

ORDER AND AUTHORIZATION

Adopted: February 23, 2009

Released: February 24, 2009

By the Acting Chief, International Bureau:

TABLE OF CONTENTS

	Paragraph No.
I. INTRODUCTION	1
II. BACKGROUND	3
A. V-band	3
B. Ka-band	7
C. Northrop Grumman Applications	10
1. Procedural History	10
2. Comments	17
III. DISCUSSION	22
A. Processing Framework	22
1. V-band	23
2. Ka-band	31
a. NGSO Component	31
b. GSO Component	35
B. Qualifications	36
1. Legal and Financial Qualifications	37
2. Technical Qualifications	38
a. V-band Allocations	38
(i) V-band Uplink	38
(ii) V-band Downlink	40
b. The Ka-band Plan	45
(i) Ka-band Uplink	45
(ii) Ka-band Downlink	48
c. NGSO Satellites	52
(i) V-band Operations	53
(ii) Ka-band Operations	69
(iii) Replacement Satellites	77
d. GSO Satellites	78
(i) V-band Operations	79
(ii) Ka-band Operations	82
(iii) Increased Power Operations in the 18.8-19.3 GHz and 28.6-29.1 GHz Frequency Bands	91
e. Tracking, Telemetry, and Command Function	94
f. Orbital Debris Mitigation	96
g. Inter-Satellite Links	103
C. License Conditions	104
1. Milestone Schedule	104
2. License Term	106
3. Reporting Requirements	107
4. International Coordination	108
5. Bond	109
IV. CONCLUSION AND ORDERING CLAUSES	111

I. INTRODUCTION

1. By this Order, we grant Northrop Grumman Space & Mission Systems Corporation (Northrop Grumman) authority for a satellite system consisting of three non-geostationary satellite orbit (NGSO) satellites and four geostationary satellite orbit (GSO) satellites.¹ These satellites will provide fixed-satellite service (FSS) in the Ka- and V-bands.² Specifically, we authorize Northrop Grumman to construct three NGSO satellites that will operate in the frequency bands outlined in the chart below. We also authorize Northrop Grumman to construct, launch and operate four GSO satellites at the orbital locations and frequency bands identified in the chart. Authorizing this combined NGSO and GSO satellite system will give Northrop Grumman an opportunity to provide customers access to a variety of advanced broadband and interactive satellite communications services.

Architecture	Authorized Frequencies	Operating Authority ³
NGSO Satellites	47.2-50.2 GHz (Earth-to-space) 37.5-42.0 GHz (space-to-Earth) 29.5-30.0 GHz (Earth-to-space) 28.6-29.1 GHz (Earth-to-space) 19.7-20.2 GHz (space-to-Earth) 18.8-19.3 GHz (space-to-Earth)	Co-Primary Co-Primary Secondary Primary Non-conforming Primary
GSO Satellites Located At 125° W.L., 73° W.L.,	47.2-50.2 GHz (Earth-to-space) 37.5-42.0 GHz (space-to-Earth)	Co-Primary Co-Primary

¹ These applications were originally filed by TRW, Inc. pursuant to a filing “cut-off date” announced by the Commission. Satellite Policy Branch Information: Applications Accepted For Filing: Cut-Off Established for Additional Space Station Applications and Letters of Intent in the 36-51.4 GHz Frequency Band, *Public Notice*, Report No. SPB-89, 12 FCC Rcd 10450 (1997) (*V-band Cut-off Notice*). In 2002, the Commission approved the transfer of control of TRW’s authorizations and pending applications to Northrop Grumman Corporation. Application of TRW Inc., Transferor and Northrop Grumman Corporation, Transferee, For Consent to Transfer of Control of Authorization to Construct, Launch and Operate a Ka-Band Satellite System in the Fixed-Satellite Service, *Order and Authorization*, 17 FCC Rcd 24625 (Int’l Bur., Sat. Div., 2002) (*TRW Transfer of Control Order*). TRW later changed its name to Northrop Grumman Space & Mission Systems Corporation. See Letter to Marlene H. Dortch, Secretary, FCC from Stephen D. Baruch, Counsel to Northrop Grumman Space & Mission Systems Corp. (Jan. 10, 2003). At that time, Northrop Grumman requested an exemption from the application “cut-off date” with respect to the TRW applications, to preserve the filing status of these applications. See Application File No. SAT-WAV-19971222-00220. In light of the Commission’s subsequent decision that transfers of control will no longer affect an application’s processing status (see Amendment of the Commission’s Space Station Licensing Rules and Policies, Mitigation of Orbital Debris, *First Report and Order and Further Notice of Proposed Rulemaking*, IB Docket Nos. 02-34 and 02-54, 18 FCC Rcd 10760, 10814 (para. 140) (2003) (*First Space Station Licensing Reform Order*)), we dismiss the request as moot and conform the applicant’s name to reflect the change in control.

² The term “Ka-band” refers to the space-to-Earth (downlink) communications in the 17.7-20.2 GHz band and the corresponding Earth-to-space (uplink) communications in the 27.5-30.0 GHz frequency band. The term “V-band” refers to the space-to-Earth (downlink) communications in the 37.5-42.5 GHz band and the corresponding Earth-to-space (uplink) communications in the 47.2-50.2 GHz frequency band.

³ Space stations operating in primary services are protected against interference from stations of secondary services. Stations operating in a secondary service cannot cause harmful interference to or claim protection from harmful interference from stations of a primary service. Co-primary services have equal rights to operate in particular frequencies. Non-conforming services may be provided only on a non-harmful interference basis to any authorized Federal, non-Federal, or non-U.S.-licensed services and may not claim interference protection from those services.

68.5° E.L., and 116.5° E.L.	29.25-30.0 GHz (Earth-to-space)	Primary
	28.6-29.1 GHz (Earth-to-space)	Secondary
	28.35-28.6 GHz (Earth-to-space)	Primary
	19.7-20.2 GHz (space-to-Earth)	Primary
	18.8-19.3 GHz (space-to-Earth)	Non-conforming
	18.3-18.8 GHz (space-to-Earth)	Primary

2. We deny, however, Northrop Grumman's request to launch and operate its NGSO satellites due to orbital debris mitigation concerns.⁴ Once Northrop Grumman has finalized its end-of-life disposal plan for the NGSO satellites, it may file an application to launch and operate these satellites. Nevertheless, we address issues relating to Northrop Grumman's proposed NGSO operations in this Order so we will be in a position to act expeditiously should Northrop Grumman file a request for launch and operating authority for the NGSO satellites. We also deny Northrop Grumman's request for a waiver of the bond requirement for its GSO satellites.

II. BACKGROUND

A. V-band

3. In July 1997, the Commission released a Public Notice establishing a cut-off for space station applications proposing to use the V-band.⁵ In response to the Public Notice, 14 entities filed applications for 17 satellites, including Northrop Grumman. These applicants proposed GSO and/or NGSO systems.⁶

4. In December 1998, the Commission released the *V-band Allocation Order*, where it allocated two gigahertz of spectrum for FSS in the 37.6-38.6 GHz and 40.0-41.0 GHz frequency bands for downlinks, and two gigahertz in the 48.2-50.2 GHz frequency band for uplinks.⁷ The *V-band Allocation Order* also re-allocated the 47.2-48.2 GHz band for exclusive non-Federal use.⁸

5. In November 2003, the Commission adopted the *V-band Second Report and Order*.⁹

⁴ See para. 102, below.

⁵ *V-band Cut-off Notice*, 12 FCC Rcd at 10450. The original cut-off date was August 21, 1997, but was later extended to September 26, 1997. Clarification and Corrections to Public Notices, Report Nos. SPB-88 and SPB-89, Establishing Deadlines for Applications, Letters of Intent, and Amendments to Applications in the 2 GHz and 36-51.4 GHz Frequency Bands, *Public Notice*, 12 FCC Rcd 12050 (Int'l Bur., 1997); Extension of Cut-off Dates for Applications, Letters of Intent, and Amendments to Applications in the 2 GHz and 36-51.4 GHz Frequency Bands, *Public Notice*, Report No. SPB-99 (Sept. 4, 1997).

⁶ Ten applicants subsequently withdrew their applications. The Commission dismissed the applications filed by three other applicants. Northrop Grumman is the only remaining V-band applicant.

⁷ 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 Fixed 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 Allocation of Spectrum in the 37.0-38.0 GHz and 40.0-40.5 GHz Frequency Bands for Government Operations, *Report and Order*, IB Docket No. 97-95, 13 FCC Rcd 24649 (1998) (*V-band Allocation Order*). See also 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 Fixed 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 Allocation 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*).

⁸ See *V-band Allocation Order*, 13 FCC Rcd at 24671 (para. 41).

⁹ 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 Fixed and Mobile Allocations in the (continued...)

In that *Order*, the Commission made various changes in V-band designations and allocations that reflected decisions made at the 2000 and 2003 World Radiocommunication Conferences. The Commission also adopted power flux density (PFD) limits for both GSO and NGSO V-band systems.¹⁰

6. In May 2003, the Commission released the *First Space Station Licensing Reform Order*, adopting new licensing procedures designed to allow it to process satellite applications significantly faster than it could previously, while maintaining adequate safeguards against speculation.¹¹ The Commission concluded that continuing to analyze pending V-band applications under the processing procedure previously in effect would frustrate these goals. The Commission directed the International Bureau to analyze all pending V-band applications pursuant to the procedures adopted in the *First Space Station Licensing Reform Order*. In this regard, the Commission directed the Bureau to treat all pending V-band applications as though they were filed at the same time. The Commission further directed the Bureau to divide the V-band FSS spectrum between GSO systems and NGSO systems based on the proportion of qualified GSO applicants and NGSO applicants. The Bureau would then assign qualified GSO applicants to the orbit locations they requested in the “GSO-designated” portion of the band. In cases where two applicants requested the same orbital location, the Bureau would subdivide the GSO spectrum between them. The Commission also directed the Bureau to divide the NGSO portion of the V-band equally among the qualified NGSO applicants.¹²

B. Ka-band

7. In May 1997, the International Bureau licensed 13 GSO applicants and one NGSO applicant to operate satellite systems as part of the first Ka-band FSS processing round.¹³ Consistent with the Commission’s 1996 decision to divide the 27.5-30.0 GHz portion of the Ka-band among several services, the Bureau authorized the GSO systems in one range of Ka-band spectrum and the NGSO system in another.¹⁴

8. In October 1997, the Bureau established a second processing round for FSS Ka-band systems.¹⁵ At that time, the Commission also adopted its *Ka-band Third Report and Order*

(...continued from previous page)

40.5-42.5 GHz Frequency Band; Allocation of Spectrum in the 46.9-47.0 GHz Frequency Band for Wireless Services; and Allocation of Spectrum in the 37.0-38.0 GHz and 40.0-40.5 GHz for Government Operations, *Second Report and Order*, IB Docket No. 97-95, 18 FCC Rcd 25428 (2003) (*V-band Second Report and Order*).

¹⁰ *V-band Second Report and Order*, 18 FCC Rcd at 25470-72 (promulgating 47 C.F.R. § 25.202(a) (1) fn. 15 and 47 C.F.R. § 25.208(q) - (u)).

¹¹ *First Space Station Licensing Reform Order*, 18 FCC Rcd at 10865 (para. 279).

¹² *Id.*

¹³ Assignment of Orbital Locations to Space Stations in the Ka-band, *Order*, 13 FCC Rcd 1030 (Int’l Bur. 1997). See also Teledesic Corp., *Order and Authorization*, 12 FCC Rcd 3154 (Int’l Bur. 1997) (authorizing Teledesic Corp. to launch and operate a NGSO FSS system in the Ka-band). Teledesic subsequently surrendered its NGSO authorization. Letter to Marlene H. Dortch, Secretary, FCC, from Mark A. Grannis, Counsel to Teledesic (June 27, 2003). In addition, a number of GSO licensees surrendered their licenses.

¹⁴ Rulemaking to Amend Parts 1, 2, 21, and 25 of the Commission’s Rules to Redesignate the 27.5-29.5 GHz Frequency Band, to Reallocate the 29.5-30.0 GHz Frequency Band, to Establish Rules and Policies for Local Multipoint Distribution Service and for Fixed Satellite Services, *First Report and Order and Fourth Notice of Proposed Rulemaking*, 11 FCC Rcd 19005 (1996) (*Ka-band Plan Order*).

¹⁵ See *Public Notice* Satellite Policy Branch Information: Satellite Applications Accepted for filing in the Ka-band, Cut-Off Established for Additional Applications in the 28.35-28.6 GHz, 29.1-30 GHz, 17.7 - 18.8 GHz, and 19.3 - 20.2 GHz Frequency Bands, Report No. SPB-106, 13 FCC Rcd 8020 (Int’l Bur. 1997).

establishing technical requirements, licensing qualifications, and service rules for GSO FSS and NGSO FSS systems in the Ka-band.¹⁶ The Bureau subsequently licensed 11 companies to operate Ka-band GSO satellites at 34 orbital locations. The Bureau deferred action on the second round Ka-band NGSO applications,¹⁷ however, until the Commission established principles by which multiple NGSO FSS systems could share the NGSO-designated portion of the spectrum.¹⁸

9. In July 2003, the Commission adopted an Order establishing a sharing method for non-Federal Ka-band FSS NGSO systems.¹⁹ Under this sharing method, all Ka-band NGSO systems will have access to the entire NGSO-designated spectrum, except during in-line interference events.²⁰ When two NGSO FSS systems cannot avoid an in-line interference event, the operators must divide the available spectrum equally for the duration of the event, unless the operators agree to a different sharing arrangement.²¹ The *Ka-band NGSO Order* also adopted a technical definition to support the sharing method, a default mechanism, and various service rules.

C. Northrop Grumman Applications

1. Procedural History

10. In September 1997, pursuant to the announcement of the V-band application filing window, Northrop Grumman filed applications for authority to establish a global V-band FSS system. This system was to use 15 NGSO satellites in medium Earth orbit (MEO) and four GSO satellites. In December 1997, in response to the filing cut-off for the second processing round for Ka-band applications, Northrop Grumman amended its V-band filings to include Ka-band frequencies on all 19 of its satellites.

11. In 2001, as part of the second Ka-band processing round, the Bureau granted Northrop Grumman authority to construct, launch, and operate four GSO Ka-band satellites.²² The Bureau deferred action on the V-band and Ka-band NGSO portions of the 1997 applications. Northrop Grumman later decided not to proceed with the authorized GSO Ka-band satellites and

¹⁶ See Rulemaking to Amend Parts 1, 2, 21, and 25 of the Commission's rules to Redesignate the 27.5-29.5 GHz Frequency Band, to Reallocate the 29.5-30.0 GHz Frequency Band, to Establish Rules and Policies for Local Multipoint Distribution Service and for Fixed-Satellite Services, *Third Report and Order*, CC Docket No. 92-297, 12 FCC Rcd 22310 (1997) (*Ka-band Third Report and Order*). In that *Order*, the Commission observed that the 27.5-30.0 GHz and 17.7-20.2 GHz band is allocated internationally and domestically for a number of uses. To address these different uses, the Commission adopted a band plan that divides the bands into several segments, each of which is designated for primary use by GSO FSS, NGSO FSS, and other services. *Id.* at 22366.

