system would use different satellites, different antennas and, in all likelihood, different coding and other operational parameters, each prospective STS licensee would need to design its terrestrial system to meet an insurmountable number of potential interference scenarios.[166] Finally, even if the secondary terrestrial mobile applicant and the primary MSS licensees agreed on co-channel interference limits,[167] the secondary terrestrial mobile applicant would still need to consider the operational parameters of forthcoming next-generation satellite systems and, as with any licensee, protect adjacent channel MSS systems from potential interference.[168] Under these circumstances, a secondary terrestrial mobile system if ever able to coordinate its operations with the primary MSS licensees, would likely be too constrained in its operations to implement STS.[169]

63. Finally, Iridium appears to believe that permitting all MSS licensees to integrate ATCs into their systems is tantamount to a "policy that, defacto, would advance the interests of only one, uniquely situated, MSS system," namely those of ICO in the 2 GHz MSS band.'" The majority of MSS licensees, however, affirm their ability to im rove their spectrum efficiency by integrating a terrestrial component into their licensed MSS systems." Although Iridium itself may not be able to integrate a terrestrial component into its particular MSS system because of its historic choice of system technology,[172] many

[164] See. *e.g.*, Iridium Comments at 6 ("to provide adequate spectrum for STS operations -- including enabling the terrestrial licensee to be able to "work around a given MSS system -- STS licenses should cover more than the bandwidth of one individual MSS system").

[165] See *also* Constellation Reply at 5 n.15 (asserting that Iridium's proposal to have terrestrial use assignments larger than a single MSS system assignment renders the STS scheme too burdensome to consider as a reasonable alternative). In addition, in the 2 GHz MSS band where MSS licensees have not yet identified their Selected Assignments, Iridium concedes that prospective STS licensees would not even know the licensees with which they would be required to coordinate their operations. See Iridium Supplemental Comments at 3-4. To remedy this failing, Iridium urges the Commission to reverse its recently issued 2 *GHz MSS Rules* Order in part and immediately assign specific frequencies to the 2 GHz MSS systems. Only by requiring MSS licensees to immediately choose their Selected Assignments could STS applicants know from the outset the identity of the corresponding primary satellite systems with which they would need to coordinate. See Iridium Supplemental Comments at 4.

[166] Constellation Reply at 13 (questioning how an STS applicant would ever adapt to both CDMA and TDMA technologies in the Big LEO band).

[167] Iridium Supplemental Comments at 6.

[168] See. *e.g.*, CTIA Supplemental Comments at 8 ("Segmenting and separately authorizing terrestrial service in the MSS bands would not change this basic requirement to protect the operations of licensees in adjacent channels, whether satellite or terrestrial.")

[169] According to MSV, the coordination requirement that Iridium envisions imposing may very well prove so burdensome that MSS spectrum might lay fallow indefinitely. MSV Reply at 14-15.

[170] See Iridium Supplemental Comments at 2; Iridium Comments at 3 (claiming that MSS ATC is "an opportunity for ICO and no one else").

[171] See Globalstar Sept. 26,2002 Ex *Parte* Letter, Attach. I at 8. 11; TMI Sept. 26,2002 Ex Pune Letter at 7; MSV Aug. 29,2002 *Ex* Pune Letter at 2.

[172] Iridium is unlikely to prove able to integrate terrestrial operations into its licensed MSS frequencies as a result of its historical choice to deploy time division multiplex analysis (TDMA) coding in its MSS system.

other MSS licensees besides ICO have demonstrated that they can do so. Accordingly, any concern that only one MSS licensee will be able to implement ATC is unfounded. In fact, Iridium appears far less concerned with monopolization of the MSS bands than with advancing its position that, unless the Commission can find a way of allowing *Iridium* to exploit the operational efficiencies, enhancements and other advantages that MSS ATC may offer, the Commission must prevent all other MSS licensees from trying to improve the efficiency of their respective MSS systems through deploying ATC. We, however, refuse to impose the same operational limitations on Commission licensees through regulation that Iridium has imposed on itself through its system design choices.

*64.* In summary, we conclude that Iridium's STS proposal would involve technical and operational complications, and problems to successfully implement. In light of those problems and notwithstanding the potential that STS may expand the number of parties eligible to implement flexible operations, we conclude that the likely burden on secondary operators, MSS licensees, and the Commission would outweigh the benefits anticipated from the proposal.[173] We, therefore, decline to adopt Iridium's STS proposal.

#### 4. Conclusion

*65.* The record demonstrates that sharing between MSS and terrestrial mobile services is neither advisable, nor practical. Revocation of the authority of operational MSS systems and those MSS licenses that have met their implementation milestones in good faith is unreasonable and unwarranted. And our detailed technical analyses demonstrate that a third party cannot operate in the licensed MSS spectrum without compromising the operations of existing and future MSS licensees. We, therefore, face a choice between quickly achieving the public-interest benefits of improved spectrum efficiency, reduced costs and increased competition at the price of giving MSS licensees more than they had originally sought, or giving MSS licensees only what they originally received at the price of the public-interest benefits that MSS ATC promises. Under these circumstances, we decide that granting the MSS licensees additional spectrum flexibility represents the better course.

### C. MSS ATC Service Rules

*66.* We adopt service-rule requirements for the provision of MSS ATC that, among other things, effectively condition MSS ATC on the provision of substantial satellite service. As explained below, an MSS licensee that wishes to include ATC must meet certain requirements concerning: (1) geographic coverage; (2) coverage continuity; (3) commercial availability; (4) an integrated offering; and *(5)* in-band operation.[174] We view full and complete compliance with each of the requirements as essential to the integrity of our "ancillary" licensing regime. Without the integrity afforded by these MSS ATC service-rule requirements, an alternative licensing or distribution mechanism should be used. Thus, failure of an MSS operator to meet any of the ATC service requirements set forth in our Rules and this Order may result in enforcement action, including the imposition of a monetary forfeiture in addition to the loss of

[173] Iridium Supplemental Comments at 8

[174] As described in detail in section III(G), *infra*, we will require MSS licensees seeking ATC authorization to modify their space-station licenses using FCC Form 312 and provide specific information and certifications describing their ATC operations as meeting these requirements. As is Commission practice for any application to modify a space-station license, these applications will be available for review in the licensee's public file. Any applications meeting these requirements will be treated as minor modifications. As with any minor modification. if upon Commission review the Commission deems it in the public interest to seek comment on an MSS ATC application, the Commission at its discretion may provide public notice and opportunity for comment.

ATC and MSS operating authority. We remind licensees that, under section 503(b) of the Communications Act and the Commission's rules, the Commission may assess a monetary forfeiture against common carriers in amounts up to $120,000 for a single violation or per day of a continuing violation with a maximum forfeiture amount of $1,200,000 and against non-common carriers in amounts up to $11,000 for a single violation or per day of a continuing violation with a maximum forfeiture amount of $87,500.[175] We have no reason to believe that licensees will not comply in good faith with the service rules we adopt today; however, we will not hesitate to use our statutory enforcement authority against those licensees that do not.

### 1. "Ancillary" Service

**67.** Our decision to permit MSS ATC is based upon the premise that ATC remains "ancillary" to a fully operational space-based MSS system. We find that an ATC system is "ancillary" when an MSS operator meets all of our requirements for the provision of ATC.

**68.** In the *Flexibility Notice*, we stated that we intended the term "ancillary" to refer to those terrestrial services that MSS operators provide that: (1) "are integrated with the satellite network"; (2) "use assigned MSS frequencies"; and (3) "are provided for the purpose of augmenting signals in areas where the principal service signal, the satellite signal, is attenuated."[176] We added that, by using the term "ancillary," we intended to exclude "services that differ materially in nature or character from the principal services offered by MSS providers."[177] Our intention in defining the term "ancillary" in the *Flexibility Notice* was to distinguish our use of "ancillary" in the context of the *Flexibility* Notice from other instances in which the Commission has employed the term, not to suggest any additional requirements. In other words, we intended the term ancillary to refer to a proposed set of conditions under which an MSS licensee might offer integrated mobile services in the bands allocated for the MSS licensee's use, consistent with its existing MSS authorization.[178]

**69.** Some commenters dispute our definition of "ancillary" in the *Flexibility Notice*.[179] For example. in the *Flexibility Notice*, we said that we did not intend ATC services to differ materially "in nature or character" from MSS services. By this language, we sought to illustrate our expectation that MSS and MSS ATC *services* should remain similar in material respects; in other words, we envisioned both MSS and MSS ATC as generally offering the same types of applications to the end user. While our intent in defining the term ancillary was to clarify, we believe that our definition in the *Flexibility* Notice may, in fact, have led to confusion of our use of the term "ancillary" in this context. CTIA, for example,

---

[175] 47 U.S.C. § 503(b); 47 C.F.R. § 1.80.

[176] *Flexibility Notice*, 16 FCC Rcd at 15546-47, ¶ 30

[177] Id. at 15546-47, ¶ 30.

[178] *Id.* at 15546, ¶ *30;* see *also* discussion *supra* n.5.

[179] See, *e.g.*, Cingular/Verizon Comments at 15 & n.47. Cingular and Verizon, for example, cite Webster's Dictionary for the proposition that "ancillary service is by definition subordinate or auxiliary to the primary service." Id. *Cf., e.g.*, Globalstar Bondholders Supplemental Comments at *2* ("[b]y definition. terrestrial authority cannot be 'ancillary' to MSS licenses unless terrestrial authority is available exclusively to existing MSS licensees"); MSV Comments at *23* (asserting that "no matter how much traffic is originated or terminated over the terrestrial base stations. the vast majority of the United States land mass will be served by the satellite and service in rural and remote areas will not be degraded and therefore any in-band terrestrial use will remain "ancillary" to the satellite emissions).

states that MSS and MSS ATC must, by necessity, differ in "nature and character" due to their different physical configurations.[180] Moreover, we recognize that our use of the term "ancillary" in the *Flexibility Notice* departs from dictionary definitions of the term.[181] To avoid confusion, therefore, we decline to adopt in our rules a definition of the term "ancillary," and instead clarify that the term "'ancillary," with respect to MSS ATC, is defined as terrestrially-based, in-band MSS operations meeting the technical and policy requirements set forth in this Order.

**70.** Concerning the merits of requiring ancillary operation, commenters generally agree that, if ATC is permitted, MSS operators should: (I) integrate ATC offerings with the principal MSS offering, (2) use the same frequencies for ATC and the principal MSS operations, and (3) use ATC simply to augment signals, consistent with MSS operations, rather than create a materially different service."' Both commenters that support and those that oppose ATC caution against allowing a terrestrial component designed to augment MSS to become a freestanding terrestrial mobile service in spectrum allocated domestically and internationally for MSS use.[183] To the extent ATC is authorized, commenters generally support adopting the limiting principles on ATC operation.[184]

71. While commenters generally agree on the need to ensure that MSS terrestrial operations remain "ancillary," commenters disagree over precisely which operational requirements will best allow us to exercise effective oversight of MSS operations. In the *Flexibility Norice,* we sought comment on whether to ensure ancillary operation by requiring MSS licensees to observe five requirements concerning: (1) geographic coverage; (2) coverage continuity; (3) commercial availability; (4) in-band operation; and (5) central data switching.'" Commenters also proposed that we adopt (6) mandatory bundling requirements for MSS ATC service offerings. We address each of these proposals and other proposed limitations on MSS ATC below.

### 2. Substantial Satellite Service

**72.** We require MSS licensees that seek authority to offer ATC service to provide substantial satellite service to the public. As described below, substantial satellite service requires certain band- and network-specific demonstrations concerning the MSS space-segment's geographic coverage area, coverage continuity and commercial availability. Applicants for MSS ATC authority must demonstrate

---

[180] CTIA Comments at 3.

[181] I *The New Shorter Oxford English Dictionary* 75 (1993) (defining ancillary as "subservient, subordinate, auxiliary, providing support; now esp. providing essential support or services to a central function or industry, especially to hospital or medical staff'); *Merriam-Websrer's Collegiate Dictionary* (2002) (defining ancillary as "subordinate. subsidiary" or "auxiliary, supplementary"), *available at* <http://www.m-w.com/cgi-bin/dictionary?ancillary> (last visited, Dec. 30,2002).

[182] See. *e.g.*, API Comments at 5 (stating that "to the extent that MSS providers are permitted to offer terrestrial services in the 2.1 GHz band, such services should he authorized only on an ancillary basis.").

[183] See Boeing Comments at 6; Celsat Reply at 9 ("Celsat fully endorses the Commission's carefully drawn definition of ancillary because it ensures that terrestrial operations remain truly ancillary to the satellite service.")

[184] *See. e.g.*, Boeing Comments at 5-8; ICO Comments at 43-51; MSV Comments at 27-28; CTIA Comments at 3-5; Voicestream Reply at 20-24; Constellation Reply at 9-16; TRW Reply at 4-6; Boeing Reply at 5-10: MSV Reply at 25-27; Globalstar Reply at 8-9.

[185] *See Flexibility Notice,* 16 FCC Rcd at 15551-52, ¶¶ 42-46

compliance with these requirements and, of course, will remain responsible for the continuing accuracy and completeness of any information furnished in pending applications.[186] Upon licensing, failure of an MSS ATC licensee to meet any of these requirements will result in enforcement action with penalties up to and including loss of ATC and MSS operating authority as well as the imposition of a monetary forfeiture.

### a. Geographic Coverage

73. We find that for an MSS licensee to secure and to maintain authority to implement ATC, it must provide space-segment service across the entire geographic area stipulated in our rules and policies for that operator's particular space-station system geometry and frequency band as proposed in the *Flexibility Notice*. In the *Flexibility Notice*, we sought comment on whether to authorize MSS ATC only after the MSS operator demonstrates that it can provide space segment service covering all 50 states, Puerto Rico, and the U.S. Virgin Islands one-hundred percent of the time, consistent with the coverage requirements for 2 GHz MSS GSO operators.[187] For the L-band, we proposed an analogous restriction. We sought comment on adopting the same requirement for L-band operators "except that if a GSO MSS operator in the L-band can demonstrate that 100 percent coverage is not possible from the orbit location of the satellite" we proposed to "permit commercial operation of terrestrial facilities so long as the MSS service is continually available in all geographic areas the satellite is capable of covering."[188] We also sought comment on minimum coverage requirements for Big LEO operators prior to their being permitted to provide ATCs.[189]

74. Parties that support authorizing ATC support adopting geographic coverage requirements similar to the ones we proposed.[190] According to these parties, geographic coverage requirements will help ensure that MSS providers use ATC only where space-station signals are attenuated and will not migrate their service toward terrestrial-only operation at some point in the future.[191] MSS operators are unlikely to spend resources on ATC facilities in areas where space-station signals already reach because deployments in those areas would only duplicate existing infrastructure investment. Geographic coverage requirements, therefore, can help ensure that ATC remains an integrated operation that augments rather than replaces satellite-based MSS services."' Indeed, by imposing geographic coverage requirements we

---

186 See *infra* App. B; 47 C.F.R. § 1.65.

187 *See Flexibility* Notice. 16 FCC Rcd at 15547,¶ 32; *id.* at 1555 I, ¶ 42.

188 See *id.* at 15551,943.

189 See *id.* at 15564, ¶ 80.

190 *See, e.g.*, Celsat Reply at 10 (addressing the coverage requirements for 2 GHz MSS band licensees and stating that "Celsat supports this coverage requirement because it effectively ensures that ancillary terrestrial use will always be part and parcel of a fully functioning satellite system.");Boeing Comments at 8; API Comments at 5 ("API agrees with the Commission's proposal that a certain level of MSS coverage be established before MSS licensees are authorized to provide terrestrial service."): MSV Comments at 23 (supporting Commission's proposals to ensure MSS licensees comply with satellite implementation and service requirements).

191 *See, e.g.*, Celsat Reply at I I

192 See, *e.g.*, MSV Comments at 23; ICO Comments at 23-24; Globalstar Bondholders Reply at 21; Letter from Laurence H. Williams, ICO Global Communications Ltd., to Marlene H. Dortch, Secretary, Federal Communications Commission, IB Docket No. 01-185, at 1-2 (tiled, Dec. 16.2002) (ICO Dec. 16,2002 *Ex* Pane Letter).

intend to prohibit an MSS licensee from deploying an ATC base station that uses all of the MSS system's available frequencies to the exclusion of the satellite signals. If an MSS licensee were to deploy a base station that uses all available satellite channels, we are concerned that a user at some distance from the terrestrial base station may not receive a signal from either the terrestrial component, or the satellite system because the base station signal would be too weak and the satellite signal would be experiencing too much interference from the base station to close a link to the end user.[193] We believe that an MSS licensee would not intentionally create "dead zones" for its customers, especially since the primary selling point of MSS ATC service would be ubiquitous coverage to end users.[194] Nevertheless, imposing geographic coverage requirements on MSS ATC operators will not permit these types of "dead zones" because an MSS licensee that left no satellite channels available for customer use would necessarily violate the band-specific requirements for ubiquitous or nearly ubiquitous geographic coverage.[195] For these reasons, an MSS licensee that wishes to provide ATC must ensure that it remains capable of providing the necessary throughput to maintain space-segment service across the entire geographic area stipulated in our rules and policies for that operator's particular space-station system geometry and frequency band. We intend to deny any initial or modification applications for MSS ATC systems that propose space-segment throughput that would be insufficient to meet the applicable geographic-coverage requirement.

**75.** In implementing geographic coverage requirements, we take into account the variable system configurations and band segments of the MSS systems at issue in this proceeding. For example, Globalstar Bondholders notes that our current geographic coverage requirements for space-stations differ depending on whether the system is GSO or NGSO and depending on the frequency band in which the satellite operates.'% Under our satellite service rules, for example, Big LEO and 2 GHz MSS NGSO licensees must be capable of providing service: "(i) to all locations as far north as 70° North latitude and as far south as 55° South latitude for at least 75% of every 24-hour period, *i.e.*, that at least one satellite will be visible above the horizon at an elevation angle of at least 5" for at least 18 hours each day, and (ii) on a continuous basis throughout the fifty states, Puerto Rico and the U.S. Virgin Islands, i.e., that at least one satellite will be visible above the horizon at an elevation angle of at least 5° at all times." [197] Similarly, L-band MSS licensees must be capable of providing service to "all of the U.S. domestic market, including all fifty states, Puerto Rico, the Virgin Islands and U.S. coastal areas up to 200 miles."[198] According to the Globalstar Bondholders, therefore, the Commission should "use existing coverage requirements as an ATC authority threshold to prevent MSS providers from neglecting required coverage outside of the 50 states, Puerto Rico, and the U.S. Virgin Islands."[199] We agree with Globalstar Bondholders that we should hold MSS space-station licensees that implement ATC to a standard no less

---

[193] See *infra* App. C

[194] See Globalstar Bondholders Comments at 2; Globalstar Bondholders Reply at 3; Celsat Comments at 17 n.42; MCHI Comments at 5-8; Celsat Reply at 11; MSV Comments at 23; MSV Reply at I I; ICO Comments at 2; ICO Reply, App. at A-6.

[195] New rule section 25.147(a)(6), moreover, expressly prohibits ATC base stations from using all available MSS frequencies. See infra App. B (adopting new rule 47 C.F.R. § 25.147(a)(6)).