¹⁷ Six NGSO applications were filed in the second Ka-band processing round. Subsequently, Motorola Global Communications, Inc., Hughes Communications, Inc., Lockheed Martin Corp., and SkyBridge II, LLC withdrew their applications. contactMEO Communications, LLC, now operating as ATCONTACT Communications, LLC, was granted a license in April 2006 for a system composed of both NGSO and GSO satellites. See contactMEO Communications, LLC, *Order and Authorization*, 21 FCC Rcd 4035 (Int'l Bur. 2006). For ease of reference, we will refer to this entity as ATCONTACT in this Order. Northrop Grumman is the only remaining NGSO Ka-band applicant.

¹⁸ *Ka-band Third Report and Order*, 12 FCC Rcd at 22325.

¹⁹ Establishment of Policies and Service Rules for the Non-Geostationary Satellite Orbit, Fixed Satellite Service in the Ka-band, *Report and Order*, 18 FCC Rcd 14708 (2003) (*Ka-band NGSO Order*).

²⁰ See 47 C.F.R. § 25.261(b). An "in-line" interference event occurs when the physical alignment of one system's earth station and another system's NGSO satellite causes unintentional transmissions in either transmission direction.

²¹ *Ka-band NGSO Order*, 18 FCC Rcd at 14717.

²² *TRW, Inc., Order and Authorization*, 16 FCC Rcd 14407 (Int'l Bur. 2001).

surrendered these licenses in 2003.²³

12. In March 2004, Northrop Grumman amended its pending V-band/NGSO Ka-band applications in response to the Commission's January 29, 2004 Public Notice inviting V-band applicants to amend their pending applications to conform to the Commission's revised V-band allocation and technical rules.²⁴ In these amendments, Northrop Grumman proposed to: (1) change the orbital configuration to a combination of three highly-elliptical orbit (HEO) NGSO satellites and four GSO satellites; (2) relocate some of the GSO satellites to different orbital locations; (3) change its V-band spectrum plan to conform with the *V-band Second Report and Order*; (4) operate its GSO satellites in portions of the Ka-band; (5) provide additional or revised technical information concerning system operation, and (6) update ownership information.²⁵

13. On May 18, 2004, the International Bureau's Satellite Division dismissed Northrop Grumman's amended application as incomplete on two grounds.²⁶ First, the Division stated that the NGSO portion of the application did not comply with Section 25.145(c)(3) of the Commission's rules.²⁷ This rule requires NGSO applicants to submit a casualty risk assessment if, as Northrop Grumman proposed, "planned post-mission disposal involves atmospheric re-entry of the spacecraft." Second, the Division stated that Northrop Grumman failed to submit the required interference analysis demonstrating that its proposed GSO satellites are compatible with the Commission's two-degree orbital spacing environment.²⁸ The Division also noted that Northrop Grumman had requested to operate its GSO satellites in Ka-band spectrum designated for NGSO use only or for NGSO use on a primary basis, and cautioned Northrop Grumman that it had failed to demonstrate that its proposed Ka-band GSO satellites could operate compatibly with NGSO systems in this spectrum.²⁹

14. Subsequently, the Satellite Division determined that the Commission's rules regarding the casualty risk assessment and two-degree interference analysis were subject to reasonable but conflicting interpretations. Consequently, the International Bureau issued Public Notices to clarify these requirements.³⁰ In the Notices, the Bureau stated that it would dismiss

²³ See Letter from Stephen D. Baruch, Counsel to Northrop Grumman Space & Mission Systems Corp. to Secretary, FCC (Mar. 5, 2003).

²⁴ See *International Bureau Invites Applicants to Amend Pending V-band Applications*, DA 04-234, Report No. SPB-199 (Jan. 29, 2004) (*V-band Amendment Public Notice*).

²⁵ See Application of Northrop Grumman, File No. SAT-AMD-20040312-00030 (NGSO March 2004 Amendment), Application of Northrop Grumman, File No. SAT-AMD-20040312-00031 (119° W.L. March 2004 Amendment), Application of Northrop Grumman, File No. SAT-AMD-20040312-00032 (89° W.L. March 2004 Amendment), Application of Northrop Grumman, File No. SAT-AMD-20040312-00033 (15° E.L. March 2004 Amendment), Application of Northrop Grumman, File No. SAT-AMD-20040312-00034, (116.5° E.L. March 2004 Amendment) (March 2004 Amendments).

²⁶ See Letter to Peter Hadinger, Northrop Grumman Space & Mission Systems Corp., from Thomas S. Tycz, Chief, Satellite Division, FCC, 19 FCC Rcd 8870 (May 18, 2004) (May 18 Letter).

²⁷ 47 C.F.R. § 25.145(c)(3).

²⁸ 47 C.F.R. § 25.140(b)(2).

²⁹ May 18 Letter, 19 FCC Rcd at 8871.

³⁰ *Public Notice*, International Bureau Satellite Division Information, Report No. SPB-208, Orbital Debris Mitigation: Clarification of 47 C.F.R. sections 25.143(b), 25.145(c)(3), 25.146(i)(4) and 25.217(d) Regarding Casualty Risk Assessment for Satellite Atmospheric Reentry, 19 FCC Rcd 10714 (Int'l Bur., Sat. Div., 2004) (*Orbital Debris Public Notice*); *Public Notice*, International Bureau Satellite Division Information: Clarification of 47 C.F.R. § 25.140(b)(2), Space Station Application Interference Analysis, Report No. SPB-207, 19 FCC Rcd 10652 (Int'l Bur., Sat. Div., 2004) (*2004 Two-Degree Spacing Public Notice*).

applications that do not contain this information on a going-forward basis, but that it would afford pending applicants an opportunity to amend their applications to comply with the clarified requirements. The Division reinstated Northrop Grumman's applications and those of other situated applicants, on its own motion, and gave all applicants an opportunity to file conforming amendments.³¹ In response, Northrop Grumman submitted a two-degree interference analysis and a revised orbital debris mitigation plan and casualty risk assessment for each application.³² Northrop Grumman also submitted additional technical information to support its claim that its GSO satellites will not cause interference to NGSO satellites of other non-Federal systems in the Ka-band. In response to a Division request, it also submitted information regarding its efforts to avoid in-orbit collisions with a similar system proposed by ATCONTACT.³³ Thereafter, the Commission's orbital debris mitigation disclosure rules became effective.³⁴ Northrop Grumman amended its applications to provide additional technical information in accordance with the new rules.³⁵

15. In February 2007, Northrop Grumman filed further amendments to each of its pending applications.³⁶ In these amendments, Northrop Grumman proposed a change in orbital location for three GSO satellites. Additionally, Northrop Grumman proposed to add Ka-band spectrum to various GSO satellites. In each of these amendments, Northrop Grumman also sought to increase power levels in the 18.8-19.3 GHz and 28.6-29.1 GHz bands to levels consistent with a four-degree orbital spacing framework. Finally, Northrop Grumman withdrew its request for a waiver of Section 25.202(g)³⁷ to allow transfer-orbit and emergency-mode on-orbit TT&C links in the 4/6 GHz (C-band). In sum, in its *2007 Amendments*, Northrop Grumman requests authority to operate its system as follows:

³¹ Letter to Peter Hadinger, Northrop Grumman Space & Mission Systems Corporation, from Thomas S. Tycz, Chief, Satellite Division, FCC, DA 04-1725 (June 16, 2004) (June 16 Letter). *See also* Mobile Satellite Ventures Subsidiary LLC, *Order and Authorization*, 20 FCC Rcd 9752, 9756 (paras. 10-11) (Int'l Bur., 2005). *See also* Mobile Satellite Ventures Subsidiary LLC, *Order*, 19 FCC Rcd 18133 (Sat. Div., Int'l Bur. 2004), and Letter to James Talens, contactMEO Communications, LLC, from Thomas S. Tycz, Chief, Satellite Division, FCC (June 16, 2004).

³² *See* Applications of Northrop Grumman, File Nos. SAT-AMD-20040719-00136, SAT-AMD-20040719-00137, SAT-AMD-20040719-00138, SAT-AMD-20040719-00140, SAT-AMD-20040719-00139 (July 2004 Amendments).

³³ Letter to Marlene Dortch, Secretary, FCC, from Stephen D. Baruch, Counsel to Northrop Grumman Space & Mission Systems Corp. (May 12, 2005).

³⁴ Mitigation of Orbital Debris, *Second Report and Order*, 19 FCC Rcd 11567 (2004) (*Orbital Debris Order*). *See also Public Notice*, International Bureau Satellite Division Information, Disclosure of Orbital Debris Mitigation Plans, Including Amendment of Pending Applications, Report No. SPB-112 (Oct. 13, 2005).

³⁵ Northrop Grumman Space and Mission Systems Corporation, File Nos. SAT-AMD-20051118-00227, 229, 230, 231, 232 (filed Nov. 18, 2005) (2005 Amendments).

³⁶ Northrop Grumman Space and Mission Systems Corporation, File Nos. SAT-AMD-20070209-00029 (125° W.L. 2007 Amendment); SAT-AMD-20070209-00030 (73° W.L. 2007 Amendment); SAT-AMD-20070209-00031 (68.5° E.L. 2007 Amendment); SAT-AMD-20070209-00032 (116.5° E.L. 2007 Amendment); SAT-AMD-20070209-00033 (NGSO 2007 Amendment); all filed February 9, 2007 (2007 Amendments).

³⁷ 47 C.F.R. § 25.202(g).

Architecture	Proposed Frequencies	Proposed Operating Authority ³⁸
NGSO Satellites	47.2-50.2 GHz (Earth-to-space) 37.5-42.0 GHz (space-to-Earth) 29.5-30.0 GHz (Earth-to-space) 28.6-29.1 GHz (Earth-to-space) 19.7-20.2 GHz (space-to-Earth) 18.8-19.3 GHz (space-to-Earth)	Primary Basis Primary Basis Secondary or Non-Unacceptable Interference Basis Primary Basis Secondary or Non-Unacceptable Interference Basis Primary Basis
GSO Satellites Located at 125° W.L., 73° W.L., 68.5° E.L., and 116.5° E.L.	47.2-50.2 GHz (Earth-to-space) 37.5-42.0 GHz (space-to-Earth) 29.25-30.0 GHz (Earth-to-space) 28.6-29.1 GHz (Earth-to-space) 28.35-28.6 GHz (Earth-to-space) 19.7-20.2 GHz (space-to-Earth) 18.8-19.3 GHz (space-to-Earth)	Primary Basis Primary Basis Primary Basis Secondary Basis Primary Basis Primary Basis Non-harmful Interference Basis

16. To implement the proposed system, as amended, Northrop Grumman requests several waivers of Commission rules. These include: (1) a contingent partial waiver of the Commission's bond requirement to permit it to post a single NGSO bond to cover the entire system; (2) a waiver of Section 25.156(d)(3) to allow the Commission to consider both the NGSO and GSO components concurrently and the V-band and Ka-band components concurrently; (3) a waiver of Section 25.202(g) to place its on-orbit TT&C links in the Ka-band rather than in both Ka- and V-band; (4) a waiver of Section 25.140(b)(2), to the extent necessary, to allow increased-power operations in the 18.8-19.3 GHz and 28.6-29.1 GHz bands consistent with a four-degree orbital spacing regime; (5) a waiver of the Commission's Ka-band Plan to operate its NGSO satellites in the 19.7-20.2 GHz and 29.5-30.0 GHz frequency bands on a secondary or "non-unacceptable interference basis"; and (6) a waiver of the Commission's Ka-band Plan to permit it to operate its GSO FSS satellites in the NGSO-designated 18.8-19.3 GHz frequency band on a "non-harmful interference basis."³⁹

2. Comments

17. We first placed Northrop Grumman's applications on Public Notice in August 2004.⁴⁰ EchoStar filed a Petition to Deny and SES Americom filed a Petition to Deny or Dismiss.⁴¹

³⁸ See, e.g., 2007 Amendments at 4-5, Table 1. In its chart, Northrop Grumman lists the 47.2-50.2 GHz and 37.5-42.0 GHz frequency bands as "Primary." The Table of Frequency Allocations, Section 2.106 of the Commission's rules, indicates that these frequencies are allocated to FSS on a "co-primary" basis. 47 C.F.R. § 2.106. Further, Northrop Grumman requests authority to operate its GSO satellites on a "non-harmful interference basis" in the 18.8-19.3 GHz band and its NGSO satellites on a secondary or "non-unacceptable interference basis" in the 19.7-20.2 GHz band. The appropriate operating status in these bands is "non-conforming." See note 3, above.

³⁹ NGSO March 2004 Amendment at 23-27.

⁴⁰ See Policy Branch Information, Satellites Space Applications Accepted for Filing, Public Notice, Report No. SAT-00234 (Aug. 13, 2004).

⁴¹ Petition to Deny of EchoStar Satellite LLC, filed Sept. 13, 2004 (EchoStar Petition to Deny); Consolidated Petition to Deny or Dismiss of SES Americom, Inc., filed Sept. 13, 2004 (SES Americom Petition to Deny).

Northrop Grumman filed a Consolidated Opposition to the EchoStar and SES Americom petitions.⁴² EchoStar and SES Americom filed replies to Northrop Grumman's opposition.⁴³

18. EchoStar argues that, because we permitted Northrop Grumman to provide additional technical showings in support of its application instead of dismissing it, we should have done the same with applications EchoStar filed proposing similar GSO FSS operations.⁴⁴ Alternatively, EchoStar suggests that the Bureau should grant EchoStar's petition for reconsideration of the dismissal of its applications, reinstate its applications, and process the applications in accordance with the Commission's "first-come, first-served" policy.⁴⁵ EchoStar argues that under this policy, EchoStar's applications are first-in-time and thus have processing priority over Northrop Grumman's applications, which seek to use two of the orbital locations that EchoStar requested in the same frequency band.⁴⁶

19. EchoStar further states that the Commission should grant EchoStar's Petition for Rulemaking to redesignate the NGSO spectrum in the 18.8-19.3 GHz and 28.6-29.1 GHz bands for both GSO and NGSO operations, and to develop sharing criteria for co-frequency NGSO/GSO operations.⁴⁷ EchoStar claims that addressing GSO/NGSO sharing issues would avoid future disputes and would effectively manage available spectrum.⁴⁸

20. SES Americom asserts that Northrop Grumman's proposal conflicts with the Commission's *Ka-band Plan Order*, and that Northrop Grumman has not justified a waiver of the plan.⁴⁹ SES Americom states that we cannot consider Northrop Grumman's application until the Commission determines whether, and under what conditions, NGSO systems can operate in GSO Ka-band spectrum on a secondary basis.⁵⁰

21. In April 2007, we placed Northrop Grumman's 2007 Amendments on Public Notice.⁵¹ No comments were received in response to these amendments.

III. DISCUSSION

A. Processing Framework

22. Northrop Grumman's proposed satellite system consists of NGSO and GSO components, with each component operating in both the Ka-band and V-band. Operations in the V-band and Ka-band are governed by separate processing and service rules. Further, NGSO and GSO satellites are governed by separate processing and service rules. Consequently, we will analyze the four components of Northrop Grumman's proposed system separately. Because we are acting on all portions of Northrop Grumman's system in this Order, however, its request for a waiver of Section

⁴² Northrop Grumman, Consolidated Opposition to Petitions to Deny or Dismiss, filed Sept. 28, 2004 (Northrop Grumman Opposition).