[196] Globalstar Bondholders Reply at 21-22 n.50

[197] See47 C.F.R. § 25.143(b)(2)

[198] MSV *License*, 4 FCC Rcd at 6055, ¶ 97

[199] Globalstar Bondholders Reply at 21-22 n.50

rigorous than that required for MSS operations generally. Thus, an eligible MSS licensee that wishes to implement ATC must provide space-segment service across the entire geographic area stipulated in our rules and policies for that operator's particular space-station system geometry and frequency band. We incorporate into Part 25 of our rules the specific geographic coverage requirements applicable to each type MSS system under consideration in this Order as a prerequisite for the provision of ATC.[200]

76. We do not find persuasive the various concerns of parties opposed to geographic coverage requirements. These parties describe the geographic coverage requirements as "cumbersome" and "difficult to enforce."[201] These parties speculate that partial or temporary lapses in geographic coverage may create unanticipated complexities for enforcement.[202] We have, however, administered geographic coverage requirements on space station systems for many years.[203] These requirements are verifiable and represent an unusually straightforward standard for such a technically complex service.[204] As ICO observes, moreover, we apply similar types of coverage requirements for terrestrial wireless services.[205] We have, in practice, found geographic coverage requirements neither cumbersome, nor difficult to enforce, and we find that the addition of an ATC will not materially complicate our administration of these longstanding requirements.

77. We also find it unlikely that geographic coverage requirements would encourage the demise of MSS space station operations. Assertions to the contrary appear to rest on speculation that geographic coverage requirements do nothing to diminish the presumed financial incentives for an MSS ATC operator to reduce its capacity for satellite services to maximize the capacity of its available spectrum for terrestrial services, which would constrain other satellite operations in the band.[206] We have rejected this

---

[200] See *infra* App. B.

[201] Stratos Reply at 14; see *also, e.g.*, Aviation Industry Parties Comments at 11 ("Even with these coverage requirements, the temptation will be great for the MSS operator to abandon or minimize its efforts to provide MSS and to concentrate on cellular service. At the end of the day, the hundreds of millions of dollars invested by aviation in the development of this service and the equipage of its aircraft would be for naught.").

[202] AT&T Wireless Comments at 6 ("Even if the Commission could rationally determine the appropriate level of MSS coverage that should be required prior to the commencement of terrestrial service, it is not clear what consequences should attach to partial or permanent lapses in satellite coverage caused by technical failure or obsolescence of a satellite (or any other reason).").

[203] See, *e.g.*, 47 C.F.R. § 25.143(b)(2)(iii).

[204] See 2 *GHz Order*, 15 FCC Rcd at 16153-54, ¶59.

[205] See ICO Reply at 10 n.41 (*citing* 47 C.F.R. § 24.103; *id.* § 24.203). Section 24.103(a) of our rules. for example, requires nationwide narrowband PCS licensees to "construct base stations that provide coverage to a composite area of 750,000 square kilometers or serve 37.5 percent of the U.S. population within five years of initial license grant date; and, shall construct base stations that provide coverage to a composite area of 1,500,000 square kilometers or serve 75 percent of the U.S. population within ten years of initial license grant date." 47 C.F.R. § 24.103(a). Alternatively, a narrowband nationwide PCS licensee may "provide substantial service to the licensed area? 47 C.F.R. § 24.103(a). Our rules define "substantial service" as "service that is sound. favorable, and substantially above a level of mediocre service that would barely warrant renewal." 47 C.F.R. § 24.103(d).

[206] Stratos Reply at 17

same type of argument in considering grants of flexibility for other Commission licensees,[207] and have considered and rejected these arguments as applied to MSS ATC elsewhere in this Order.[208]

### b. Coverage Continuity

78. We further adopt a requirement that MSS operators maintain space station coverage over the relevant geographic area to maintain authority to provide ATC. We also adopt standards for reasonable replacement of satellites in the event coverage should degrade as a result of satellite failure tailored to the particular configuration of a given MSS satellite system. For operational NGSO MSS ATC systems, we require the licensee to maintain an in-orbit spare. For operational GSO MSS ATC systems, we require the licensee to maintain a spare satellite on the ground within one year of commencing operations and launch it into orbit during the next commercially reasonable launch window following a satellite failure. We require licensees to report any outages that meet this standard within ten days of their occurrence.

79. In the *Flexibility* Notice, we also sought comment on whether and how to require the MSS operator to maintain space-station signal coverage if, for example, a satellite fails.[209] As discussed above, MSS licensees have strong economic and legal incentives to recoup the investment costs of their MSS systems by continuing to offer satellite-based services.[210] For global MSS operators, revenues from satellite service offerings to customers in the United States represent only a portion of the total revenue from the global satellite-services market. Under these circumstances, an MSS operator would have an economic incentive to replace the failed satellite.

80. Commenters that support ATC also tend to support requiring MSS licensees to maintain continuous coverage of the geographic region relevant for that particular licensee as a condition for ATC authority."' According to the Globalstar Bondholders, for example, "[e]nforcing MSS coverage requirements can ensure the provision of 'ancillary' service by preventing the operation of an ATC platform from degrading in any way the satellite service received by MSS subscribers that are not served by the ATC platform."[212] Several ATC proponents add that. if a licensee's failure to replace a satellite causes the MSS portion of the system to degrade, the Commission should revoke ATC authority."'

---

[207] *See, e.g.*, *CMRS Flexibility Order*, 11 FCC Rcd at 8975, ¶ 22 ("[N]othing in the record suggests that giving licensees who provide CMRS services the flexibility to offer fixed service would make them less responsive to market demand for mobile service. In fact, the record indicates that most carriers intend to offer consumers integrated packages and combinations of mobile and fixed services.").

[208] See supra § III(A)(4) (discussing competition and MSS ATC).

[209] *See Flexibility Notice*, 16 FCC Rcd at 15551, ¶ 44.

[210] See *supra* § III(A)(4) (addressing enhanced competition).

[211] *See, e.g.*, Celsat Comments at 14 ("full-time coverage of the service area is the best way to ensure that terrestrial reuse of the 2 GHz MSS band is truly ancillary to the satellite service."); Boeing Comments at 8-9 ("Boeing, therefore, would support the revocation of an MSS operator's terrestrial authorization if the operator does not, for example. replace a sufficient number of failed satellites within a reasonable time period to maintain the Commission's coverage requirements.").

[212] Globalstar Bondholders Reply at viii.

[213] See Constellation Comments at 27; see also, *e.g.*, MSV Comments at 23-25; MSV Reply at 23-27. MSV supports a requirement that MSS licensees maintain their satellite service in order to provide terrestrial service. hut (continued....)

81. Notwithstanding the preexisting economic and legal incentives that an MSS licensee may have to return the MSS space component to full operation as quickly as possible in the event of a satellite failure, we find that imposing a continuous coverage requirement would address concerns raised by certain commenters that MSS operators might not exercise sufticient diligence in returning an MSS system to full operation if the operator can continue to generate operating revenues from its ancillary terrestrial system.[214] AT&T Wireless, for example, claim that an infusion of new investment capital to ATC-enabled MSS systems "would make compliance with any satellite coverage thresholds adopted by the Commission virtually impossible because no new investment dollars would be devoted to launching and maintaining capital-intensive satellite systems."[215] We question whether an MSS operator would direct investment to ATC at the expense of the MSS system on which the authority to operate ATC depends. Although we view investment in ATC at the expense of MSS coverage requirements as unlikely, expressly conditioning ATC authority on maintenance of the MSS licensee's satellite-coverage obligation may provide some benefit in helping to ensure continued investment and innovation in an MSS licensee's space-station assets, because it would require the MSS operator to act as if the space-segment assets were still the company's sole source of income.[216] Given widespread support for a continuous coverage requirement?" the lack of any significant cost to MSS licensees and the possibility of some long-term benefit to the public, we adopt our proposal to require MSS licensees to maintain continuous coverage of the geographic region that we require them to serve.

82. As a part of our proposal to require continuous coverage, we sought comment on the circumstances under which we should revoke an MSS operator's ATC authority if coverage were interrupted. Although most commenters support a reasonable time for replacement of failed or disabled satellites, commenters propose widely variant time periods in which to replace failed MSS space stations.[218] MSV, for example, proposes that the Commission allow an operator two years to replace a failed satellite.[219] ICO proposes a three-month replacement period.[220] Meanwhile, Boeing proposes that the Commission establish specific milestones for satellite replacements. which, if not met, would require the MSS licensee to forfeit ATC authority; Boeing does not specify .a time period in which replacement

(Continued from previous page)

asserts that an MSS operator whose satellite has failed should receive "a reasonable period of time," which MSV asserts is two years, to launch a replacement satellite. MSV Comments at 24-25.

[214] See, *e.g.*, AT&T Wireless Comments at 2-3; AT&T Wireless Reply at 2.5-7; Boeing Comments at 7; CTIA Comments at 5-9.

[215] AT&T Wireless Reply at 11. Similarly, Boeing notes that, without some type of coverage requirement in place, over time "there is a strong possibility that the 2 GHz spectrum could eventually 'default' to terrestrial use without any satellite component." Boeing Comments at 8.

[216] See, *e.g.*, Boeing Comments at 9 ("[o]nce ATS is initiated, MSS operators that employ ATS should also maintain, on an ongoing basis, sufficient satellite coverage and service availability of their MSS services.").

[217] See, *e.g.*, *id.* at 8; MSV Comments at 24-25; ICO Comments at 44-46; Constellation Reply at 9; Boeing Reply at 5-6; MSV Reply at 25; Globalstar Reply at 8.

[218] Celsat Reply at 10-11 & n.26.

[219] See MSV Comments at 24-25 (suggesting a maximum two-year limit during which the MSS operators should be permitted to operate terrestrial facilities without satellite coverage, taking into consideration the time to procure "long-lead" parts to assemble a spare satellite).