⁴³ EchoStar Satellite LLC, Consolidated Reply to Oppositions to Petitions to Deny, filed Oct. 8, 2004 (EchoStar Reply). Consolidated Reply of SES Americom, filed Oct. 8, 2004 (SES Americom Reply).

⁴⁴ EchoStar Petition to Deny at 6.

⁴⁵ EchoStar Petition to Deny at 7.

⁴⁶ *Id.*

⁴⁷ EchoStar Petition to Deny at 9.

⁴⁸ *Id.*

⁴⁹ SES Americom Petition to Deny at 1, citing *Ka-band Plan Order*, 11 FCC Rcd at 19005.

⁵⁰ SES Americom Petition to Deny at 7.

⁵¹ See Policy Branch Information, Satellites Space Applications Accepted for Filing, Public Notice, Report No. SAT-00434 (Apr. 6, 2007).

25.156(d)(3) of the Commission's rules, which would allow us to proceed with all components on parallel processing tracks, is moot.

1. V-band

23. In the *First Space Station Licensing Reform Order*, the Commission adopted new processing rules for space station applications. Specifically, it adopted a first-come, first-served approach for GSO applications, under which it grants an application if the applicant is qualified and the proposed satellite will not cause harmful interference to a previously licensed satellite or to a satellite proposed in a previously-filed application.⁵² Further, the Commission adopted a "modified processing round" approach for NGSO applications. Under this approach, when an NGSO application is filed, the Commission issues a public notice announcing a filing deadline for additional NGSO applications to be considered concurrently with the first application, and then divides the available spectrum equally among the qualified NGSO applicants filing by the cut-off date.⁵³

24. As noted, in adopting these new licensing procedures, the Commission directed the International Bureau to treat all then-pending V-band applications filed in the 1997 processing round as if they were filed at the same time.⁵⁴ Consistent with newly adopted Section 25.156(d)(5) of its rules, the Commission further directed the Bureau to divide the spectrum proportionally between qualified GSO and NGSO applicants and to subdivide the GSO and NGSO spectrum, respectively, where there were conflicts between qualified GSO or NGSO applicants.⁵⁵

25. Northrop Grumman is the only remaining V-band applicant.⁵⁶ Its proposed system includes both GSO and NGSO satellites. Thus, under the framework set out in the *First Space Station Licensing Reform Order* and the Commission's rules, we would divide the V-band spectrum in half, designating one-half to NGSO operations and the other half to GSO operations. Next, because there would be no conflicts among requested orbital locations, we would assign Northrop Grumman's proposed GSO satellites to its requested locations. Further, to accommodate multiple entry pursuant to Section 25.157(e)(2) of the rules, we would assign Northrop Grumman's NGSO constellation to only one-third of the V-band NGSO spectrum and make the remaining NGSO spectrum available to other NGSO systems in an additional processing round.⁵⁷ Northrop Grumman, however, requests authority to operate both the NGSO and GSO components of its system throughout all of the V-band spectrum allocated in the United States for FSS uplinks and throughout most of the V-band spectrum allocated in the United States for FSS downlinks.⁵⁸

26. Given the design of Northrop Grumman's proposed system and the manner in which it will operate, we find that a waiver of Sections 25.156(d)(5) and 25.157(e)(2) is warranted. The Commission may waive its rules and policies where particular facts make strict compliance

⁵² *First Space Station Licensing Reform Order*, 18 FCC Rcd at 10792-10805 (paras. 71-108).

⁵³ *First Space Station Licensing Reform Order*, 18 FCC Rcd at 10774 (paras. 23-34).

⁵⁴ *First Space Station Licensing Reform Order*, 18 FCC Rcd at 10865 (para. 279).

⁵⁵ *Id.*

⁵⁶ See note 6, above.

⁵⁷ Section 25.157(e)(2) provides that where there are one or two applications in a processing round, the Commission will assign each applicant to 1/3 of the available spectrum, and will conduct an additional processing round to assign the remaining spectrum. 47 C.F.R. § 25.157(e)(2).

⁵⁸ In the United States, the 47.2-50.2 GHz and 37.5-42.5 GHz bands are allocated to FSS on a co-primary basis for uplink and downlink operations, respectively. Northrop Grumman requests authority to operate in the 47.2-50.2 GHz uplink band, and in the 37.5-42.0 GHz downlink band. NGSO March 2004 Amendment at 5, Table 1.

inconsistent with the public interest.⁵⁹ In doing so, the Commission may take into account more effective implementation of overall policy on an individual basis, and whether a deviation from the general rule will better serve the public interest.⁶⁰ We conclude that waiving the band segmentation provisions in Sections 25.156(d)(5) and 25.157(e)(2) of the Commission's rules is warranted here. Allowing Northrop Grumman to operate its NGSO and GSO satellites throughout the V-band spectrum as proposed: (1) will not contravene the purpose of the band-splitting approach, which was to accommodate all qualified GSO and NGSO applicants in cases where co-frequency NGSO-like and GSO-like applications are filed simultaneously, and (2) will not preclude additional entry by either GSO or NGSO applicants in the V-band.

27. The Commission adopted the first-come, first-served processing procedure for GSO-like applications because granting the first-filed application would not preclude additional entry in that band. This is because the Commission's rules require GSO satellites operating in the same frequency band to operate compatibly at two-degree orbital intervals.⁶¹ At two-degree spacings, more than a dozen GSO satellites can provide service to the United States in the same frequency band. In contrast, the Commission has not adopted a wholesale set of rules under which NGSO systems can use the same spectrum or under which hybrid GSO/NGSO systems can use the same spectrum without causing mutual harmful interference. Although the Commission has adopted specific NGSO/NGSO and NGSO/GSO sharing criteria in certain frequency bands through rulemakings, this is not the case in many bands, including the V-band. In these cases, band-segmentation allows the Commission to accommodate multiple entrants.

28. Here, however, granting Northrop Grumman authority to operate its NGSO and GSO satellites throughout the requested V-band spectrum will not preclude additional entry in the V-band. Northrop Grumman proposes to operate its three NGSO satellites in "highly elliptical orbit," with one NGSO satellite in each of three orbital planes. The altitude of Northrop Grumman's proposed highly elliptical orbit (HEO) satellites at their apogees is such that the HEO satellite appears nearly stationary when viewed from the Earth. This architecture reduces the potential for "in-line" interference events with other systems. Further, when an in-line interference event occurs, Northrop will switch operations to one of its GSO satellites. This will allow another V-band system to continue to operate across the entire V-band spectrum at all times. Thus, multiple systems similar to Northrop Grumman's in design can operate in the same frequency bands if their operators coordinate their orbits. In this way, Northrop Grumman can operate its HEO and GSO satellites in the same frequency bands and we can license additional GSO and HEO satellites in the same band.

29. In the past, we have granted NGSO systems access to the entire frequency band when doing so will not preclude additional entry.⁶² In these circumstances, we have treated NGSO systems under a first-come, first-served approach and have not instituted a processing round. Given the opportunities for additional V-band entrants afforded by Northrop Grumman's system design, we waive the band segmentation requirements. Thus, we allow Northrop Grumman's hybrid system to operate across its requested frequencies and will process Northrop Grumman's applications on a

⁵⁹ *Northeast Cellular Telephone Co. v. FCC*, 897 F.2d 1164, 1166 (*Northeast Cellular*); 47 C.F.R. § 1.3.

⁶⁰ *WAIT Radio v. FCC*, 418 F.2d 1153 (D.C. Cir. 1969) (*WAIT Radio*).

⁶¹ See 47 C.F.R. § 25.140(b)(2).

⁶² See *Space Imaging, LLC, Declaratory Order and Order and Authorization*, 20 FCC Rcd 11964, 11969 (para. 13) (Int'l Bur., 2005) (the Bureau can grant waivers of the NGSO-like satellite system processing rules in cases where band segmentation is not necessary to preclude an applicant from unreasonably restricting further entry into the frequency band). See also *Lockheed Martin Corporation, Order and Authorization*, 20 FCC Rcd 11023, 11028 (para. 15) (Int'l Bur., 2005); *Digital Globe, Inc., Order and Authorization*, 20 FCC Rcd 15696, 15699 (paras. 7-8) (Int'l Bur., 2005).

first-come, first-served basis.⁶³

30. Northrop Grumman is the only remaining applicant in the 1997 V-band Processing Round and, thus, has "first-in-line" status. No other satellites or satellite systems are authorized to operate in the V-band. Consequently, granting Northrop Grumman access to its requested V-band spectrum will not cause interference to any previously licensed satellite system or to a system proposed in a previously filed application. Accordingly, we grant Northrop authority to operate its GSO satellites and NGSO satellites throughout its requested V-band spectrum.

2. Ka-band

a. NGSO Component

31. As noted above, the portion of Northrop Grumman's 1997 amendment requesting Ka-band NGSO authority is still pending. The Bureau deferred action on the pending Ka-band NGSO satellite applications filed in the second Ka-band application processing round until the Commission completed a rulemaking on technical rules for Ka-band NGSO systems. As a result of that rulemaking, the Commission required Ka-band NGSO systems to share the NGSO-designated Ka-band spectrum by employing mechanisms designed to avoid in-line interference events between NGSO systems.⁶⁴ In situations where an in-line interference event is unavoidable, the Commission required operators to employ mechanisms enabling them to divide the spectrum equally among the affected systems for the duration of the event. We will process that portion of Northrop Grumman's application proposing NGSO operations in the 18.8-19.3 GHz and 28.6-29.1 GHz bands designated for primary NGSO use pursuant to these rules.⁶⁵ In other words, we will permit Northrop Grumman to operate NGSO satellites throughout the entire Ka-band spectrum designated for primary NGSO use by employing mechanisms designed to avoid in-line interference events with other NGSO systems.

32. The in-line interference avoidance mechanism adopted in the *Ka-band Order* applies only to NGSO operations in the 18.8-19.3 GHz and 28.6-29.1 GHz bands.⁶⁶ It does not apply to the 19.7-20.2 GHz or the 29.5-30.0 GHz bands in which Northrop Grumman proposes to operate its NGSO satellites on a non-conforming and secondary basis, respectively. Rather, Section 25.157 of the Commission's rules applies to these bands.⁶⁷ Sections 25.157(c) and (e) require us to establish a processing round for NGSO applications in these bands and divide the available spectrum among the qualified applicants in that processing round.⁶⁸ Northrop Grumman, however, requests authority to operate its NGSO satellites throughout the 19.7-20.2 GHz and 29.5-30.0 GHz bands.

33. Given the design of Northrop Grumman's proposed NGSO operations and the

⁶³ 47 C.F.R. §§ 25.156(d)(5), 25.157(e)(2). If Northrop Grumman does not implement its GSO satellites, however, we may revisit this issue.

⁶⁴ *Ka-band NGSO Order*, 18 FCC Rcd at 14708. See para. 9, above.

⁶⁵ The Commission had not completed the Ka-band NGSO rulemaking proceeding at the time it adopted the band segmentation licensing approach for NGSO systems in the *First Space Station Licensing Reform Order*. The Commission stated in the *First Space Station Licensing Reform Order* that since the record in the Ka-band NGSO rulemaking proceeding was fully developed, it would complete that rulemaking rather than apply a band segmentation approach to the pending Ka-band NGSO applications. In addition, the Commission directed the Bureau to award Ka-band NGSO licenses pursuant to the processing mechanism adopted in the *Ka-band NGSO Report and Order*. See *First Space Station Licensing Reform Order*, 18 FCC Rcd at 10865-66 (para. 280).

⁶⁶ *Ka-band NGSO Order*, 18 FCC Rcd at 14708, fn.1.

⁶⁷ 47 C.F.R. § 25.157.

⁶⁸ 47 C.F.R. §§ 25.157(c), (e).

manner in which it will operate, we find that a waiver of Section 25.157 is warranted. Northrop Grumman's NGSO satellites will employ a mechanism designed to permit multiple NGSO systems to operate in the same spectrum by limiting the number of in-line interference events between NGSO systems and dividing the spectrum among the affected NGSO systems during such an event. We see no reason to prevent Northrop Grumman from taking advantage of this multiple-entry architecture in all portions of the Ka- FSS-band in which it seeks to operate.

34. As noted, we have granted NGSO systems access to the entire frequency band when doing so will not preclude additional entry.⁶⁹ In these circumstances, we have treated NGSO systems under a first-come, first-served approach and have not instituted a processing round. Consequently, as we did for the Northrop Grumman's proposed V-band operations, we waive the processing round and band segmentation requirements and will process Northrop Grumman's request to operate its NGSO satellites in the 19.7-20.2 GHz and 29.5-30.0 GHz bands on a first-come, first-served basis.

b. GSO Component

35. Northrop Grumman applied to add Ka-band capacity to its proposed GSO V-band satellites in March 2004. Because Northrop Grumman filed these amendments after the Commission reformed its processing procedures, we analyze the Ka-band portion of the GSO satellites under a "first come, first served" procedure. There are no other Ka-band GSO satellites licensed to operate at any of Northrop Grumman's requested orbital locations. Further, there are no prior-filed Ka-band GSO applications requesting authority to operate at these locations. Consequently, we grant Northrop Grumman's Ka-band GSO requests.

B. Qualifications

36. All applicants requesting authority to launch and operate a satellite space station must present information sufficient to establish their legal, technical, and financial qualifications to hold a Commission license. The regulations set forth in Part 25 of the Commission's rules govern FSS applicants and licensees.⁷⁰

1. Legal and Financial Qualifications

37. Based on the record, we find no evidence that Northrop Grumman lacks the legal qualifications under our rules to hold a Commission license.⁷¹ In its *First Space Station Licensing Reform Order*, the Commission eliminated the financial requirements then in place and replaced them with a bond requirement.⁷² We discuss the bond requirement in paragraphs 109-110, below, which we include as a condition of Northrop Grumman's license.

2. Technical Qualifications

a. V-band Allocations

(i) V-band Uplink

38. The 47.2-50.2 GHz band in which Northrop Grumman proposes to operate V-band

⁶⁹ See para. 29, above.

⁷⁰ In the *First Space Station Licensing Reform Order*, the Commission emphasized that even in cases where it decided not to apply the new satellite processing rules to particular applications, the remainder of the rules adopted in the proceeding, such as safeguards against speculation, would apply. *First Space Station Licensing Reform Order*, 18 FCC Rcd at 10866 (paras. 281-83).

⁷¹ See also *TRW Transfer of Control Order*, 17 FCC Rcd at 24628-29 (paras. 8-12) (discussion of Northrop Grumman's legal qualifications as a general matter).