[220] ICO Comments at 44 (suggesting three months as a reasonable replacement deadline for "all but the most unexpected outages")

should occur, but suggests that the milestones should be shorter than those required for the construction and operation of initial MSS satellites.[221]

83. The construction, launch and operation of space stations are subject to launch failures, satellite malfunctions and other unique hazards. We agree that MSS licensees should repair or replace space stations within a reasonable time frame. For 2 GHz MSS systems, for example, we required licensees to meet a series of implementation milestones designed to ensure the construction, launch and operation of systems within three-and-a-half years of grant of the NGSO MSS licensees and within five years of the GSO MSS license grant?" Repairing or even replacing a malfunctioning satellite, for all its complexity, requires less time than designing and constructing a new system. Even in the worst case where a satellite is destroyed, a licensee can ordinarily replace a lost satellite with a ground spare at the next available launch window, or procure a technically identical satellite in an expedient manner since it would have already completed the complex design process. As suggested by Boeing's comments, however, different types of failures on different types of systems require different periods of time to correct.[223] To recognize these differences, we adopt a standard for reasonable replacement tailored to the particular configuration of a given MSS satellite system and the relative cost of NGSO and GSO space stations. For operational NGSO MSS ATC systems, we will require the licensee to maintain at least one in-orbit spare. For operational GSO MSS ATC systems, we will require the licensee to maintain a ground spare within one year of commencing operations and launch the ground spare into orbit during the next commercially reasonable launch window following a satellite failure. We require licensees to report any outages that meet this standard within ten days of their occurrence.[224]

84. While no replacement standard can anticipate every potential failure with precision, adopting standards tailored specifically for NGSO and GSO MSS configurations strikes an appropriate balance between reinforcing the licensee's commercial and legal incentives to provide continuous service and allowing sufficient time for the licensee to repair or replace satellites that have failed. In addition, we note that nothing in this Order constrains our authority to impose forfeitures on licensees that fail to meet their obligations as MSS licensees in addition to any other remedies available under our rules. We adopt these requirements as a condition of authorizing ATC and incorporate them into Part 25 of our rules.

c. Commercial Availability

85. In the *MSS Flexibility Notice,* the Commission asked whether an "MSS operator could initiate operation of terrestrial services as soon as its operational satellites cover 100 percent of the United States

[221] See Boeing Comments at 9

[222] 2 *GHz MSS* Rules *Order,* 15 FCC Rcd at 16177-78,¶ 106. Specifically, for 2 GHz MSS NGSO system licensees must enter into a non-contingent satellite manufacturing contract for the system within one year of authorization, complete critical design review within two years of authorization, begin physical construction of all satellites in the system within two and a half years of authorization, and complete construction and launch of the first two satellites within three and a half years of grant. See *id.* For 2 GHz MSS GSO systems. licensees must enter into a non-contingent satellite manufacturing contract within one year, complete critical design review within two years, begin physical construction of all satellites in the system within three years, and complete construction of, and launch, one satellite of its constellation into its assigned orbital location within five years of authorization. *Id.*

[223] See, *e.g.*, Boeing Comments at 9

[224] See *infra* App. B.

100 percent of the time, even if the operator has not yet launched its entire constellation of satellites."[225] We require MSS to be commercially available in accordance with the coverage requirements that pertain to each band as a perquisite to an MSS licensee's offering ATC service.[226]

86. Whether an operator can commence ATC operations prior to making its satellite system commercially available to the public represents an extension of the arguments for and against the geographic or continuous coverage requirements discussed above. Several commenters note, and we agree, that the financial incentives to operate an MSS system are neither as strong, nor as pressing, if an MSS licensee can operate the terrestrial component of its system prior to constructing, launching and operating MSS space stations and offering commercial MSS services.[227] According to these commenters, an MSS operator that can operate the terrestrial component of its system prior to operating the satellite portion may choose not to launch space stations, or may delay implementation through petitions for waiver of the implementation milestones.[228] We remain committed to the vigorous enforcement of our satellite implementation milestones. If the Commission were to permit full-scale commercial operation of MSS ATC prior to the commercial availability of service from the MSS space stations, however, the denial of a milestone extension request and the accompanying revocation of the applicant's MSS license would adversely affect not only the MSS licensee, but also the MSS licensee's terrestrial customers. Unlike satellite space station failures, in which the licensee may have one year or more to repair or replace the satellite prior to loss of ATC authority, a licensee's failure to meet an implementation milestone, such as a licensee's failure to enter a binding contract for the construction of the satellites, could occur without any advance notice to the public or the Commission. As a result, the Commission would be forced to choose between maintaining the integrity of its satellite licensing process. or requiring the operator to immediately cease service to customers with little advance notice. Given the potential for disruption either to an MSS licensee's customers or to the integrity of the Commission's licensing processes that might occur, we find that permitting commercial operation of ATC prior to commencement of MSS operations would disserve the public interest. Therefore, authorizations to provide MSS ATC shall be conditioned upon the commercial availability of MSS in accordance with the requirements of this Order prior to or at the same time ATC operations are initiated.

### 3. Integrated Service Offering

87. To remain consistent with our allocation and service rules, we believe that MSS licensees should offer an integrated service. MSS licensees must make an affirmative showing to the Commission that demonstrates that their ATC service offering is truly integrated with their MSS offering. We recognize that it is important for industry to have a clear understanding of what would meet this showing. Accordingly, the Commission is creating a minimum showing that would constitute a safe harbor for MSS ATC applicants to demonstrate that they are providing an offering that is integrated with their MSS

---

[225] *See Flexibility* Notice. 16 FCC Rcd at 15551, ¶ 44.

[226] *See* App. B

[127] See, *e.g.*, Boeing Comments at 8 ("[a] prior condition for offering ATS should be full compliance with" existing satellite implementation milestones).

[228] See. *e.g.*, *id.* at 8-9; AT&T Wireless Comments at 2-3; see also Globalstar Reply at 25 ("Allowing MSS providers to offer commercial ATC services prior to compliance with applicable satellite coverage requirements could undermine the ancillary nature of ATC.").

offering.[229] The safe harbor is that MSS licensees that wish to provide ATC services could demonstrate that they use a dual-mode handset to provide the proposed ATC service.

88. MSS licensees that choose not to rely on this safe harbor will have to submit for Commission review evidence demonstrating that the service they propose to offer will be integrated. This can be accomplished through technical, economic or any other substantive showing that the primary purpose of the MSS licensee's system remains the provision of MSS.[230] We encourage MSS operators to submit integrated service showings as early as possible to allow full evaluation without compromising the timing of ATC deployment. This integrated service requirement and the other rules adopted today will help ensure that MSS remains first and foremost a satellite service and that the terrestrial component remains ancillary to the primary purpose of the MSS system. In this manner, the public will be able to obtain the many benefits associated with the deployment of MSS systems.

### 4. In-Band Operation

89. In the *Flexibility Notice,* we sought comment on which MSS frequencies we should permit MSS licensees to operate MSS ATC.[231] The Commission generally allocates spectrum on either a primary basis or a secondary basis.[232] Within the 2 GHz MSS band, however, MSS licensees may operate outside of the specific MSS sub-band that they have selected on a secondary basis to other MSS licensees, subject to certain conditions.[233] Within the Big LEO band, operators are authorized to use different amounts of spectrum within the band, depending on the type of frequency coding they have chosen to deploy?[234] And within the L-band, MSS operators' specific frequency assignments in the region of North America are assigned by international a eement and consensus, and operations outside of these assigned frequencies is generally not permitted.[235] In our *Flexibility Notice,* we asked whether and under what conditions we should authorize MSS ATC inside of the MSS allocations, but outside of the narrow "Selected Assignment" that any given MSS operator has elected to use.[236] Commenters also addressed whether granting ATC authority in less than all of an operator's licensed MSS frequencies in the Big LEO

---

[229] We do not believe that this same requirement should be imposed on Personal Data Assistants (PDAs), laptops, or other computers.

[230] An economic showing could include, for example, information on the pricing structure of an integrated service offering.

[231] *See Flexibility Notice.* 16 FCC Rcd at 15552, ¶ 46-47

[232] A spectrum allocation permits the use of radio frequency spectrum for one or more of the various defined radio services listed in section 2.1 of the Commission's rules. 47 C.F.R. § 2.105(b) & n.7.

[233] *See Flexibility Notice,* 16 FCC Rcd at 15552, ¶ 46-47; see *also Amendment of the Commission's Rules to Establish Rules and Policies Pertaining to a Mobile Satellite Service in the 1610-1626.5/2483.5-2500 MH: Frequency Bands.* Report and Order, 9 FCC Rcd 5936, 5956, 5958 ¶¶ 48.52 (1994) *(Big LEO Service Rules Order)* (granting all CDMA Big LEO licensees the right to operate across the entire 2483.5-2500 MHz band and the 1610-1621.35 MHz band).

[234] Big LEO *Service Rules Order,* 9 FCC Rcd 5954-63, ¶¶ 43-63,

[235] *See Conisat Corporation d/b/a Comsat Mobile Communications,* Memorandum Opinion, Order and Authorization. 16 FCC Rcd 21661, 21696-99, ¶¶ 65-72 (2001) (*Comsat Authorization*).

[236] See *Flexibility Notice.* 16 FCC Rcd at 15552, ¶¶ 46-47

bands was appropriate.

90. In the 2 GHz MSS band, several ATC proponents support authorizing ATC across the entire MSS band, subject to the same or similar requirements as the principal MSS operations.[237] These commenters support granting ATC authority that is entirely coterminous with MSS authority in the eligible MSS bands.[238] Other commenters, however, urge us to adopt spectrum-usage restrictions on MSS ATC. CTIA, for example, urges the Commission to limit 2 GHz MSS ATC only to the licensee's Selected Assignment. According to CTIA, authorizing greater flexibility in MSS spectrum uses will impair the Commission's ability to reallocate spectrum "[b]ecause terrestrial systems would have to be physically retuned if their frequency bands were changed due to missed implementation milestones or Commission action.[239] Voicestream similarly proposes a 7 megahertz spectrum cap on MSS ATC operation in the 2 GHz MSS band to prevent an MSS licensee from aggregating too much MSS spectrum for MSS ATC.[240]

91. In the Big LEO band, the Commission has divided the band between CDMA compatible systems and TDMA compatible systems. As explained in the Notice of Proposed Rulemaking initiated below,[241] the Commission in 1994 found that up to four CDMA Big LEO MSS systems could share 11.35 megahertz of service uplink spectrum in the 1610-1621.35 MHz band and 16.5 megahertz of service downlink spectrum in the 2483.5-2500 MHz band. The Commission then found that one TDMA system could operate satellite uplinks and downlinks in single 5.15 megahertz block of spectrum in the 1621.35-1626.5 MHz band. At present, two Big LEO systems – Iridium and Globalstar – are currently operational. As a CDMA system, Globalstar is authorized to operate uplinks in 11.35 megahertz of spectrum and downlinks in 16.5 megahertz of spectrum. As a TDMA system, Iridium operates bi-directionally in 5.15 megahertz of spectrum. After the close of the comment cycle in this rulemaking, however, Iridium petitioned the Commission to redesignate portions Big LEO band downlink spectrum from CDMA systems (Globalstar) to TDMA systems (Iridium) and implement other changes in the Big LEO band plan.

92. In the L-band, specific MSS frequencies are agreed upon through the Mexico City MoU,

---

[231] See, *e.g.*, TMI Comments at 2 ("operation outside a 'selected assignment' or 'selected segment' should be both feasible and desirable due to the enhanced spectral efficiency");Constellation Comments at 33 ('Constellation believes that the Commission should allow terrestrial use of any portion of the MSS operator's "selected assignment.").

[238] For example, TMI suggests that, as with satellite-based MSS operations, the Commission should limit MSS ATC operations that involve more than one Selected Assignment to situations in which MSS operators have devised a sharing scheme for the operation of terrestrial and satellite facilities. TMI Comments at 2-3. Similarly, just as MSS licensees must coordinate any satellite-based MSS operations outside of their Selected Assignment with other MSS licensees. Globalstar states that the Commission should require "some degree of coordination" among MSS licensees for any MSS ATC operations outside of the operator's Selected Assignment. Globalstar Reply at 7. Boeing, however, proposes to bar MSS operators from offering MSS in its Selected Assignment if the MSS operator provides ATC "in a 2 GHz MSS sub-band outside its selected assignment, or vice versa." Boeing Comments at 7.

[239] CTIA Comments at 14. CTIA also claims that limiting MSS ATC to an operator's Selected Assignment would limit interference to other services, such as GPS. Id. For our analysis of possible interference concerns, see discussion *infra* at § III(D).

[240] Voicestream Reply at 24.

[241] See *infra* § IV.

which is an agreement between the five MSS satellite operators and their respective national administrations that provide service in the L-band in the North American coverage area regarding spectrum assignments between the operators. The operators signed a one-year agreement, which was originally was to be revisited annually, that provided each system with an amount of spectrum based on its current and projected near-term traffic requirements."' The precise frequency assignments for these operators within the L-band MSS spectrum are subject to confidentiality provisions under the Mexico City MoU. The parties to the MoU last revised spectrum assignments in **1999** and, pending further negotiations, continue to operate under those assignments today.

**93.** To ensure maximum gains in spectrum efficiency, minimal potential for interference and limited regulatory intrusion, we believe a licensee's authority to operate MSS ATC should remain linked to its MSS authority, and limited to the precise frequency assignment authorized for MSS. Therefore, we limit each MSS licensee to its "core" MSS spectrum in each of the three bands at issue in this proceeding:

- In the 2 GHz band, an MSS operator may seek authority to provide ATC only in its Selected Assignment, which, under the 2 *GHz MSS* Rules Order is comprised of **3.5** megahertz in each direction for a total of 7 megahertz for each MSS **licensee.**[243] Because coordination among the MSS licensees to conduct MSS ATC outside of the MSS licensee's Selected Assignment is likely to prove difficult, time-consuming and unlikely to produce an acceptable interference environment, operations beyond the MSS licensee's Selected Assignment are not permitted.

- In the Big LEO band, both of the two MSS operators in band – Iridium and Globalstar – may seek authority to provide ATC in **no** more than 5.5 megahertz of spectrum in each direction consistent with the MSS ATC service **rules.**[244] Accordingly, systems that operate uplinks and downlinks in separate bands, such as Globalstar. could deploy MSS ATC in a total of up to **11** megahertz of spectrum while systems that operate uplinks and downlinks in the same band, such as Iridium, could deploy MSS ATC in a total of up to **5.5** megahertz. To avoid any possible prejudice to the outcome of allocation and assignment decisions under consideration in the Notice of Proposed Rulemaking adopted below, we adopt an upper limit of **5.5** MHz in each direction for possible MSS ATC operations. Furthermore, to avoid harmful interference, Big **LEO** MSS licensees will be permitted to implement ATC only **on** those channels that MSS is authorized, consistent with the Big **LEO** band-sharing arrangement set forth in this **Order.**[245]

- In the L-band, an MSS operator may seek authority to provide ATC only in those frequency assignments that are available to that MSS operator for MSS use in accordance with the

---

[242] **See** *International* Action: FCC Hails Historic *Agreement* **on** *International* Satellite Coordination, "News Release," Report No. IN 96-16 (June 25, 1996): see also *Flexibility* Notice. 16 **FCC** Rcd at 15539-40, ¶ 13.

[243] The seven megahertz spectrum assignment originally granted to each 2 GHz MSS licensee is subject to increase, pending resolution of the 2 GHz MSS milestone implementation review process.

[244] We do not intend to prohibit Iridium from using technically innovative techniques to deploy in-band terrestrial operations in its MSS frequencies. provided Iridium can meet the technical and service rules established in this Order.

[245] See *infra* § III(D)(3) (discussing where Iridium and Globalstar can operate ATCs); see ***also infra*** Section IV (Notice of Proposed Rulemaking, seeking comment on proposals for reassigning or reallocating a portion of spectrum in the Big **LEO** MSS frequency bands).

Mexico City MoU.[246] If future agreements reached pursuant to the Mexico City MoU were to alter precise frequency assignments of MSS ATC providers in the United States. the MSS ATC provider would be required to operate on its assigned MSS frequencies.

Generally speaking, therefore, MSS licensees may generally seek authorization for MSS ATC only in the bands in which they are authorized to operate an MSS system, subject to the same regulatory status and restrictions, if any, that the MSS licensee would have to observe in that MSS assignment.

### 5. Central Data Switching

94. In the *Flexibility Notice*, we sought comment on whether requiring that MSS operators integrate the terrestrial and satellite operations of their network through one central data switch would ensure that the terrestrial component is ancillary to the satellite component?" We asked commenters to address the types of functions that a central data switch performs and to discuss whether and how requiring a central data switch might encourage the integration of terrestrial component into the MSS network.[248] We also sought comment on how we might monitor compliance with a central data switch requirement."'

95. The comments indicate a certain amount of confusion over what we meant by proposing a "central data switch." Only three commenters addressed the issue at any length. MSV, which construed the "central data switch" as central monitoring and control point, supported this requirement.[250] ICO and Constellation, which construed a "central data switch to mean routing all traffic over a single switch, opposed the proposal as failing to promote the integration of ATC into MSS and as creating a significantly more vulnerable, more expensive and more inefficient MSS system."' By proposing a central data switch, we did not intend that MSS operators would need to route their communications through a single mechanical or optical device that opens or closes circuits in the MSS licensee's system.

---

[246] *See infra* § III(D)(2).

[247] *Flexibility Notice,* 16 FCC Rcd at 15551-52, ¶ 45

[248] *Id*

[249] *Id*

[250] MSV Comments at 25

[251] ICO Comments at 25 n.41 (claiming that the central data switch requirement "would make urban MSS traffic more vulnerable to outage (because it would create a single point of failure) and more expensive (because it would prevent network operators from using least-cost routing)."); *accord id.* at 45-46 (claiming no need exists for a central data switch requirement since it would not limit use of ATC, would not integrate ATC and MSS, would not ensure the terrestrial component remains ancillary to an MSS network, would make the service "more vulnerable to outage by creating a single point of failure for all traffic in the network" and would contravene the Commission's general policy of operational and service flexibility"); Constellation Comments at 31 n.65 ("Requiring a "central data switch" is inefficient and may undercut the ability to establish a robust, distributed network and entail intrusive Commission involvement in network design and operation. The situation becomes complicated since integrated networks are likely to have different paths for signaling and traffic, and for voice and packet-switched data."). In its reply comments. MSV indicated its opposition to a central switch requirement as envisioned by Constellation and ICO. See MSV Reply at 25-26 (asserting that if the Commission sought to require central routing as Constellation and ICO assert, then "MSV shares ICO's concern that such a requirement will not allow for least cost routing and will result in a 'single point of failure."').

We agree with the commenters that adopting such a requirement would impose costs far in excess of any possible benefit in integrating ATC-enable MSS systems. We expressly decline to adopt a single-switch requirement for MSS ATC systems.

96. MSV's vision of ow "central data switch" requirement comes closest to what we actually intended. We sought comment on the need for centralized control necessary to achieve dynamic frequency management of both MSS and ATC operations, and, in fact, the proponents of MSS ATC view centralized control as crucial to successful implementation of MSS ATC.[252] Constellation, for example, states that central control of both satellite and earth-station components of MSS permits the operator "to manage the assignment of powers and frequencies for satellite and terrestrial links within a satellite beam coverage area to maximize the total amount of service offered to subscribers ...."[253] ICO adds that it has developed and installed a single, integrated Satellite Resource Management System (SRMS) that will "produce frequency allocation plans that vary minute-by-minute, tracking [the system's] satellite movements through their six-hour orbits."[254] Although the MSS ATC proponents propose various methods of coordinating intra-system satellite and terrestrial operations, each method of achieving greater frequency reuse through MSS ATC requires the operator's "full knowledge of all satellite and terrestrial activity on its network in order to make real-time adjustments to accommodate continuously changing operating conditions."[255]

97. While we find that the ability to dynamically control the basic components of an integrated MSS ATC system is necessary for MSS ATC to achieve the maximum frequency reuse possible through the combination of satellite and terrestrial infrastructure, we agree with those commenters that note that requiring system management through a single central point of presence may have undesirable consequences. We also find the record does not demonstrate any significant benefit to such a requirement. Accordingly, we decline to adopt our proposal that MSS ATC operators control their respective MSS ATC operations through a central data switch.