⁷² *First Space Station Licensing Reform Order*, 18 FCC Rcd at 10823-24 (paras. 162-165).

uplinks is allocated, on a co-primary basis, to the fixed service (FS), mobile service (MS), and the Fixed-Satellite Service (FSS). The FSS allocation requires FSS operators to limit use of the 47.2-48.2 GHz portion of the band to gateways.⁷³ Further, the allocation identifies the 48.2-50.2 GHz portion of the band to high-density applications for FSS, such as user terminals.⁷⁴ Further, Federal FS, MS, and FSS systems are allocated to operate in the 48.2-50.2 GHz portion of this band. For ease of reference, the uplink V-band allocations are depicted as follows:

<u>Frequency Band</u> (Bandwidth, in megahertz)	47.2-48.2 GHz (1000)	48.2-50.2 GHz (2000)
<u>Non-Federal Service</u>	FS FSS MS	FS FSS MS
<u>Federal Service</u>	No Allocations	FS FSS MS

39. We note that, in accordance with Article 5, Footnotes 5.149, 5.340 and 5.555 of the ITU Radio Regulations, the 48.94-49.04 GHz band is also allocated to the radio astronomy service on a primary basis in all ITU Regions.⁷⁵ Footnote 5.555 is incorporated in the U.S. Table of Frequency Allocations.⁷⁶ We also note that, in accordance with Article 5, Footnote 5.552 of the ITU Radio Regulations, the ITU has urged Administrations to take all practical steps to reserve the 47.2-49.2 GHz band for feeder links for the broadcasting-satellite service operating in the 40.5-42.5 GHz band in all ITU Regions.⁷⁷ In addition, in accordance with Article 5, Footnote 5.516B of the ITU Radio Regulations, the 48.2-50.2 GHz band is identified for use by high-density applications in the fixed-satellite service (Earth-to-space) in ITU Region 2.⁷⁸ ITU coordination will be required to protect these services. National coordination will be required with radio astronomy stations in the

⁷³ Gateways are earth station complexes consisting of multiple interconnecting earth station antennas supporting the communication routing and switching functions of an FSS system as a whole. See 47 C.F.R. § 25.201. Further, operators may use FSS gateways in this band only if the licensee has: (1) coordinated earth station downlink operations in the 37.5-40.0 GHz band (see *V-band Second Report and Order*, 18 FCC Rcd at 25436 (para. 17) and 25441-42 (paras. 30-33)) and (2) obtains a license under Part 101 of the Commission's rules or an agreement from a Part 101 licensee for the area in which an earth station is to be located. Satellite earth station facilities in this band may not be ubiquitously deployed and may not be used to serve individual consumers. 47 C.F.R. § 25.202 n.15.

⁷⁴ See 47 C.F.R. § 2.106, fn. 5.516B.

⁷⁵ See ITU Radio Regulations, Article 5, Footnotes 5.149, 5.340 and 5.555. For the purpose of frequency allocation, the International Telecommunication Union (ITU) has divided the world into three Regions. ITU Region 1 includes Europe, Africa, territories of the former U.S.S.R. in Asia, as well as portions of the Arctic, Atlantic and Pacific Oceans. ITU Region 2 includes North and South America. ITU Region 3 includes Southern Asia, Australia, New Zealand, and some Pacific Islands.

⁷⁶ See 47 C.F.R. § 2.106, fn. 5.555.

⁷⁷ See ITU Radio Regulations, Article 5, Footnote 5.552.

⁷⁸ See ITU Radio Regulations, Article 5, Footnote 5.516B, and Resolution 143 (WRC-2007). In accordance with Article 5, Footnote 5.516B of the ITU Radio Regulations, the other V-band uplink frequencies that have been identified for use by high-density applications in the fixed-satellite service are 47.5-47.9 GHz (space-to-Earth) in ITU Region 1, 48.2-48.54 GHz (space-to-Earth) in ITU Region 1, and 49.44-50.2 GHz (space-to-Earth) in ITU Region 1.

48.94-49.04 GHz band. Finally, the 2007 World Radio conference (WRC-2007) adopted a resolution establishing out-of-band protection criteria for the Earth Exploration Satellite Service (Passive) operating in the 50.2-50.4 GHz band. Under this Resolution, FSS systems operating in the adjacent 49.7-50.2 GHz (Earth-to-space) frequency band must meet specified out-of-band emission limits.⁷⁹

(ii) V-band Downlink

40. In the V-band downlink band at 37.5-42.0 GHz, the Commission adopted “soft segmentation” as a sharing method between the FS and FSS services.⁸⁰ “Soft-segmentation” encourages high-density FS deployment below 40 GHz by requiring satellite operators to meet more restrictive power flux density (PFD) limits in this portion of the band, and encourages high-density FSS deployment above 40 GHz by permitting more liberal PFD limits in this band. The PFD limits are different for GSO FSS systems and NGSO FSS systems. Further, the Commission restricted the 37.5-40.0 GHz band to FSS gateway operations⁸¹ to protect the designated high density FS operations in this band and identified the 40.0-42.0 GHz band for high-density applications for FSS.⁸²

41. The downlink allocations are depicted as follows:

<u>Frequency Band</u> (Bandwidth, in megahertz)	37.5-38.0 GHz (500)	38.0-38.6 GHz (600)	38.6-39.5 GHz (900)	39.5-40.0 GHz (500)	40.0-40.5 GHz (500)	40.5-41.0 GHz (500)	41.0-42.0 GHz (1000)	42.0-42.5 GHz (500)
<u>Non-Federal Service</u>	FS FSS MS	FS FSS MS	FS FSS MS	FS FSS MS	FSS MSS	BS BSS FSS fs ms mss	BS BSS FS FSS MS	FS BS BSS MS
<u>Federal Service</u>	FS MS SRS (downlink)	FS MS	No Allocations	FSS MSS	EESS (downlink) eess (uplink) FSS MSS SRS (uplink)	FSS mss	No Allocations	No Allocations

42. As mentioned in the *V-band Second Report and Order*,⁸³ rain fade has a significant impact on radio propagation at 40 GHz.⁸⁴ Because of the high rain fade, higher PFD levels and other ameliorative techniques are necessary, at times, to maintain adequate satellite performance, even for gateway operations in the 37.5-40.0 GHz band. Thus, although the Commission adopted a PFD

⁷⁹ See ITU Resolution 750 (WRC-2007). See also Article 5, Footnote 5.BA03 (WRC-2007).

⁸⁰ See *V-Band Second Report and Order*, 18 FCC Rcd at 25432 (para. 8).

⁸¹ In addition, as noted above, use of this band by the fixed-satellite service is limited to gateway earth station operations. See 47 C.F.R. § 25.202(a)(1) fn. 15, 16. See also *V-band Second Report and Order*, 18 FCC Rcd at 25436 (para. 17) and 25441-42 (paras. 30-33).

⁸² See 47 C.F.R. § 2.106, Footnote 5.516B.

⁸³ *V-band Second Report and Order*, 18 FCC Rcd at 25440-41 (para. 29).

⁸⁴ *Id.*

limit in the *V-band Second Report and Order*, it has permitted PFD limits to exceed this level on a case-by-case basis. Additionally, this issue will be addressed in a rulemaking that will establish specific criteria for evaluating when, and to what extent, PFD levels may exceed the specified "clear-air" levels in the 37.5-40.0 GHz band.⁸⁵ We discuss this PFD issue in more detail below.⁸⁶

43. In addition, we note that, in accordance with the ITU Radio Regulations, the downlink frequencies identified for use by FSS high-density applications are 40-40.5 GHz (space-to-Earth) in all ITU Regions, and 40.5-42 GHz (space-to-Earth) in ITU Region 2.⁸⁷ We encourage, but do not require, Northrop Grumman to use these bands for any high-density applications it chooses to implement. If Northrop Grumman chooses to implement other FSS applications in these bands, it will be required to coordinate with other applicants/licensees who have planned or implemented high-density applications in these bands.

44. Further, the Federal Space Research Service (SRS) will operate on a co-primary basis in portions of the V-band. In this regard, NTIA submitted a letter in the V-Band proceeding in 2004, indicating that the *Space Exploration Initiative of 1989* identified the 37.0-37.5 GHz and 40.0-40.5 GHz frequency bands for use by space research systems to be implemented in support of U.S. initiatives to provide a permanent manned presence in Earth orbit (on or near the moon) and to begin manned exploration of the planet Mars.⁸⁸ The letter also states that the 1992 World Administrative Radio Conference (WARC 1992) adopted a downlink allocation for SRS in the 37.0-37.5 GHz band, an uplink allocation for SRS in the 40.0-40.5 GHz band, and an allocation at 37-38 GHz for space research systems to be implemented in support of Very Long Baseline Interferometry (VLBI) by satellite. The letter further states that when operating manned spacecraft over distances as far removed from the Earth as Mars, it might be necessary to combine the received signals simultaneously from more than one receiving site, e.g., Goldstone, CA and Socorro, NM, to achieve mission objectives.⁸⁹ For those reasons, NTIA proposes to protect seven SRS sites from FSS V-band operations: Goldstone, California; Green Bank, West Virginia; Guam; Merritt Island, Florida; Wallops Island, Virginia; and White Sands and Socorro, New Mexico.

b. The Ka-band Plan

(i) Ka-band Uplink

45. The Commission completed its proceeding involving the 27.5-30.0 GHz frequency band in 1996. At that time, the Commission segmented the band and designated specified portions for terrestrial operations, feeder link operations for mobile-satellite service (MSS) systems, service link operations for GSO FSS systems, and service link operations for NGSO FSS systems.⁹⁰ Significantly, the Commission adopted discrete designations for NGSO FSS systems and GSO FSS

⁸⁵ See *V-Band Second Report and Order* 18 FCC Rcd at 25440-41 (paras. 28, 29).

⁸⁶ See para. 54, below.

⁸⁷ See ITU Radio Regulations, Article 5, Footnote 5.516B, and Resolution 143 (WRC-2007). In addition, in accordance with Article 5, Footnote 5.516B of the ITU Radio Regulations, the V-band downlink frequencies that have been identified for use by high-density applications in the fixed-satellite service are 39.5-40.0 GHz (space-to-Earth) in ITU Region 1 (Europe).

⁸⁸ See letter from Frederick R. Wentland, Associate Administrator, Office of Spectrum Management, NTIA, to Edmond J. Thomas, Chief, Office of Engineering and Technology, FCC (Mar. 24, 2004) (NTIA Letter), at 1. See also Amendment of the Commission's Rules Regarding the 37.0-38.6 GHz and 38.6-40.0 GHz Bands, *Third Notice of Proposed Rulemaking*; ET Docket No. 95-183 and PP Docket No. 93-253, 19 FCC Rcd 8232 (2004).

⁸⁹ *NTIA Letter* at 1-2.

⁹⁰ *Ka-band Plan Order*, 11 FCC Rcd 19005.

systems, while adopting shared designations for other services. As relevant here, the Commission designated the 28.35-28.6 GHz and 29.25-30.0 GHz bands to GSO FSS (Earth-to-space) on a primary basis, with NGSO FSS services (Earth-to-space) permitted on a secondary basis.⁹¹ It also designated the 28.6-29.1 GHz band to NGSO FSS (Earth-to-space) on a primary basis.⁹² In adopting the Ka-band Plan, the Commission stated that “[t]he plan ... designates co-frequency sharing in band segments where the Commission and the parties have concluded it is technically feasible.”⁹³

46. The uplink plan is depicted as follows:

<u>Frequency Band</u> (Bandwidth, in megahertz)	28.35-28.6 GHz (250)	28.6-29.1 GHz (500)	29.25-29.5 GHz (250)	29.5-30.0 GHz (500)
<u>Non-Federal Service</u>	GSO FSS ngso fss	NGSO FSS gso fss	GSO FSS	GSO FSS ngso fss

47. We note that in accordance with Article 5, Footnote 5.516B of the ITU Radio Regulations, the Ka-band uplink frequencies identified for use by high-density applications in the fixed-satellite service are 28.35-28.45 GHz (Earth-to-space) in ITU Region 2, 28.45-28.94 GHz (Earth-to-space) in all ITU Regions, 28.94-29.1 GHz (Earth-to-space) in ITU Regions 2 and 3, 29.25-29.46 GHz (Earth-to-space) in ITU Region 2, and 29.46-30.0 GHz (Earth-to-space) in all ITU Regions.⁹⁴ We also note that in accordance with Article 5, Footnote 5.538 (WRC-2007) of the ITU Radio Regulations, the 29.999-30.0 GHz band is allocated to the FSS (space-to-Earth) on a primary basis for beacon transmissions intended for uplink power control. Such space-to-Earth transmissions shall not exceed an equivalent isotropically radiated power of +10 dBW in the direction of adjacent satellites on the geostationary-satellite orbit.⁹⁵

(ii) Ka-band Downlink

48. The Commission also adopted rules for non-Federal users involving the space-to-Earth (downlink) FSS allocation at 18.3-20.2 GHz. In this regard, the Commission designated the 18.3-18.8 GHz band and the 19.7-20.2 GHz band for primary use by GSO FSS and the 18.8-19.3 GHz downlink segment for primary NGSO FSS use.⁹⁶ The Commission originally permitted GSO

⁹¹ *Ka-band Third Report and Order*, 12 FCC Rcd at 22310.

⁹² *Ka-band Plan Order*, 11 FCC Rcd at 19030.

⁹³ *Ka-band Plan Order*, 11 FCC Rcd at 19024.

⁹⁴ See ITU Radio Regulations, Article 5, Footnote 5.516B, and Resolution 143 (WRC-2007). In accordance with Article 5, Footnote 5.516B of the ITU Radio Regulations, the other Ka-band uplink frequencies that have been identified for use by high-density applications in the fixed-satellite service are 27.5-27.82 GHz (Earth-to-space) in ITU Region 1.

⁹⁵ See *Ka-band Plan Order*, 11 FCC Rcd at 19005; and ITU Radio Regulations, Article 5, Footnote 5.538 (WRC-2007).

⁹⁶ Redesignation of the 17.7-19.7 GHz Frequency Band, Blanket Licensing of Satellite Earth Stations in the 17.7-20.2 GHz and 27.5-30.0 GHz Frequency Bands, and the Allocation of Additional Spectrum in the 17.3-17.8 GHz and 24.75-25.25 GHz Frequency Bands for the Broadcast Satellite Service Use, *Report and Order*, 15 FCC Rcd 13430, 13432 (2000) (*18 GHz Order*). In redesignating the 18.3-18.58 GHz band for FSS primary operations, the Commission also adopted provisions designed to ensure the orderly migration and timely reimbursement of FS stations operating in the band. Redesignation of the 17.7-19.7 GHz Frequency Band, Blanket Licensing of Satellite Earth Stations in the 17.7-20.2 GHz and the 27.5-30.0 GHz Frequency

(continued...)

and NGSO systems to operate on a secondary basis in those portions of the band where that architecture did not have primary status.⁹⁷ In the *18 GHz Order*, however, the Commission eliminated the secondary designations after concluding that "secondary use of the 18 GHz band is not viable because it would unreasonably inhibit high-density deployment of these services and limit the use of spectrum by primary users of the bands."⁹⁸ The Commission confirmed these conclusions on reconsideration, stating that removing secondary operations lessens the potential for harmful interference to the primary services and avoids disruptions that could occur to users of secondary services.⁹⁹

49. The downlink plan is depicted as follows:

<u>Frequency Band</u> (Bandwidth, in megahertz)	18.3-18.8 GHz (500)	18.8-19.3 GHz (500)	19.7-20.2 GHz (500)
<u>Non-Federal Service</u>	GSO FSS	NGSO FSS	GSO FSS

50. In addition, Federal GSO and NGSO systems operate throughout the 17.8-20.2 GHz frequency band. These systems operate in accordance with the PFD limits contained in the ITU Radio Regulations.¹⁰⁰ Non-Federal systems must be coordinated with these Federal systems in accordance with Footnote US334 to the Table of Allocations.¹⁰¹ As set forth in the *Ka-band NGSO Report and Order*, each NGSO FSS licensee must complete coordination with all other operational NGSO FSS licensees and with Federal FSS systems, prior to the launch of its first satellite.¹⁰² Additionally, GSO satellites that operate in the 18.6-18.8 GHz band must comply with Footnote US255 to the Table of Frequency Allocations, which prescribes PFD limits for the 18.6-18.8 GHz band to protect the Earth Exploration-Satellite Service (passive).¹⁰³

(...continued from previous page)

Bands, and the Allocation of Additional Spectrum in the 17.3-17.8 GHz and 24.75-25.25 GHz Frequency Bands for Broadcast Satellite Service Use, *Second Order on Reconsideration*, 17 FCC Rcd 24248 (2002).

⁹⁷ *Ka-band Plan Order*, 11 FCC Rcd at 19035 (para. 77).

⁹⁸ *18 GHz Order*, 15 FCC Rcd at 13456-57 (para. 55).

⁹⁹ Redesignation of the 17.7-19.7 GHz Frequency Band, Blanket Licensing of Satellite Earth Stations in the 17.7-20.2 GHz and the 27.5-30.0 GHz Frequency Bands, and the Allocation of Additional Spectrum in the 17.3-17.8 GHz and 24.75-25.25 GHz Frequency Bands for Broadcast Satellite Service Use, *First Order on Reconsideration*, 16 FCC Rcd 19808, 19821 (2001).

¹⁰⁰ See *18 GHz Order*, 15 FCC Rcd at 13473. The PFD limits in the 18.3-18.6 GHz band are -115/-105 dB (W/m²) in any one megahertz band, depending on the angle of arrival. There are no power flux-density limits in the 19.7-20.2 GHz band. See Letter from William T. Hatch, National Telecommunications and Information Administration, to Dale Hatfield, Chief, Office of Engineering and Technology, FCC (Mar. 29, 2000).

¹⁰¹ 47 C.F.R. § 2.106, fn. US 334.

¹⁰² *Ka-band NGSO Report and Order*, 18 FCC Rcd at 14722. See also 47 C.F.R. § 2.106, fn. US 334. A licensee may initiate coordination under US 334 by submitting a letter request to the Commission. A system is deemed operational when at least one of its satellites reaches its intended orbit and initiates transmission and reception of radio signals.

¹⁰³ 47 C.F.R. 2.106, fn. US255 (as revised in the *18 GHz Order*, 15 FCC Rcd at 13489) states: In addition to any other applicable limits, the power flux-density across the 18.6-18.8 GHz band produced at the surface of the Earth by emissions from a space station under assumed free-space propagation conditions shall not exceed

(continued...)

51. Further, in accordance with Article 5, Footnote 5.516B of the ITU Radio Regulations, the Ka-band downlink frequencies identified for use by high-density applications in the fixed-satellite service are 18.3-19.3 GHz (space-to-Earth) in ITU Region 2, and 19.7-20.2 GHz (space-to-Earth) in all ITU Regions.¹⁰⁴ Accordingly, we encourage, but do not require, Northrop Grumman to use these bands for any high-density applications it chooses to implement. If Northrop Grumman chooses to implement other FSS applications in these bands, it will be required to coordinate with other applicants/licensees who have planned/implemented high-density applications in these bands.¹⁰⁵

c. NGSO Satellites

52. For reasons discussed below, we find Northrop Grumman technically qualified to construct its NGSO FSS satellites, pending submission of additional information regarding its orbital debris mitigation plans.¹⁰⁶ We will authorize Northrop Grumman to launch and operate its NGSO satellites once it submits the requisite orbital debris mitigation information. Nevertheless, we address technical issues relating to Northrop Grumman's proposed NGSO operations in this Order so we will be in a position to act expeditiously on any request by Northrop Grumman for launch and operating authority.

(i) V-band Operations

53. Northrop Grumman proposes to operate its NGSO satellites in the 37.5-42.0 GHz (downlink) and 47.2-50.2 GHz (uplink) frequency bands that are allocated to FSS on a co-primary basis. No comments or objections were filed regarding operations in this band. For the reasons discussed below, we find that Northrop Grumman's proposed NGSO V-band operations comply with the Commission's technical requirements now in place for this new service, but condition grant to require Northrop Grumman to comply with any technical requirements that may be applicable in the future. Further, we require Northrop Grumman to coordinate with other co-primary services operating in the NGSO V-band spectrum as described below.

54. First, we find that Northrop Grumman's NGSO downlink operations, based on data provided in Northrop Grumman's Technical Annex,¹⁰⁷ meet the PFD limits contained in Section 25.208(r), (s), and (t) of the Commission's rules in the 40.0-42.0 GHz band.¹⁰⁸ The NGSO operations in the 37.5-40.0 GHz band, however, exceed the "clear-air" PFD limits for elevation angles between approximately 11 and 22 degrees. Nevertheless, since Northrop Grumman's system employs very narrow antenna beams, it should be possible for Northrop Grumman to operate only those satellite antenna beams that can be received by earth stations at sufficiently high elevation angles to meet the PFD limits. Because Northrop Grumman did not submit a waiver request to operate at PFD limits above the specified values, we will permit Northrop Grumman to operate its NGSO satellites in the 37.5-40.0 GHz band only when the NGSO satellites meet the clear-air PFD

(...continued from previous page)

-95 dB (W/m²) for all angles of arrival. This limit may be exceeded by up to 3 dB for no more than 5 percent of the time. *See also* 47 C.F.R. § 25.208(d).

¹⁰⁴ *See* ITU Radio Regulations, Article 5, Footnote 5.516B, and Resolution 143 (WRC-2007).

¹⁰⁵ In addition, Article 5, Footnote 5.519 (WRC-2007) of the ITU Radio Regulations, allocates the 18.3-18.4 GHz band to the meteorological satellite service (space-to-Earth) on a primary basis in Regions 1 and 3.

¹⁰⁶ *See* paras. 96-102, below.

¹⁰⁷ *See* NGSO March 2004 Amendment, Technical Appendix at 18, Figure 7. *See also* NGSO 2007 Amendment, Technical Appendix, Section 6.

¹⁰⁸ *See* 47 C.F.R. §§ 25.208(r), (s), (t).

limits, *i.e.*, at elevation angles to the NGSO satellites that are greater than 22 degrees.

55. Aside from PFD limits, the Commission has not adopted specific service rules for NGSO V-band operations. In the *First Space Station Licensing Reform Order*, the Commission stated that, rather than delaying licensing in cases where it had adopted a domestic allocation for a particular service but had not adopted specific service rules in Part 25, it would license systems based on specified default rules.¹⁰⁹ Section 25.217(b)(1) of the Commission's rules contains a list of the default rules that apply to NGSO-like satellites.¹¹⁰ The Commission also stated that, absent Part 25 rules, it would require licensees to comply with any applicable ITU technical requirements.¹¹¹ Thus, Northrop Grumman's V-band NGSO system must comply with the applicable default rules and any applicable ITU requirements. We note, however, that the Commission also stated that any license issued under the default rules will be subject to any subsequent service rules it adopts.¹¹² Consequently, we require Northrop Grumman to modify its operations, if necessary, to bring them into conformance with any service rules the Commission may later adopt.

56. The default rules applicable to Northrop Grumman's proposed V-band NGSO system are Sections 25.142(d) (prohibition of exclusionary agreements); 25.143(b)(2)(ii) and 25.143(b)(2)(iii) (geographic service area requirements); 25.204(g) (earth station uplink requirements during rain fade conditions); 25.210(c) (ability to change transponder flux densities by ground command); 25.210(d) and 25.210(f) (full frequency reuse); 25.210(i) (cross-polarization isolation requirements); 25.210(k) (antenna measurements); and 25.210(l) (reporting requirements). We address these requirements below.

57. *Prohibition of Exclusionary Agreements.* Section 25.142 (d) of the Commission's rules¹¹³ prohibits Commission licensees from acquiring or enjoying any right to distribute service by virtue of any concession, contract, or arrangement with an affiliated company that is denied to other U.S. operators. Nothing in Northrop Grumman's application suggests that Northrop Grumman has acquired any such rights. Once licensed, Northrop Grumman must continue to abide by this policy.

58. *Geographic Service Area Requirements.* Section 25.143(b) requires NGSO systems to be capable of serving locations as far north as 70 degrees latitude and as far south as 55 degrees latitude for at least 75 percent of every 24-hour period.¹¹⁴ It also requires NGSO systems to be capable of providing continuous service throughout the 50 states, Puerto Rico and the U.S. Virgin Islands.¹¹⁵

59. Northrop Grumman acknowledges that its NGSO satellites do not adequately cover the far southern latitudes. It asserts, however, that the combined coverage of its hybrid NGSO/GSO satellites meets the NGSO coverage requirements.¹¹⁶ We find that while Northrop Grumman has not shown that it complies with the letter of the Commission's NGSO coverage requirements, it has provided a sufficient basis for a waiver of that requirement. As noted above, waivers may be granted

¹⁰⁹ *First Space Station Licensing Reform Order*, 18 FCC Rcd at 10784 (para. 52).

¹¹⁰ 47 C.F.R. § 25.217(b)(1).

¹¹¹ *First Space Station Licensing Reform Order*, 18 FCC Rcd at 10784 (para. 52).

¹¹² *First Space Station Licensing Reform Order*, 18 FCC Rcd at 10784 (para. 52). *See also* 47 C.F.R. § 25.217(e).

¹¹³ 47 C.F.R. § 25.142(d).

¹¹⁴ 47 C.F.R. § 25.143(b)(2)(ii).

¹¹⁵ 47 C.F.R. § 25.143(b)(2)(iii).

¹¹⁶ NGSO March 2004 Amendment at 18-19. *See also* NGSO 2007 Amendment, Technical Appendix, Section 6.

if the relief requested would not undermine the policy objective of the rule in question and would otherwise serve the public interest.¹¹⁷ In this case, because the footprints of Northrop Grumman's four GSO satellites extend well south of the required 55 degrees latitude in the southern hemisphere, a waiver will not undermine the policy objective of the rule in question. If Northrop Grumman chooses not to construct any of its GSO satellites, however, it should address its compliance with the NGSO coverage requirement in its modification application to change its system design.

60. *Compensation for Rain Fade.* Section 25.204(g) of the Commission's rules requires earth stations to employ uplink adaptive power control or other methods of fade compensation to enable the station to meet the desired performance while reducing potential interference to other networks.¹¹⁸ We defer our determination of whether Northrop Grumman's complies with this requirement until we receive an earth station application seeking authority to communicate with Northrop Grumman's V-band NGSO system.

61. *Switchable Transponder Flux Densities.* Northrop Grumman's proposed V-band NGSO satellites will not use transponders, but rather will demodulate and remodulate signals in a processor. As a result, Northrop Grumman's satellite, as proposed, will not employ any transponders that do not comply with Section 25.210(c) of the Commission's rules.

62. *Full Frequency Reuse.* Sections 25.210(d) and (f) of the Commission's rules require NGSO satellite systems to employ state-of-the-art full frequency reuse either through the use of orthogonal polarizations within the same beam and/or the use of spatially independent beams.¹¹⁹ Northrop Grumman has demonstrated that each of the beams on its NGSO satellites meet this requirement by using orthogonal polarization in all operating bands.¹²⁰

63. *Cross-polarization Isolation.* Section 25.210(i) of the Commission's rules requires all FSS space stations to be designed to provide a cross-polarization isolation such that the ratio of the on-axis co-polar gain to the cross-polar gain of the antenna in the assigned frequency band is at least 30 dB within its primary coverage area.¹²¹ Northrop Grumman has demonstrated that it has designed its NGSO space stations to provide at least 30 dB cross-polarization isolation within their primary coverage area.¹²²

64. *Reporting Requirements.* Section 25.210(k) of the Commission's rules requires licensees to measure each space station antenna's co-polarized and cross-polarized performance and to report this data to the Commission within thirty days after the licensee completes preliminary in-orbit testing.¹²³ Section 25.210(l) of the Commission's rules requires licensees to submit reports on June 30th of each year, detailing the status of space station construction and, once launched, the operating status of each transponder.¹²⁴ We require Northrop Grumman to submit all required reports in a timely manner.¹²⁵

¹¹⁷ See para. 26, above, citing *WAIT Radio*, 418 F.2d at 1157.

¹¹⁸ 47 C.F.R. § 25.204(g).

¹¹⁹ 47 C.F.R. §§ 25.210(d), (f).

¹²⁰ See NGSO March 2004 Amendment, Technical Appendix at 2, 5-12.

¹²¹ 47 C.F.R. § 25.210(i).

¹²² See NGSO March 2004 Amendment, FCC Form 312, Schedule S, Section S7(g). See also NGSO 2007 Amendment, FCC Form 312, Schedule S, Section S7(g).

¹²³ 47 C.F.R. § 25.210(k).

¹²⁴ 47 C.F.R. § 25.210(l).

¹²⁵ See para. 107, below.

65. *Applicable ITU Requirements.* The 37.5-38.0 GHz band is allocated for the Federal Space Research Service (SRS) on a co-primary basis. Consequently, we will require Northrop Grumman to coordinate its NGSO operations with all co-primary Federal SRS operations prior to launch of its first satellite. In particular, we will require Northrop Grumman's FSS downlink transmissions to protect licensed Federal SRS facilities operating in the 37.5-38.0 GHz band. To this end, we will require Northrop Grumman and SRS facilities to coordinate their operations based on Recommendation ITU-R SA.1396, "Protection Criteria for the Space Research Service in the 37-38 GHz and 40-40.5 GHz Bands." More specifically, the ITU Recommendation includes criteria designed to protect SRS earth stations that operate in the 37.0-38.0 GHz band from harmful interference that would be caused if the total time during which the power density of noise-like interference or the total power of CW-type interference in any single band or in all sets of bands 1 hertz wide, is greater than -217 dB(W/Hz) at the input terminals of the earth station receiver for a period exceeding 0.001% of the time for manned missions, and 0.1% of the time for all other space research missions. The ITU Recommendation also includes criteria designed to protect SRS space stations that operate in the 40.0-40.5 GHz band from harmful interference that would be caused if the total power density of noise-like interference or the total power of CW-type interference in any single band or in all sets of bands 20 hertz wide, is greater than -193 dB(W/20 Hz) at the input terminals of the space station receiver, with the amount of time of exposure to the interference limited to 0.1% of the time for both manned and unmanned missions. The Recommendation allows levels exceeding these protection criteria on a case-by-case basis. To adequately protect SRS facilities, we will not permit Northrop Grumman to begin operations in the 37.5-38.0 GHz and 40.0-40.5 GHz bands until it has successfully coordinated its operations with licensed SRS operations pursuant to Recommendation ITU-R SA.1396.¹²⁶

66. Last, we recognize that in 2007, the ITU addressed an out-of-band interference issue between co-primary V-band Federal and non-Federal service. Specifically, the ITU adopted a resolution specifying that the level of unwanted emissions from the transmit power density at the input of a fixed-satellite service earth station antenna in the 49.7-50.2 GHz (Earth-to-space) frequency band falling into the 50.2-50.4 GHz EESS (Passive) band shall not exceed -20 dBW/200 MHz for VSAT/user-type terminals and -10 dBW/200 MHz for gateway/hub applications under clear sky conditions.¹²⁷ The WRC-2007 resolutions became effective on January 1, 2009. As noted, the Commission has stated that, absent Part 25 rules, it will require licensees to comply with any applicable ITU technical requirements.¹²⁸ Thus, if the Commission has not adopted service rules when Northrop Grumman brings its system earth stations into operation, we will require Northrop Grumman's earth stations to comply with the ITU emission limits.¹²⁹

67. *Additional Coordination with NTIA.* Further, NTIA has informed us of several locations where it expects to implement co-primary terrestrial facilities for the military in the 37.5-38.6 GHz band.¹³⁰ We require Northrop Grumman to coordinate with NTIA in this band as well. As with all Federal/non-Federal sharing, coordination is to be effectuated through the Interdepartmental Radio Advisory Committee (IRAC) and its Frequency Assignment Subcommittee (FAS).