### 6. Other Proposed Requirements

98. While certain technical standards are necessary to protect the public and to establish a baseline for commercial negotiation, we must resist the temptation to proscribe detailed, uniform technical specifications for Commission licensees absent legitimate public interest justifications for doing so.[256] Some commenters claim that ATC will quickly escape the basic limiting principles we seek to maintain unless we impose specific regulatory measures on MSS ATC operations beyond those we

[252] MSV Comments at 25-26; ICO Supplemental Comments at 6-7.

[253] Constellation Supplemental Comments at 4

[254] ICO Supplemental Comments at 8

[255] Id. at 11.

[256] Globalstar Reply at 15 ("A grant of ATC authority should not require MSS providers to integrate ATC and MSS platforms in any one particular manner. Commission dictated integration is not flexibility at all. Rather, ATC authority is intended to provide MSS providers with the operational flexibility to individually develop, guided by efficiency enhancing market forces and public interest needs, innovative solutions to the coordination challenges raised by ATC-MSS integration.").

proposed in the *Flexibility Notice*.[257] Although commenters opposed to ATC ask us to consider adopting any number of additional regulatory restrictions on MSS ATC, the principal limitations they propose would require MSS operators: (1) to offer satellite service as the predominant use in any given geographic area;[258] (2) to use dual-mode handsets or to route terrestrial calls through the MSS satellite network to ensure MSS ATC system integration;[259] (3) to demonstrate a technical inability to serve proposed ATC locations with MSS satellites as a condition to site-by-site ATC authorization;[260] (4) to pay annual fees to the Commission in exchange for MSS ATC rights;[261] and (5) to regulate the carriage,"' pricing,[263] or terms and conditions" of an operator's MSS ATC offering. These proposed conditions, with slight variations from commenter to commenter, represent the most fully developed conditions that appear in the record.[265] In general, we find that the complexity, cost and inefficiency of these proposed conditions would outweigh any limited utility that they might have.

99. First, requiring MSS licensees to ensure that satellite services constitute the "predominant" or "primary" use of their systems – whether measured in minutes of use or by number of customers – would limit spectrum efficiency. As we have found, to achieve the spectrum efficiency gains, ATC relies on flexible switching between the terrestrial and satellite components: the operator can dynamically allocate spectrum to either satellite use or terrestrial use. The proposal to require "predominant" satellite use would limit the MSS provider's flexibility and its concomitant spectrum efficiencies, e.g., by requiring predominant satellite coverage in geographic areas that can be more efficiently served by ATC, such as large cities. Also, establishing precisely how much of a limitation on MSS operators such a requirement would entail determining how to measure the "predominance" of satellite services between highly flexible, dynamically coordinated spectrum uses – whether by minutes of use, number of channels

---

[257] See, *e.g.*, Comtech Mobile Comments at 5 ("simply defining the term 'ancillary' may be insufficient to ensure that satellite service remains the primary use of the spectrum").

[258] Voicestream Reply at 22 (proposing that the Commission adopt a rule barring an MSS operator from acquiring more terrestrial customers than satellite customers); Comtech Mobile Comments at 2-5 (recommending a limit on the proportion of a system's customers that use the terrestrial network rather than the satellite network as their primary source of service (*i.e.*, more than 50% of the customer's monthly minutes are over the terrestrial path rather than the satellite path)).

[259] Voicestream Comments at 20-24. CTIA suggests that the Commission only permit MSS providers to provide ATC services using dual-band handsets that automatically select a satellite transmission path if it is available. CTIA Comments at 6.

[260] API Comments at 5 (proposing a requirement that MSS licensees provide technical evidence that they are unable to serve via satellite each location that they intend to serve via ATC).

[261] See P&FF Comments at 2, 13-15.

[262] Stratos Comments at 16-20.

[263] Voicestream Reply at 22.

[264] Stratos Comments at 16-20.

[265] While other regulatory initiatives have been suggested. these other proposals duplicate existing regulations or lack sufficient record evidence for us to adopt. API, for example, proposes that MSS licensees "periodically" report their geographic coverage. API Comments at 5. Section 25.143 of our rules, however, already imposes such a reporting requirement on MSS licensees. See, *e.g.*, 47 C.F.R. § 25.143(e) (requiring Big LEO and 2 GHz MSS licensees to report the operational status of their satellite constellations on October 15 of each year).

occupied, number of consumers served, revenue from calls, or coverage area of each component. In short, even if we had not found that imposing a predominant use requirement for MSS ATC would limit spectrum efficiency, we currently lack sufficient record evidence to determine any basis by which to select one measure of "predominant use" over another.

100. Second, requiring satellite-routing would defeat most of the benefits of authorizing ATC in the first instance. The disadvantages would increase markedly if we were to further restrict MSS operators to offering only dual-mode phones that defaulted to the satellite transmission path. Requiring MSS licensees to route all traffic through the MSS satellite system would greatly limit the spectrum efficiency gains that will occur under ATC. Under the satellite-routing proposal, an MSS operator would be required to route communications from ATC base stations to MSS earth stations to the MSS satellite and back again, *even if more efficient system transmissions paths existed.* An MSS ATC user, for example, might place a call to another MSS ATC user within the broadcast radius of the same ATC base station. Instead of permitting the licensee to use the least-cost routing method through the ATC base station, a satellite-routing requirement would force the licensee to send the signal from the ATC base station to an MSS earth station, which would send the signal to the MSS space-station, which would retransmit the signal back to the MSS earth station, which would return the signal to the ATC base station from which it originated.[266] This circuitous, unnecessary transmission path would materially increase the cost and complexity of ATC and greatly limit the spectrum efficiencies possible under the dynamic spectrum-sharing model of an MSS ATC. We are not persuaded that the public interest considerations ostensibly served by requiring satellite-routing justify the significant costs of limiting consumer choice, stifling innovation, and requiring additional operational expenses and inefficiencies.

101. Third, requiring MSS licensees to demonstrate a technical inability to serve proposed ATC locations with MSS satellites as a condition of every ATC base station authorization would create spectrum and administrative inefficiencies. Achieving optimal spectrum usage may require an MSS operator to use ATC even though a particular call might be served via satellite. Moreover, requiring an MSS licensee to demonstrate a technical inability to serve the area surrounding the ATC base station would require the Commission to adopt a site-by-site licensing process to scrutinize the technical merits of every proposed ATC base station location. The MSS licensee would need to update its engineering analysis for each proposed ATC base station location whenever buildings are built, modified, or razed in or near the proposed ATC base station location. Tower locations are scarce in any urban environment. Subjecting MSS licensees to the additional technical constraint of guaranteeing that no satellite signal could penetrate the proposed tower location, particularly given the steady variation of our nation's urban landscape due to development and demolition, has the potential to preclude the selection and construction of any MSS ATC base stations. We find that the expensive, time-consuming testing and monitoring of every proposed base station locations would prevent the rapid deployment and development of MSS ATC without any corresponding public benefit or regulatory rationale.

102. Fourth, we reject a proposal to impose additional fees on MSS licensees that implement ATC to supplement their MSS network. In the case of MSS ATC, several commenters observe[267] and

[266] See. *e.g.*, Globalstar Reply at 26 ("Artificially limiting terrestrial spectrum reuse as proposed by these commenters would increase the amount of traffic required to be carried by an MSS provider's satellite system. Some of this traffic could be more efficiently and economically carried via an ATC platform. By requiring this traffic nevertheless to be carried via satellite, the Commission effectively would reduce the amount of spectrum bandwidth available to rural subscribers that only can be economically served by satellites.").

[267] See MSV Comments at 31-32 (asserting that no rational basis exists by which to determine the magnitude of any such fees).

even the principal proponent of an MSS ATC fee acknowledges, that insufficient economic data exists on which we could develop a rational user-fee regime.[268] Even if we were to conclude that a user fee on MSS ATC were warranted and could be rationally geared to the prospects of the MSS ATC segment, the Communications Act of 1934, as amended, does not clearly authorize us to impose such fees on MSS licensees that implement ATC. When Congress allowed flexible use of the broadcast spectrum and permitted licensees to offer ancillary or supplemental services, for example, Congress granted the Commission express authority to require the licensee to pay fees designed to avoid unjust enrichment and to recover for the public an amount that, to the extent feasible. equals the amount that would have been recovered had the service been licensed pursuant to the provisions of section 309(j).[269] Outside of the broadcast spectrum, however, no similar grant of authority directs us to impose fees on other flexible uses that we permit. As we observed in our *Flexibility Notice,* "absent legislation, we likely do not have the authority to assess . . . fees" on MSS ATC.[270] No commenter disputes this observation. At this time, therefore, we do not find that imposing additional fees on MSS licensees that implement ATC would serve the public interest.

### D. Technical Requirements and Rules for Terrestrial Operations

**103.** In the *Flexibility Notice,* we proposed to adopt flexible technical requirements and service rules that would encourage ATC development in the most rapid, economically efficient and diverse manner.[271] We proposed to apply a minimum set of technical standards to avoid harmful interference to other users of the spectrum and sought comment on whether our specific proposals were necessary and sufficient.'" After reviewing the record evidence, including comments from the National Telecommunications and Information Administration (NTIA), we address these issues in this section. First, we individually evaluate the 2 GHz MSS band, L-band, and Big LEO bands. Though the concepts and proposals for ATC operations are similar among the MSS systems, each frequency band has its distinct inter-service and intra-service sharing scenarios. In each of the bands, we address the intra-service sharing scenarios (i.e., MSS systems sharing the same MSS allocation with ATC operations) and then we evaluate the inter-service sharing possibilities (i.e., when the MSS ATC operations are in a frequency band that is adjacent to another service allocation). For the intra-service analyses, we evaluate the amount of interference that would be caused to another operator's system that is sharing the same MSS allocation. This interference could be an increase in the noise received by the space station receivers of the other MSS system or it could be interference caused to the mobile earth terminals (METs)

---

[268] See P&FF Comments at 13 n.49, 14-15.

[269] *See* 47 U.S.C. § 336; see *also Fees for Ancillary or Supplementary Use of Digital Television Spectrum Pursuant to Section 336(e)(1) of the Telecommunications Act of 1996*, MM Docket No. 97-247, Memorandum, Opinion and Order, 14 FCC Rcd 19931, 19939, ¶ 20 (1999) (construing section 336 of the Communications Act to provide that "only *ancillary* or *supplementary* services are subject to fees under the Act") (emphasis in original).

[270] *Flexibility Notice, 16* FCC Rcd at 15549-50, ¶ 40,

[271] Id. at 15555, ¶ 54.

[272] We sought comment on what limits should be placed on the terrestrial facilities' out-of-band emissions into adjacent bands, whether it is necessary to impose intersystem limits, or instead allow applicants to coordinate among themselves. whether there are alternative approaches that would provide ample protection while better furthering our goals of encouraging rapid, efficient deployment of integrated MSS terrestrial services, and whether there are differences between the 2 GHz MSS and L-bands that would require an alternative approach for operations in one or the other band. Id.

operating with the other MSS system. For the inter-service case, we evaluate the impact of out-of-band emissions from ATC operations on adjacent band systems.

**104.** We adopt technical parameters for ATC operations in each of the hands at issue designed to protect adjacent and in-band operations from interference from ATC.[273] We fully expect that these operational parameters will be sufficient. Nevertheless, in the unlikely event that an adjacent MSS or other operator does receive harmful interference from ATC operations, either from ATC base stations or mobile terminals, the ATC operator must resolve such interference. If the MSS ATC operator claims to have resolved the interference and other operators claim that interference has not been resolved, then the parties to the dispute may petition the Commission for a resolution of their claims.[274]

### 1. 2 GHz MSS Band

105. On August 25, 2000, the Commission released the 2 *GHz MSS Rules Order* setting forth licensing and service rules for pending applicants to provide MSS in the 1990-2025 MHz and 2165-2200 MHz bands.[275] In the 2 *GHz MSS Rules Order,* the Commission adopted a band arrangement that can accommodate initially the multiple and technically-diverse systems that have requested authorization. Each authorized system received an equal share of the available frequencies. Because there is not sufficient spectrum to award to each applicant the full amount of spectrum that it has indicated its proposed system requires, the Commission stated in the 2 *GHz MSS Rules Order* that operational systems could aggregate spectrum assignments "by reaching agreement for sharing of those assignments among themselves."[276] Not all proposed systems can share the same spectrum due to the modulation schemes proposed. A licensee will select the specific frequencies in which its primary service operations will take place at the time it has launched one satellite into its intended orbit.[277] In addition, because there are a number of incumbent terrestrial services, such as Broadcast Auxiliary Services, in the 2 GHz MSS hand, each authorized system will have flexibility to operate MSS at other frequencies in the band.[278]

106. The July 17, 2001 Orders authorizing Boeing, Celsat, Constellation, Globalstar, ICO, Iridium, MCHI, and TMI to provide 2 GHz MSS in the United States requires the satisfaction of certain implementation milestones.[279] Our milestone rules are intended to ensure the speedy delivery of service

---

[273] Many of the rules adopted today impose operating limits to protect against harmful interference based on current technology, current coding methods or current network configurations. See *infra* App. B (adopting new rules 47 C.F.R. §§ 25.147, 25.252, 25.253, 25.254). Although our rules are designed with today's systems in mind. we do not intend to limit the ability of existing or future licensees to deploy new, different or innovative technologies, provided that the applicant can demonstrate that the new system configuration produces no greater interference than permitted under our existing rules. We adopt notes to this effect in each of our band-specific MSS ATC rules. *See infra* App. B (47 C.F.R. §§ 25.252, 25.253, 25.254).

[274] *See, e.g.*, 47 C.F.R. §§ 25.272, 25.274

[275] *2 GHz MSS Ruler Order,* 15 FCC Rcd 16127

[276] *Id.* at 16140-41, ¶ 22

[277] *Id.* at 16138, ¶ 16.

[278] *Id.* at 16139-40. ¶¶ 19-21. Operations at frequencies outside *of* an MSS operator's selected frequency assignment cannot cause harmful interference to other assigned satellite networks or incumbent terrestrial services.

[179] *See supra* n.10. As foreign applicants seeking authorizations for their foreign licensed systems. ICO and TMI were authorized as non-U.S. licensed satellite systems for which the Commission reserved spectrum to serve the (continued....)

to the public and to prevent warehousing of spectrum."' To date, all licensees have certified that they have met their first construction milestone of July 17, 2002 to enter into a non-contingent satellite manufacturing contract. Boeing plans to use its 2 GHz MSS license specifically to provide aeronautical services.[281] Boeing has filed an application to modify its 2 GHz MSS authorization to substitute a geostationary orbit satellite network for the non-geostationary orbit MSS network in its license?" Celsat plans to implement a geostationary satellite orbit MSS system while Iridium plans to implement a non-geostationary satellite orbit MSS system.[283] Globalstar has filed an application to modify its 2 GHz MSS authorization to reduce the number of operational non-geostationary orbit satellites in its network, with proposed technical modifications.[284] TMI operates a geostationary orbit satellite system licensed in Canada and, through a subsidiary, holds a letter of intent authorization from the Commission.[285] ICO operates an NGSO satellite network and is authorized under the laws of the United Kingdom and, through a subsidiary, holds a letter of intent authorization from the Commission which requires that a second satellite be launched prior to January 2005.[286] On July 18, 2002, ICO, Constellation, and MCHI filed

(Continued from previous page)

United States. Pursuant to the 2 *GHz MSS Rules Order,* these authorizations provided each system access to "Selected Assignments" of 3.5 megahertz of spectrum in each of the 1990-2025 MHz and 2165-2200 MHz bands and the transceivers must be capable of tuning across at least 70% of the MSS allocation. The International Bureau delayed full implementation of the 2 *GHz MSS Rules Order* with regard to an incremental 0.38 megahertz of spectrum per licensee in each band, pending Commission consideration of various pending proposals related to the 2 GHz frequencies.

[280] These milestone deadlines began to run on the authorization date, July 17, 2001. Specifically, non-geostationary satellite orbit (NGSO) MSS operators must enter into a non-contingent satellite manufacturing contract within one year of authorization, complete critical design review (CDR) within two years of authorization, begin physical construction of all satellites in the system within two-and-a-half years of authorization, and complete construction and launch of the first two satellites within three-and-a-half years of authorization. *See* 2 *GHz MSS* Rules Order, 15 FCC Rcd at 16177, ¶ 106. The entire system must be launched and operational within six years of authorization. *Id.* at 16178, ¶ 106. Geostationary satellite orbit (GSO) operators must enter a non-contingent satellite manufacturing contract within one year, complete CDR within two years, begin physical construction of all the GSO satellites in the system within three years, and complete construction of one satellite in the constellation and launch it into its assigned orbital location within five years of authorization. Id. at 16177, ¶ 106. Hybrid GSO-NGSO satellite systems must follow GSO milestones for the GSO portion of their systems as well as NGSO milestones for the NGSO portion of their systems. *Id.*

[281] Boeing 2 *GHz MSS License,* 16 FCC Rcd at 13704, ¶ 36.

[282] *See Application of The Boeing Company to Modify its Satellite Authorization*, SAT-MOD-2002072640133. Public Notice Report No. SAT-OI 15 (rel. Aug. 1.2002).

[283] Celsat 2 *GHz MSS License,* 16 FCC Rcd at 13712, ¶ 2; *Iridium* 2 *GHz MSS License,* 16 FCC Rcd at 13778.9 2.

[284] *See Applications of Globalstar L.P. to Modify its Satellite Authorization*, SAT-MOD-20020722-00107, SAT-MOD-20020722-00108. SAT-MOD-20020722-00109, SAT-MOD- 20020722-00110, SAT-MOD-20020722-00112, Public Notice Report No. SAT-01 15 (rel. Aug. 1, 2002).

[285] *See TMI 2 GHz MSS Order,* 16 FCC Rcd 13808. MSV. one of the original applicants in this proceeding, is a joint venture between TMI and Motient Corporation. *See supra* n.13 and accompanying text.