¹²⁶ Any future FSS space station applicants in this band must provide a showing in their applications that their downlink operations will not interfere with any previously licensed SRS receiving earth stations. See *V-band Second Report and Order*, 18 FCC Rcd at 25445 (para. 39).

¹²⁷ See ITU Resolution 750 (WRC-2007) and ITU Radio Regulations, Article 5, Footnote 5.BA03 (WRC-2007).

¹²⁸ See para. 55, *above*.

¹²⁹ Given the three-to-five year construction period required for most space stations, we do not expect Northrop Grumman to file applications for system earth stations before the ITU rules become effective.

¹³⁰ See NTIA Letter at Enclosure 2.

68. Consequently, we find that Northrop Grumman's proposed NGSO V-band operations comply with all applicable Commission requirements, ITU requirements, or, in the case of geographic service area requirements, that a waiver is warranted. We therefore grant Northrop Grumman authority to construct its proposed NGSO satellites in these bands, subject to the conditions discussed above.

(ii) Ka-band Operations

69. Northrop Grumman proposes to use several portions of the Ka-band for NGSO operations. First, it seeks to use the 18.8-19.3 GHz (downlink) and 28.6-29.1 GHz (uplink) frequency bands for communications links between its users and its NGSO satellites.¹³¹ These operations are consistent with the Ka-band Plan, which designates these bands for primary NGSO operations. Moreover, we find that Northrop Grumman's proposed operations comply with the applicable PFD limits in Section 25.208(e) of the Commission rules and in ITU Article 21.16 (Table 21-4).¹³² Further, for the same reasons discussed in paragraphs 58-59, above, we grant Northrop Grumman a waiver of the geographic service area requirements in Sections 25.145(1) and (2) of the Commission's rules for its NGSO Ka-band satellites.¹³³ Thus, we grant Northrop Grumman authority to construct the NGSO satellites that it proposes to operate in this band. Once we issue Northrop Grumman launch and operating authority in this band, it will be required to coordinate its operations with Federal systems in the 18.8-19.3 GHz frequency band in accordance with Footnote US334 to the Table of Frequency Allocations before it launches its first NGSO satellite.¹³⁴ Further, Northrop Grumman must comply with the spectrum sharing method adopted in the *Ka-band NGSO Order* when in-line interference events occur with other Ka-band NGSO systems.¹³⁵

70. Northrop Grumman requests a waiver of the Ka-band Plan to operate its NGSO satellites on a non-interference basis in the 19.7-20.2 GHz (downlink) and 29.5-30.0 GHz (uplink) frequency bands designated for primary GSO FSS use.¹³⁶ Northrop Grumman asserts that its satellites will meet the equivalent power flux density (EPFD) limits in Article 22 of the ITU Radio Regulations and that the satellites' downlink EPFD levels are at least 15 dB lower than the values specified in Article 22. Consequently, Northrop Grumman concludes that "[t]his means that no unacceptable interference would be caused to the GSO networks with primary designations in those bands...." It also states that it will not claim interference protection from GSO FSS operations in these bands.¹³⁷

71. SES Americom argues that Northrop Grumman's compliance with Article 22's EPFD limits does not justify its requested waiver. SES Americom states the Commission has not considered or adopted the ITU's international EPFD limits and that Northrop Grumman has not

¹³¹ NGSO March 2004 Amendment at 18; and at 5, Table 1.

¹³² See 47 C.F.R. § 25.208(e). See also *First Space Station Licensing Reform Order*, 18 FCC Rcd at 10784. See also NGSO 2007 Amendment, Technical Appendix, Table 6, Figure 6, and Section 6. WRC-07 modified the power flux density limits for certain types of NGSO constellations operating in the 18 GHz band. Northrop Grumman is required to meet these limits.

¹³³ 47 C.F.R. § 25.145(1), (2). These rules are identical to the default rules that apply to V-band NGSO operations.

¹³⁴ 47 C.F.R. § 2.106, fn. US 334.

¹³⁵ *Ka-band NGSO Order*, 18 FCC Rcd at 14714. As set forth in Part 25 of our rules, Northrop Grumman must also request authority for Earth-to-space transmissions in an earth station application. 47 C.F.R. § 25.115. In the *18 GHz Order*, the Commission authorized blanket licensing for NGSO FSS earth stations in the bands in which NGSO FSS is designated primary status. See *18 GHz Order*, 15 FCC Rcd at 13432.

¹³⁶ NGSO March 2004 Amendment at 26.

¹³⁷ NGSO March 2004 Amendment at 26-27.

justified the use of these limits domestically.¹³⁸ As discussed below, we find that Northrop Grumman has justified use of Article 22 EPFD limits.

72. The Ka-band Plan authorizes NGSO operations on a secondary basis to GSO operations in the 29.5-30.0 GHz band. Because Northrop Grumman proposes to operate its NGSO satellites on a secondary basis in this band, no waiver is required. As a secondary user, however, Northrop Grumman's operations shall not cause harmful interference to primary GSO operations, nor can Northrop Grumman claim protection from harmful interference caused by GSO operations. In analyzing requests to operate on a secondary basis, the Commission has always required applicants to demonstrate that their proposed secondary operations are not likely to cause interference to primary operations.¹³⁹ To do otherwise would create an unacceptable likelihood of disruption to primary services.

73. Our review of Northrop Grumman's technical showing indicates that Northrop Grumman's uplink NGSO operations are not likely to interfere with GSO operations in the 29.5-30.0 GHz band. Because there are no Part 25 rules governing NGSO operations in this band, we require Northrop Grumman to comply with the relevant ITU requirements.¹⁴⁰ Northrop Grumman's technical demonstration in its March 2004 Amendment uses computer simulation software developed in accordance with specifications outlined in ITU-R Recommendation S.1503 and demonstrates that the maximum uplink EPFD limits calculated for its NGSO satellites satisfy the requirements of Article 22 of the ITU Radio Regulations.¹⁴¹ We note, however, that in April 2005, the ITU released a later version of this Recommendation (S.1503-1). Therefore, we require Northrop Grumman to file a certification within 30 days of the date of this Order stating that it is still compliant with the ITU EPFD limits. Moreover, Article 22.5I of the ITU Radio Regulations provides that if the associated EPFD limits are met, the NGSO FSS satellite system is considered coordinated with GSO networks. Thus, we conclude that if Northrop Grumman continues to meet the ITU EPFD limits, there is little likelihood that its NGSO operations will interfere with GSO operations. We therefore find sufficient basis to grant Northrop Grumman's request to operate its NGSO satellites in the 29.5-30.0 GHz band on a secondary basis.

74. In contrast, the 19.7-20.2 GHz downlink band for non-Federal systems is designated for GSO only, with no secondary designation for non-Federal NGSO operations. Northrop Grumman therefore requests a waiver to operate its NGSO satellites in this portion of the band. As noted previously, waivers may be granted if the relief requested would not undermine the policy objective of the rule in question, and would otherwise serve the public interest.¹⁴² Further, in analyzing requests for non-conforming spectrum uses, the Commission has indicated it would generally grant such waivers "when there is little potential for interference into any service authorized under the Table of Frequency Allocations and when the non-conforming operator accepts

¹³⁸ *SES Americom Petition to Deny* at 6.

¹³⁹ *See, e.g., Qualcomm, Inc., Memorandum Opinion and Order, and Authorization*, 4 FCC Rcd 1543 (1989) (authorizing mobile-satellite service on a secondary basis in the 14 GHz band and on a non-conforming basis in the 12 GHz band).

¹⁴⁰ *First Space Station Licensing Reform Order*, 18 FCC Rcd at 10784 (para. 52).

¹⁴¹ NGSO March 2004 Amendment, Attachment D at 50. Northrop Grumman's calculation assumed five NGSO users operating in the same frequency channel within GSO 1.55 degrees beam. According to Northrop Grumman, the maximum uplink EPFD levels are: 0.7m: -176.2 dB (W/m²/40 kHz); 1.2 m: -185.73 dB (W/m²/40 KHz). *Id.* Commission staff reviewed Northrop Grumman's calculations, verified their accuracy, and found that the proposed operations fall within the corresponding limits defined in Article 22 of the ITU Radio Regulations.

¹⁴² 47 C.F.R. § 1.3. *See also WAIT Radio*, 418 F.2d 1153; *Northeast Cellular*, 897 F.2d 1166.

any interference from authorized services.”¹⁴³

75. Northrop Grumman, relying on its computer simulation software, demonstrates that the operations of its NGSO satellites in the 19.7-20.2 GHz band meet the ITU EPFD limits in Article 22, Tables 22-1C and 22-4B. As noted above, the ITU considers a NGSO FSS system that meets these EPFD limits to be fully coordinated with respect to any GSO FSS network.¹⁴⁴ In light of the ITU rules and our verification of Northrop Grumman’s software calculations, we find that Northrop Grumman’s operations should not affect primary non-Federal GSO operations in the band. As a further assurance against unacceptable interference to GSO operations, we will require Northrop Grumman to publish its NGSO satellites’ ephemeris data in the North American Aerospace Defense Command’s (NORAD’s) two-line format on a Northrop Grumman-maintained web site and to update this data every three days.¹⁴⁵ Consequently, we find that granting a waiver to allow Northrop to operate NGSO satellites in the 19.7-20.2 GHz band will not undermine the objective of the rule to protect primary services and will serve the public interest by allowing Northrop Grumman to offer consumers a range of broadband and interactive services. We will also require Northrop Grumman to comply with any service rules the Commission may later adopt.

76. Further, Northrop Grumman must coordinate its Ka-band NGSO satellites with Federal GSO and NGSO systems in this frequency band in accordance with Footnote US334 to the Table of Frequency Allocations prior to the launch of its first satellite. As a non-conforming user, Northrop Grumman’s operations will be on a non-harmful interference basis, and Northrop Grumman will not be protected from interference from other allocated non-Federal and Federal operations in this band. In addition, as a non-conforming user, Northrop Grumman shall not cause harmful interference to any authorized Federal GSO or NGSO FSS system, and shall immediately cease operations upon notification of such harmful interference resulting from its operations. Similarly, Northrop Grumman must also coordinate with specific GSO earth stations pursuant to ITU Article 9, No. 9.7A.

(iii) Replacement Satellites

77. In the *Ka-band NGSO Report and Order*, the Commission adopted a blanket licensing procedure that authorizes the construction and launch of all satellites in the constellation. This includes satellites needed to replace those that fail or are retired prior to the end of the license term.¹⁴⁶ This follows the procedure used for NGSO constellations in other frequency bands.¹⁴⁷ The blanket licensing procedure provides licensees with the ability to replace satellites in their fleets

¹⁴³ Fugro-Chance, Inc., *Order and Authorization*, 10 FCC Rcd 2860 (para. 2) (Int’l Bur. 1995) (authorizing non-conforming mobile-satellite service in the 4/6 GHz band); see also Motorola Satellite Communications, Inc., *Order and Authorization*, 11 FCC Rcd 13952, 13956 (para. 11) (Int’l Bur. 1996) (authorizing service to fixed terminals in bands allocated to the mobile-satellite service); Geostar Positioning Corp., *Order and Authorization*, 4 FCC Rcd 4538 (para. 7) (1989) (authorizing service to radiodetermination satellite service terminals in a band allocated to the fixed-satellite service).

¹⁴⁴ See para. 73, above.

¹⁴⁵ See *Ka-band NGSO Order*, 18 FCC Rcd at 14720. Ephemeris data is information that will allow a GSO operator to locate an NGSO constellation at any given time. To avoid in-line interference events, the Commission requires Ka-band NGSO FSS licensees and Ku-band NGSO licensees operating in the 10.75-14.5 GHz band to provide such data. See Amendment of Parts 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, ET Docket No. 98-206, *First Report and Order and Further Notice of Proposed Rulemaking*, 16 FCC Rcd 4096, 4138 (para. 102) (2000).

¹⁴⁶ *Ka-band NGSO Order*, 18 FCC Rcd at 14726.

¹⁴⁷ See, e.g., 47 C.F.R. § 25.142(a)(5) (for the “Little LEO” service) and 47 C.F.R. § 25.143(c) (for the “Big LEO” service).

promptly and to avoid any service disruptions to their customers. Thus, we issue Northrop Grumman a blanket license for the Ka-band component of its NGSO constellation. In addition, we extend blanket licensing, and its benefits, to Northrop Grumman's V-band NGSO component. Consequently, we authorize Northrop Grumman to construct three hybrid Ka-band/V-band NGSO FSS satellites and to maintain this constellation until the end of the license period. Any replacement satellites that Northrop Grumman launches before the end of the constellation's license term must be technically identical to those in service, including the frequency bands and orbital parameters, and may not result in a net increase in the number of operating satellites.

d. GSO Satellites

78. In addition to its request for NGSO satellite system authority, Northrop Grumman seeks authority to operate a GSO FSS satellite at each of four orbital locations (125° W.L., 73° W.L., 68.5° E.L. and 116.5° E.L.), in both the V-band and the Ka-band. As discussed below, we find Northrop Grumman's proposed GSO satellites meet the Commission's technical and service rules. We discuss V-band and Ka-band operations separately below.

(i) V-band Operations

79. Northrop Grumman proposes to operate its four GSO satellites in the 37.5-42.0 GHz (downlink) and 47.2-50.2 GHz (uplink) frequency bands, which are allocated on a co-primary basis to FSS. No comments or objections were filed regarding these operations. Thus, we allow Northrop Grumman to operate in these bands, provided that it meets all the technical requirements applicable to these bands, including those in the default rules.¹⁴⁸

80. To comply with our rules, Northrop Grumman must show that its GSO V-band satellite operations will meet two-degree orbital spacing requirements. The Commission has stated that it will apply the two-degree spacing requirements that it applies to GSO satellites in the C-band, Ku-band, Ka-band, and to proposed GSO satellites in other frequency bands.¹⁴⁹ Northrop Grumman indicates that its V-band operations are consistent with operations in a two-degree spacing environment.¹⁵⁰ Because there are no authorized co-frequency V-band GSO FSS satellites within two-degrees of Northrop Grumman's proposed orbital locations, Northrop Grumman conducted a two-degree compatibility analysis using the characteristics of its own satellites.¹⁵¹ Our review of this analysis confirms Northrop Grumman's conclusion that its proposed satellites are two-degree compatible.¹⁵² We also find that Northrop Grumman's proposed V-band operations meet the PFD limits for operations in the 37.5-42.0 GHz band specified in Sections 25.208 (q), (s), and (u) of the Commission's rules and in ITU Article 21.16 (Table 21-4).¹⁵³ Further, with the exception of the geographic service area requirement, the same default rules apply to Northrop Grumman's GSO V-band operations as apply to its NGSO operations. For the reasons discussed in paragraphs 56-64 above, we find that Northrop Grumman's proposed GSO operations similarly comply with these

¹⁴⁸ 47 C.F.R. § 25.217(c). See also *First Space Station Licensing Reform Order*, 18 FCC Rcd at 10784 (para. 52).