[286] *See ICO* 2 *GHz MSS Order,* 16 FCC Rcd at 13775 ¶ 34. ICO has informed the Commission that it has completed construction of additional satellites. *See, e.g.*, Letter of Cheryl A. Tritt, Counsel to ICO Services Limited to Magalie Roman Salas, Secretary, Federal Communication Commission, File Nos. 188-SAT-LOI-97; SAT-LOI-19970926-00163; SAT-AMD-20000612-00107; SAT-AMD-20001103-00155 (tiled Oct. 15, 2001) (responding to its obligations under section 25.143(e) Annual Report and Certification of Construction Milestones).

applications with the Commission proposing to: (1) transfer control of Constellation's and MCHI's MSS licenses to ICO; and (2) modify the technical specifications of Constellation's and MCHI's 2 GHz MSS systems to conform with the technical specifications of ICO's 2 GHz MSS system.[287] The proposed modifications include a request for Constellation and MCHI to implement their 2 GHz MSS systems by sharing satellite infrastructure with ICO pursuant to a Spectrum Sharing Agreement, pending approval of the transfer of control applications.[288] On January 29, 2003, the International Bureau declared Constellation's, Globalstar's and MCHI's 2 GHz MSS licenses null and void, after finding that these entities failed to satisfy their first 2 GHz MSS implementation milestone.[289]

**107.** In its application, ICO proposed four different frequency plans and architectures to integrate ATC into its MSS system.[290] Briefly, the four architectures are: (1) Forward Band Mode, (2) Reverse Band Mode, (3) Downlink Duplex Mode, and (4) Uplink Duplex Mode. In the Forward Band Mode, ATC Mobile Terminals (MTs) would transmit in the MSS uplink frequency band and Base Stations (BSs) would transmit in the downlink band; in the Reverse Band Mode, the MTs would transmit in the MSS downlink frequency band and the BSs would transmit in the uplink band; in the Uplink Duplex Mode, the MTs and BSs would transmit in the uplink MSS frequency band; and in the Downlink Duplex Mode, the MTs and BSs would transmit in the downlink MSS frequency band. We evaluate in Appendix C1 all four Modes of ATC operation in greater detail to determine the potential for each Mode to cause interference to other in-band 2 GHz MSS systems and to systems operating in adjacent frequency allocations. ICO was the only 2 GHz MSS band licensee to submit a proposal for ATC.[291] Other than Boeing, which was the only 2 GHz MSS band licensee to express concern about ATC operations potentially interfering with its MSS system, the 2 GHz MSS band licensees either generally supported the concept of ATC or explicitly indicated that ATC could be implemented without causing interference to MSS systems.[292]

**108.** We conclude that the Forward Band Mode of operation for ATC is the least interfering to in-band MSS systems and systems operating in adjacent frequency bands. Moreover, since the Forward Band Mode would require the fewest technical and operating constraints, overall it would have the greatest amount of technical flexibility for implementation and it appears to be the more desirable Mode

---

[287] *Application of Constellation Communications Holdings Inc. to Modify its Satellite Authorization,* SAT-MOD-20020719-0103, Public Notice Report No. SAT-0116 (rel. Aug. 5. 2002); *Application of Constellation Communications Holdings Inc. to Transfer Control of Satellite Authorizations to ICO Global Communications Holdings,* SAT-T/C-20020718-00114, Public Notice Report No. SAT-0116, (rel. Aug. 5, 2002); *Application of Mobile Communications Holdings Inc. to Modify its Satellire Authorization,* SAT-MOD-20020719-0105, Public Notice Report No. SAT-0116, (rel. Aug. 5, 2002); *Application of Mobile Communications Holdings Inc. to Transfer Control of Satellite Authorizations to ICO Global Communications Holdings,* SAT-T/C-20020719-00104, Public Notice Report No. SAT-0116, (rel. Aug. 5, 2002) (collectively *ICO/MCHI/Constellation Applications Notice).*

[288] *See ICO/MCHI/Constellation Applications Notice,* at 1-3.

[289] *See supra n.* 11

[290] *See* ICO Mar. 8, 2001 Ex *Parte* Letter at 8-10 & App. B

[291] Globalstar, however, provided substantial technical information on how it would integrate a forward band mode ATC network in its 2 GHz MSS system. See Globalstar Supplemental Comments. Technical Comments at 15-18.

[292] See, *e.g.*, ICO Comments at 15-30 Constellation Comments at 22-38; TMI Comments at 2-4; MCHI Comments at 11; Globalstar Bondholders Comments at 31; *see also, e.g.*, Boeing Comments at 12-13; Boeing Reply at 7-8, 23. Boeing's specific concerns are addressed below.

to implement ATC.[293] As described in detail in Appendix C1, our analyses indicate that the Reverse Band Mode, and both Duplex Modes of operation for ATC, have significantly greater potential to interfere with other systems than the Forward Band Mode. Specifically, an ATC MT operating in Reverse Band Mode or the Downlink Duplex Mode, has the potential to interfere with other MSS MET receivers when the terminals are within approximately 300 feet of each other.[294] Additionally, ATC BSs operating in Reverse Band Mode and in the Uplink Duplex Mode have the potential to interfere with Broadcast Auxiliary Service (BAS) equipment in the allocation above 2025 MHz when, for example, ATC BSs and Electronic News Gathering (ENG) receivers are within 2.6 km of each other?'' The technical and operational constraints that would have to be placed on these Modes of ATC operation to protect in-band and adjacent allocation systems (e.g., coordination prior to operation, more stringent EIRF'or out-of-band emission levels) would lessen the technical flexibility to effectively deploy ATC. We decline to authorize these Modes of operation for ATC and we adopt technical rules to implement the Forward Band Mode.

109. To implement the decision in this Order, we adopt rules permitting ATC in the Selected Assignments of the 2 GHz MSS band licensees?% The ATC technical rules shall apply to all 2 GHz MSS licensees choosing to implement ATC in their selected MSS frequency assignments.[297] The technical rules for ATC, discussed below, provide for operation of ATC in the 2 GHz MSS allocations, protect currently licensed in-band MSS systems from interference, and protect systems operating in adjacent service allocations from interference. In brief, to protect other in-band MSS systems and systems operating in adjacent frequency bands, ATC operators will be required to meet specific MT out-of-band emission limits based upon our analyses that include reserving a minimum amount of link margin for power control in their ATC networks to accommodate for structural attenuation.[298] ATC operators will also be required to meet specific BS out-of-band emission limits, meet an EIRP limit toward the horizon and maintain a separation distance from airports. We discuss each of the rules below.

---

[293] ICO, for example, indicates that "the Forward Band Mode is the most straightforward" and it seems to place more emphasis on this Mode of operation. See ICO Mar. 8,2001 *Ex* Pone Letter at 8. Globalstar and MSV also support the Forward Band Mode approach for ATC operations in the Big LEO and L-band, respectively. See Globalstar Comments at 1a & n.28; Motient/TMI Assignment and Modification Application, File No. ISP PDR-20010302-00007 at 8-9 (filed, Mar. 1,2001).

[294] See *infra* App. C1 § 2.2.4.1

[295] See *infra* App. C1 § 3.1. Added constraints would be required on the Base Stations (e.g. site-by-site coordination of the base stations prior to operation) to ensure protection of ENG operations in the adjacent frequency allocation.

[2%] ICO has informed the Commission of its Selected Assignment within the 2 GHz MSS Band. See Letter of Cheryl A. Tritt, Counsel to ICO Satellite Services G.P. to Marlene H. Dortch, Secretary, Federal Communications Commission, File No. 188-SAT-LOI-97;IBFS Nos. SAT-LOI-19970926-00163; SAT-AMD-20000612-00107; SAT-AMD-20001103-00155 (October 15.2002) (2 GHz MSS Selected Assignment Notification, Annual Section 25.143(e) Report, and Section 25.121(d)(2) Certification).

[297] See *supra* § III(C); see *also infra* App. B

[298] We use the term "structural attenuation" to mean the signal attenuation caused by transmitting to and from mobile terminals that are located in buildings or other man-made structures that limit the transmission of radiofrequency radiation.

### a. Intra-Service Sharing

110. ICO's ATC proposal suggests that ATC could be provided on a licensee's selected MSS assignment and, on a secondary basis, on other MSS licensees' selected frequency assignments in the MSS allocation.[299] Since we are limiting 2 GHz licensees ATC operations to the licensee's selected assignments,[300] we only address the interference potential of ATC operations in one licensee's selected frequencies to the MSS operations in another licensee's selected frequency assignments (i.e., we address the interference potential from an adjacent channel perspective). Boeing has conducted substantial technical studies on adjacent channel interference in response to ICO's proposed integrated ATC network."' Boeing is concerned about the potential for interference that ICO's ATC operations could cause to Boeing's licensed MSS satellite network. We address Boeing's analysis, which is based upon its original proposal for a non-geostationary satellite network, in Appendix C1.

111. Boeing submitted initial comments indicating that, based upon a number of assumptions. it is concerned about possible interference from the ATC BSs to its satellite uplink receivers."' Since we are only authorizing the Forward Band Mode of ATC operation, BSs will not be transmitting in the satellite uplink band and this potential for interference no longer exists. Additionally, Boeing indicated that, based on ICO's proposal, it did not expect interference to occur to its satellite uplink receivers from ATC MTs.[303] However, ICO modified its proposal to include more liberal ATC MT out-of-band emission levels[304] and we evaluate the Boeing link analysis in Appendix C1 using the modified assumptions provided by ICO. The results of our analysis concur with Boeing's initial results that ATC MTs operating in Forward Band Mode will not interfere with Boeing MSS receivers in the uplink. Specifically, taking into account the -67 dBW/4kHz out-of-channel emission level we adopt and the mitigating effects of ATC network power control which is standard engineering practice to include in terrestrial mobile networks,[305] the Boeing satellite receiver noise would be increased by less than 1%.[306] This increase in satellite receiver noise temperature would not cause unacceptable interference to Boeing's satellite operations or other MSS systems operating in adjacent channels in the MSS

---

[299] This proposal is consistent with the MSS service rules relating to MSS frequency assignments. See 2 *GHz MSS Rules Order* 15 FCC Rcd at 16172-89, ¶¶ 92-140.

[300] See *supra* § III(C)(3).

[301] See Boeing Comments App. A at 1-7.

[302] Boeing Comments at 12

[303] *Id.*, App. A, Table4

[304] ICO modified its MET out-of-channel emission level of -93.5 dBW/4kHz to -67 dBW/4kHz. See ICO Apr. 11, 2002 *Ex Parte* Letter at 2.

[305] See MSV Reply, Technical Annex at 7; see *also* lean-Paul M.G. Linnartz, ed.. Wireless *Communication: The Interactive Multimedia CD-ROM, Link Budget, available at* <http://150.250.105.16/~krchnave/spring2002/wireless/Kluwer_CD/chaptr04/outage/linkbudg.htm> (last visited, Jan. 9.2003).

[306] See *infra* App. C1. The analysis contained in Section 2.1.3. does not include the use of power control and therefore the results are conservative. A typical value to use for power control in cellular and PCS systems is 18 dB. Incorporating power control in the ATC network would add at least 10 dB to Boeing's link margin to protect it from receiving interference from ATC MT transmissions.