¹⁴⁹ *First Space Station Licensing Reform Order*, 18 FCC Rcd at 10808 (para. 119).

¹⁵⁰ See 116.5° E.L. July 2004 Amendment, Annex 1 at 5. See also 125° W.L. 2007 Amendment, 73° W.L. 2007 Amendment, 68.5° E.L. 2007 Amendment, 116.5° E.L. 2007 Amendment, Attachment A.

¹⁵¹ See 116.5° E.L. July 2004 Amendment, Annex 1 at 5, 125° W.L. 2007 Amendment, 73° W.L. 2007 Amendment, 68.5° E.L. 2007 Amendment, 116.5° E.L. 2007 Amendment, Attachment A. See also *2004 Two-Degree Spacing Public Notice*, 19 FCC Rcd at 10952.

¹⁵² NGSO July 2004 Amendment, Annex 1 at 1-5.

¹⁵³ See 47 C.F.R. §§ 25.208(q), (s), and (u), ITU Article 21.16 (Table 21-4) of the ITU Radio Regulations. See also *First Space Station Licensing Reform Order*, 18 FCC Rcd at 10784 (para. 52).

rules. Last, as noted above, we require Northrop Grumman's GSO operations to comply with applicable ITU or Commission requirements governing out-of-band earth station emission limits.¹⁵⁴

81. Further, Northrop Grumman must complete coordination with all Federal FSS systems operating in the 37.5-42.0 GHz and 47.2-50.2 GHz frequency bands prior to launch of its first satellite. Finally, we limit Northrop Grumman's operations in the 37.5-40.0 GHz and 47.2-48.2 GHz portions of the V-band to gateway operations, consistent with the requirements in Footnote 15 of Section 25.202(a)(1) of the Commission Rules.¹⁵⁵

(ii) Ka-band Operations

82. Northrop Grumman proposes to operate all four GSO FSS satellites in the 18.3-18.8 GHz (downlink), 19.7-20.2 GHz (downlink), 28.35-28.6 GHz (uplink), and 29.25-30.0 GHz (uplink) bands, which are designated for primary use for GSO operations. Northrop Grumman also proposes to operate all four GSO satellites in the 28.6-29.1 GHz (uplink) and 18.8-19.3 GHz (downlink) frequency bands. The 28.6-29.1 GHz band is designated for GSO FSS use on a secondary basis with respect to primary NGSO FSS operations. The 18.8-19.3 GHz band does not contain a designation for GSO FSS operations and thus can only be authorized for use by GSO satellites on a non-conforming basis. Northrop Grumman requests waivers of the Ka-band Plan to allow GSO use of the 28.6-29.1 GHz and 18.8-19.3 GHz frequency bands.¹⁵⁶

83. We find that Northrop Grumman's proposed operations in the primary GSO Ka-band frequencies comply with all requirements for GSO satellites in Part 25 of the Commission's rules. First, we find that Northrop Grumman's analyses show that its GSO FSS satellites are compatible with a two-degree orbital spacing environment.¹⁵⁷ Further, we find that Northrop Grumman's proposed operations comply with the applicable PFD limits in Sections 25.138(a)(6), 25.208(c), and 25.208(d) of the Commission rules, as well as ITU Article 21.16 (Table 21-4) of the ITU Radio Regulations.¹⁵⁸ Accordingly, we grant Northrop Grumman authority to operate its four proposed GSO satellites in the GSO Ka-band frequencies. We condition this authority, however, on Northrop Grumman coordinating its operations with Federal systems in accordance with Footnote US334 to the Table of Frequency Allocations.¹⁵⁹

84. Next, we analyze Northrop Grumman's request to operate its GSO satellites in those portions of the Ka-band designated for primary NGSO use. In support of its waiver request to permit these operations, Northrop Grumman states that its GSO FSS satellites will comply with applicable PFD limits in Section 25.208(e) of the Commission rules and Article 21.16 (Table 21-4) of the ITU Rules and Regulations.¹⁶⁰ Northrop Grumman also states that its GSO component will facilitate spectrum sharing among NGSO systems because Northrop Grumman will switch its NGSO operations to a GSO satellite during an in-line event. This will allow other NGSO systems to

¹⁵⁴ See para. 66, above.

¹⁵⁵ See 47 C.F.R. § 25.202(a)(1), fn. 15.

¹⁵⁶ See NGSO March 2004 Amendment at 27.

¹⁵⁷ 125° W.L. 2007 Amendment, Technical Appendix, Attachment B-1; 73° W.L. 2007 Amendment, Technical Appendix Attachment B-2; 68.5° E.L. 2007 Amendment, Technical Appendix Attachment B-3, 116.5° E.L. 2007 Amendment, Technical Appendix Attachment B-4.

¹⁵⁸ See 47 C.F.R. §§ 25.138(a)(6) and 25.208(c),(d) and Article 21.16 (Table 21-4) of the ITU Radio Regulations. See 125° W.L. 2007 Amendment, Technical Appendix, Attachment B-1; 73° W.L. 2007 Amendment, Technical Appendix, Attachment B-2; 68.5° E.L. 2007 Amendment, Technical Appendix Attachment B-3, 116.5° E.L. 2007 Amendment, Technical Appendix, Attachment B-4.

¹⁵⁹ 47 C.F.R. § 2.106, fn. US 334.

¹⁶⁰ 47 C.F.R. § 25.208(e), Article 21.16 (Table 21-4) of the ITU Radio Regulations.

operate across the entire designated Ka-band spectrum during an NGSO to NGSO in-line event rather than reducing spectrum use, as would otherwise be required. Thus, Northrop Grumman argues that granting a waiver will not undermine the purpose of the rule designating the 18.8-19.3 GHz and 28.6-29.1 GHz frequency bands for primary NGSO FSS use.¹⁶¹

85. EchoStar and SES Americom observe that the Commission previously denied an EchoStar application to operate GSO satellites in spectrum designated for Ka-band NGSO services because EchoStar's commitment to shut off its GSO satellites upon notification of a "concrete risk of harmful interference" was not sufficient to ensure that NGSO satellites would not receive harmful interference.¹⁶² EchoStar and SES Americom assert that EchoStar's proposal to cease operations during an in-line interference event is analogous to Northrop Grumman's proposal to switch its traffic to a GSO satellite and that we should similarly deny Northrop Grumman's applications.¹⁶³ Although SES Americom recognizes that Northrop Grumman provides a technical analysis while EchoStar did not, SES Americom maintains that the technical analysis is not relevant because the Commission has not established protection criteria for Ka-band NGSO systems.¹⁶⁴ SES Americom also asserts that accepting Northrop Grumman's application before the Commission conducts a rulemaking to permit GSO operations in NGSO-designated bands gives Northrop Grumman unfair "first-in-line" date priority over other potential applicants.¹⁶⁵

86. We find that Northrop Grumman has provided adequate justification for a waiver of the Ka-band Plan to the extent such a waiver is necessary. We first address Northrop Grumman's request for waiver of the Ka-band Plan in the 28.6-29.1 GHz (uplink) frequency band. This band contains a secondary designation for GSO FSS uplink operations. Consequently, Northrop Grumman does not need a waiver of the Table of Frequency Allocations to operate in this spectrum on a non-interference basis. We will permit Northrop Grumman's GSO satellites to operate in this band if these operations do not interfere with primary NGSO operations. Technical studies to develop interference criteria between GSO and NGSO systems have not been completed.¹⁶⁶ We recognize that, without established NGSO FSS interference protection criteria, satellite operators cannot fully assess the impact of proposed GSO operations on NGSO operations. Nevertheless, we note that Northrop Grumman has provided a quantitative demonstration of how its GSO satellites will protect NGSO systems in the 28.6-29.1 GHz frequency band. Northrop Grumman's analysis included potential interference from its GSO satellites into the NGSO satellite design proposed by ATCONTACT, and the low-Earth orbit satellite design proposed by SkyBridge II, which has since been withdrawn.¹⁶⁷ Northrop Grumman analyzed the potential interference between each of these systems in terms of the Interference-to-Noise Ratio, I_o/N_o assuming a minimum topocentric line of sight angular separation of ten degrees. Based on the worse case scenarios, Northrop Grumman calculated a I_o/N_o of -31.3 dB with respect to the ATCONTACT system and an I_o/N_o of -15 dB with respect to the SkyBridge II system. This corresponds to a $\Delta T/T$ of 0.07% and 3.16%,

¹⁶¹ NGSO March 2004 Amendment at 22, 27.

¹⁶² SES Americom Petition at 7-8; EchoStar Petition at 5-6.

¹⁶³ EchoStar Reply at 2-4.

¹⁶⁴ SES Americom Petition at 8-9.

¹⁶⁵ SES Americom Petition at 10-11; SES Americom Reply at 9-10.

¹⁶⁶ See Astrolink International, LLC, *Order and Authorization*, 16 FCC Rcd 20124, 20127 (Int'l Bur. 2001).

¹⁶⁷ See, e.g., 119° W.L. July 2004 Amendment, at Annex 3. SkyBridge II LLC withdrew its Ka-band NGSO FSS application in October 2004. *Public Notice*, Policy Branch Information, Report No. SAT-00252, 19 FCC Rcd 20950 (Int'l Bur. 2004). See also 125° W.L. 2007 Amendment, Technical Appendix, Attachment C-1; 73° W.L. 2007 Amendment, Technical Appendix, Attachment C-2; 68.5° E.L. 2007 Amendment, Technical Appendix, Attachment C-3, 116.5° E.L. 2007 Amendment, Technical Appendix, Attachment C-4.

respectively. These values are well below the 6% threshold that triggers coordination between satellite systems under the relevant ITU Radio Regulations. Therefore, we conclude that the Northrop Grumman satellite system will not cause harmful interference to the ATCONTACT system nor would it have to the SkyBridge II system. Neither SES Americom nor EchoStar has provided any technical analyses to disprove Northrop Grumman's demonstration nor do we have any reason to believe that Northrop Grumman's study is flawed.

87. In contrast, the Table of Frequency Allocations limits the use of the 18.8-19.3 GHz band – which Northrop Grumman proposes for GSO downlink operations – to NGSO downlink operations.¹⁶⁸ The Commission stated that secondary GSO operations would be feasible only if an NGSO receiver does not point at the geostationary orbit.¹⁶⁹ It further stated that pointing flexibility allows NGSO licensees to use fewer satellites in their constellations and that it would not constrain such flexibility to facilitate NGSO sharing with non-primary GSO operations.¹⁷⁰ Northrop Grumman's NGSO orbital characteristics are such that the NGSO receive earth stations within its own system will never point toward the geostationary arc. Furthermore, Northrop Grumman's technical analysis, discussed above, demonstrates that its downlinks on its GSO FSS satellites would not cause harmful interference to any of the then-pending proposed non-Federal NGSO FSS systems.¹⁷¹ Finally, allowing Northrop Grumman to switch to its GSO satellites during in-line events between its NGSO satellites will facilitate NGSO operations in this band.

88. We also conclude that EchoStar's applications are not similarly situated with Northrop Grumman's. While both entities requested a waiver of the Ka-band plan to operate GSO satellites in NGSO-designated spectrum, EchoStar -- in contrast to Northrop Grumman -- did not provide a technical analysis to support its waiver request. Generally, the Commission requires applicants proposing non-conforming operations to demonstrate that their proposed operations will not cause interference into allocated services. Instead, EchoStar asserted that it did not need to provide a technical analysis because it would terminate operations upon notification that its GSO operations were posing a "concrete risk of harmful interference" to NGSO operations.¹⁷² It also asserted that a waiver was justified because the NGSO-designated band, which was not being used, would otherwise remain fallow.¹⁷³ The Division rejected these assertions, citing several pending applications proposing NGSO operations in this band (including Northrop Grumman's) and noting that EchoStar had not justified a departure from the Commission's policy to ensure that allocated services do not receive *any* interference from non-conforming services.¹⁷⁴ In contrast, Northrop Grumman's application included an undisputed technical showing that it would not interfere with NGSO operations. While Northrop Grumman submitted this showing in an amendment to its initial application, this information was in the record when the Division reviewed the merits of Northrop

¹⁶⁸ 47 C.F.R. § 2.106, fn. NG 165.

¹⁶⁹ 18 GHz Order, 15 FCC Rcd at 13458-9.

¹⁷⁰ *Id.*

¹⁷¹ See NGSO July 2004 Amendment, 119° W.L. July 2004 Amendment, 89° W.L. July 2004 Amendment, 15° E.L. July 2004 Amendment, and 116.5° E.L. July 2004 Amendment at Annex 3. See also 125° W.L. 2007 Amendment, Technical Appendix, Attachment C-1; 73° W.L. 2007 Amendment, Technical Appendix, Attachment C-2; 68.5° E.L. 2007 Amendment, Technical Appendix, Attachment C-3, 116.5° E.L. 2007 Amendment, Technical Appendix, Attachment C-4.

¹⁷² See, e.g., EchoStar Satellite Corporation, Application for Authority to Construct, Launch, and Operate a Geostationary Satellite Using Ka-band Frequencies at 121° W.L., File No. SAT-LOA-20030827-00180, at 15 (*EchoStar Application*), denied in EchoStar Satellite LLC, *Memorandum Opinion and Order*, 19 FCC Rcd 7846 (Sat. Div., Int'l Bur. 2004) (*EchoStar Order*).

¹⁷³ EchoStar Application at 16.

¹⁷⁴ *EchoStar Order*, 19 FCC Rcd at 7853.

Grumman's proposal.

89. Further, SES Americom's argument that Northrop Grumman's compliance with the ITU EPFD limits does not provide justification for a waiver is misplaced. We do not rely on Northrop Grumman's EPFD assertions, but rather base our waiver grant on our review of its interference analysis as set forth above. Finally, we do not agree with SES Americom that giving Northrop Grumman "first-in-line" status is unfair. Other potential applicants were free to file substantially complete applications with adequately supported requests for waiver of the Ka-band plan, just as Northrop Grumman did.¹⁷⁵

90. Therefore, we grant Northrop Grumman a waiver of Section 2.106 of the Commission's rules to operate its GSO satellites on a non-conforming basis in the 18.8-19.3 GHz frequency band and grant it authority to operate its proposed GSO satellites in the 28.6-29.1 GHz band on a secondary basis. We require Northrop Grumman to accept interference from all operations with superior status in these bands, including Federal GSO and NGSO systems, and to terminate operations if it causes harmful interference to any superior-status service. Further, we require Northrop Grumman to terminate GSO operations in order to avoid an in-line interference event between one of its GSO satellites and other systems' NGSO satellites. Northrop Grumman must also coordinate with Federal GSO and NGSO FSS systems in the 18.8-19.3 GHz band in accordance with Footnote US334 to the Table of Frequency Allocations. We condition this authority, however, on Northrop Grumman complying with any interference criteria that may be adopted by the Commission.

(iii) Increased Power Operations in the 18.8-19.3 GHz and 28.6-29.1 GHz Frequency Bands

91. In its most recent amendments, Northrop Grumman proposes to increase the power levels on its GSO satellites in the 18.8-19.3 GHz and 28.6-29.1 GHz frequency bands. Northrop Grumman states that it requests this change because it seeks to provide emergency and homeland security operations during disasters in these bands.¹⁷⁶ Northrop Grumman indicates that these operations will require earth station terminals as small as 0.25 meters in diameter and that these small antennas require somewhat higher operating powers.¹⁷⁷ Northrop Grumman states that although the increased power still complies with applicable Commission rules, the combination of earth station size and power makes the earth stations best suited to a four-degree orbital spacing environment. Northrop Grumman therefore suggests that the Commission adopt four-degree orbital spacing for GSO satellites operating in these bands.¹⁷⁸ Northrop Grumman also requests a waiver of Section 25.140(b)(2) of the Commission's rules,¹⁷⁹ which requires applicants to provide an interference analysis demonstrating the compatibility of the proposed system with GSO satellites two-degrees away.

92. The Commission adopted a two-degree orbital spacing framework for Ka-band GSO

¹⁷⁵ Indeed, ATCONTACT applied for, and was granted, a similar waiver to operate GSO Ka-band satellites in the portion of the Ka-band designated for primary NGSO operations. *See* contactMEO Communications, LLC, 21 FCC Rcd at 4047-48. EchoStar and SES Americom objected to the grant of ATCONTACT's secondary/non-conforming GSO operations for the same reasons they object to Northrop Grumman's secondary/non-conforming GSO operations. These arguments were rejected in the order granting ATCONTACT's application. *Id.*

¹⁷⁶ *See, e.g.*, 125° W.L. 2007 Amendment at 10-13.

¹⁷⁷ *See, e.g.*, 125° W.L. 2007 Amendment at 11.

¹⁷⁸ *See, e.g.*, 125° W.L. 2007 Amendment at 10-13.

¹⁷⁹ *See, e.g.*, 125° W.L. 2007 Amendment at 11. *See also* 47 C.F.R. § 25.140(b)(2).

satellites in the *Ka-band Third Report and Order*.¹⁸⁰ Even assuming Northrop Grumman had filed a Petition for Rulemaking, which is the correct procedural vehicle to revisit the Commission's Ka-band decision, it has not persuaded us to consider increasing orbital spacings for GSO satellites in the 18.8-19.3 GHz and 28.6-29.1 GHz bands. The downlink frequency band at 18.8-19.3 GHz does not contain a designation for GSO satellites and the uplink frequency band at 28.6-29.1 GHz contains only a secondary designation for GSO satellites.¹⁸¹ This means that GSO satellite operations cannot cause harmful interference to or claim protection from NGSO operations in these bands, which have a primary designation in both bands. We attempt to accommodate the provision of disaster-related relief services, where possible. We are reluctant to approve such services, however, where they could be subject to interference and could be required to be terminated upon notification of interference into NGSO operations. We note that GSO satellites provide disaster-related relief services in many other bands that contain a two-degree orbital spacing framework, including that portion of the Ka-band spectrum designated for GSO operations on a primary basis.

93. Nevertheless, we grant Northrop Grumman a waiver of Section 25.140(b)(2) of the Commission's rules to permit it to operate at its proposed higher power levels with small antennas on a conditional basis.¹⁸² No other GSO satellites are now operating or are authorized to operate within four-degrees of Northrop Grumman's proposed satellites in the 18.8-19.3 GHz and 28.6-29.1 GHz bands.¹⁸³ Thus, allowing Northrop to operate at its proposed power levels will not affect any other GSO operator at this time. We require Northrop Grumman, however, to protect the operations of any two-degree compliant GSO operator that operates in these bands in the future. Further, Northrop Grumman may not claim protection against interference to its operations caused by a two-degree compliant GSO operator in these bands. Finally, given the secondary/non-conforming status of GSO operations in these bands, we require Northrop Grumman to notify its customers who are using antennas that are not two-degree compliant, in writing, that service is being provided on a non-conforming or secondary basis in these bands, that Northrop Grumman will be required to terminate operations if its operations cause harmful interference to a service designated to use these bands on a primary basis, and that Northrop Grumman cannot claim protection against interference caused by any operations with superior operating status.

e. Tracking, Telemetry, and Command Function

94. Section 25.202(g) of the Commission's rules requires FSS systems to operate their tracking, telemetry, and command (TT&C) links at the edges of the frequency bands in which they are providing service.¹⁸⁴ The rule further provides that operators should select frequencies, polarization, and coding to minimize interference into other satellite networks and within their own satellite system. Northrop Grumman represents that each of its NGSO and GSO satellites will conduct TT&C at the edges of the NGSO Ka-band using one or two TT&C channels on each satellite with channel bandwidths of two megahertz.¹⁸⁵

¹⁸⁰ *Ka-band Third Report and Order*, 12 FCC Rcd at 22319.

¹⁸¹ Indeed, as previously noted, the Commission eliminated the secondary designation for GSO downlinks at 18.8-19.3 GHz because it concluded that allowing secondary operations would inhibit use by primary users. *18 GHz Order*, 15 FCC Rcd at 13432.

¹⁸² Northrop Grumman must still file license applications for any earth stations it seeks to operate in conjunction with its GSO satellites.

¹⁸³ ATCONTACT Communications, LLC has the only licensed GSO system in the 18.8-19.3 GHz and 28.6-29.1 GHz bands. None of its GSO satellites are authorized less than four-degrees away from Northrop Grumman's GSO satellites.

¹⁸⁴ 47 C.F.R. § 25.202(g).

¹⁸⁵ See, e.g., 125° W.L. 2007 Amendment, Technical Appendix at 14.

95. Northrop Grumman asks us to grant a waiver of Section 25.202(g) to allow it to use TT&C frequencies in just one of the frequency bands used in which it is providing service—that is, the Ka-band NGSO FSS service bands—to allow it to take advantage of the efficiencies of a hybrid V-band/Ka-band system.¹⁸⁶ Northrop Grumman’s request for a waiver of Section 25.202(g) is unnecessary. Section 25.202(g) does not require Northrop Grumman to conduct TT&C operations at the band edges of both the Ka- and V-bands. The rule requires only that TT&C operations occur at the band edges of an FSS band in which it is providing service. We find Northrop Grumman in compliance with this rule.

f. Orbital Debris Mitigation

96. An applicant for a space station license must submit a description of the design and operational strategies that it will use to mitigate orbital debris, including a statement detailing post-mission disposal plans for space stations at the end of their operating life.¹⁸⁷ Northrop Grumman included an orbital debris mitigation plan in its amended application.¹⁸⁸ Thereafter, the Satellite Division released a Public Notice clarifying information that must be included in an applicant’s casualty risk assessment if the planned post-mission disposal involves atmospheric re-entry of spacecraft.¹⁸⁹ Northrop Grumman further amended its application, consistent with the Public Notice, with respect to the proposed controlled re-entry of its NGSO FSS satellites during post-mission disposal of the spacecraft.¹⁹⁰ Northrop Grumman further amended its applications in February 2007 and submitted an erratum to each of the four GSO amendments that consisted of an updated orbital debris plan for each of these satellites.¹⁹¹

97. In its orbital debris mitigation plan, Northrop Grumman represents that it will incorporate vehicle design and operational techniques to minimize orbital debris.¹⁹² It states that its system design will minimize the possibility of collision between satellites and other known objects. Further, Northrop Grumman states that its spacecraft design will also consider, and to the extent practicable, limit the probability that collisions with items smaller than one centimeter in diameter could cause a loss of control, and thereby prevent intended means of post-mission disposal.¹⁹³ In addition, Northrop Grumman states that critical components of its system will be designed to minimize vulnerability to high-speed particles and untracked debris that may result in loss of satellite control.¹⁹⁴

98. As a general matter, although the risk of collision between the satellites is extremely low, the Commission has indicated that in cases in which orbital parameters for proposed satellite systems are similar to those of other operating systems, such that the two systems may have an

¹⁸⁶ NGSO March 2004 Amendment at 25-26.

¹⁸⁷ *Orbital Debris Order*, 19 FCC Rcd 11567, 11619; 47 C.F.R. § 25.145. *See also* 47 C.F.R. § 25.114(d) (14).

¹⁸⁸ *See* SAT-AMD-20031104-00324. *See also* March 2004 Amendments.

¹⁸⁹ *Orbital Debris Public Notice*, 19 FCC Rcd 10714 (June 16, 2004).

¹⁹⁰ *See* July 2004 Amendments.

¹⁹¹ *See* Errata to 125° W.L. 2007 Amendment, 73° W.L. 2007 Amendment, 68.5° E.L. 2007 Amendment, 116.5° E.L. 2007 Amendment, all filed on March 19, 2007.

¹⁹² *See, e.g.*, NGSO July 2004 Amendment, Annex 2. *See also* 116.5° July 2004 Amendment, Annex 2. *See also* errata to 125° W.L. 2007 Amendment; 73° W.L. 2007 Amendment; 68.5° E.L. 2007 Amendment; 116.5° E.L. 2007 Amendment.

¹⁹³ *Id.*

¹⁹⁴ *Id.*

increased risk of physical collision, further review may be warranted.¹⁹⁵ In April 2005, the Division asked Northrop Grumman and ATCONTACT to provide written explanations regarding measures they will take to avoid in-orbit collisions between the NGSO satellites in their constellations that have similar orbital parameters.¹⁹⁶ In response, Northrop Grumman and ATCONTACT state that operational conditions, *i.e.*, initial orbital parameters, and ongoing coordination will ensure that the two systems' operations are physically compatible.¹⁹⁷

99. According to Northrop Grumman, its GSO FSS satellites at the end of mission will be raised to an orbit with perigee altitude of at least 300 km above the GSO operational altitude. Although this proposal is consistent with prior practices, the Commission's new end-of-life disposal rule requires the disposal perigee altitude of the GSO spacecraft to be no lower than that calculated using the Interagency Space Debris Coordination Committee ("IADC") formula.¹⁹⁸ Although a perigee 300 kilometers above the geostationary altitude is typically sufficient to meet the IADC formula, a 300 kilometer increase may be insufficient depending on spacecraft design. Pursuant to the new rule, Northrop Grumman is required to make certain that the disposal perigee altitude of its GSO spacecraft complies with this requirement.

100. To ensure adequate disposal altitude for its GSO FSS satellites, Northrop Grumman assures the Commission that it will budget enough fuel to ensure that these satellites are properly disposed of at the end of life. Northrop Grumman also states that after end-of-life disposal, all remaining energy sources will be depleted or deactivated. This includes depleting remaining fuel, venting pressurized systems, discharging batteries and deactivating other safety systems.¹⁹⁹

101. At end of mission of its NGSO FSS satellites, Northrop Grumman plans to de-orbit its NGSO FSS satellites through controlled re-entry by using a series of maneuver burns. Northrop Grumman states that the deorbit process will be designed to assure that the satellite is stable and under control throughout the deorbit process.²⁰⁰ Northrop Grumman has identified an open area in the southern Pacific Ocean as the projected geographic region of the debris field.²⁰¹ Northrop Grumman also states that authorities for shipping lanes and airline routes in the area of the debris field will be notified of the event.

102. This case is one of the first in which we have addressed a system's plans to dispose of satellites using controlled atmospheric reentry, at end-of-life. According to Northrop Grumman, its system is still in the design process. Given the stage of development for its NGSO constellation, Northrop Grumman's application does not provide more detailed information concerning end-of-life operations, such as detailed operational plans, methods for coordination with relevant government

¹⁹⁵ See, e.g., *Orbital Debris Order*, 19 FCC Rcd at 11588.

¹⁹⁶ Letter to Peter Hadinger, Northrop Grumman Space & Missions Systems Corp., from Robert Nelson, Chief, Satellite Engineering Branch (Apr. 27, 2005). See also Letter to David Drucker, Manager, contactMEO Communications, LLC from Robert Nelson, Chief, Satellite Engineering Branch (Apr. 27, 2005).

¹⁹⁷ Letter to Marlene Dortch, Secretary FCC, from Stephen D. Baruch, Attorney for Northrop Grumman Space & Mission Systems Corporation (May 12, 2005); Letter to Marlene Dortch, Secretary, FCC, from James M. Talens, Attorney for contactMEO Communications, LLC (May 12, 2005).

¹⁹⁸ 47 C.F.R. § 25.283. IADC formula: $36,021 \text{ km} + (1000 \cdot C_R \cdot A/m)$, where C_R is the solar pressure radiation coefficient of the spacecraft, and A/m is the Area to mass ratio, in square meters per kilogram, of the spacecraft.

¹⁹⁹ See NGSO July 2004 Amendment at Annex 2; 116.5° E.L. July 2004 Amendment at Annex 2. See also errata to 125° W.L. 2007 Amendment; 73° W.L. 2007 Amendment; 68.5° E.L. 2007 Amendment; 116.5° E.L. 2007 Amendment.

²⁰⁰ *Id.*

²⁰¹ *Id.*

agencies, and insurance arrangements. We believe that a more detailed review of these issues is warranted as system design progresses, and prior to authorization of launch and operating authority. Until such a review can be completed, we are not in a position to conclude that either the disposal of Northrop Grumman's NGSO satellites, or the launch that would necessitate disposal, are in the public interest. Accordingly, we require Northrop Grumman to file, no later than 30 days following completion of the Critical Design Review milestone for its NGSO satellites, an application to modify its license, specifying its end-of-life operations. This application should provide detailed information concerning all aspects of the proposed disposal plan. Because the United States is potentially strictly liable for any damage caused on the surface of the Earth by re-entering Northrop Grumman satellites, we would anticipate that such a plan would involve insurance policies listing the United States as an additional insured party. Authority to launch and operate the satellites, as specified in this Order, will be granted if the information submitted demonstrates that Northrop Grumman's end-of-life disposal plans are in the public interest.

g. Inter-Satellite Links

103. Northrop Grumman suggests that it may use optical inter-satellite links on its NGSO satellites, although it does not propose any specific frequencies.²⁰² Under these circumstances, no further action is necessary at this time.²⁰³

C. License Conditions

1. Milestone Schedule

104. To ensure that licensees remain able and committed to implementing their planned satellites and do not hold scarce orbit and spectrum resources to the exclusion of other entrants, the Commission imposes milestone schedules on each licensed satellite. If a licensee fails to meet any of these milestones, the license becomes null and void. These milestones are set forth in Section 25.164 of the Commission's rules and are slightly different for GSO FSS satellites and NGSO FSS satellite constellations.²⁰⁴ Northrop Grumman notes these differences and proposes that the earlier of the applicable milestones apply to its hybrid NGSO/GSO system.²⁰⁵

105. Licensees of satellite systems that include both GSO and NGSO components are required to construct the GSO portions of their system within the GSO milestones and the NGSO portion of their system within the NGSO milestones.²⁰⁶ NGSO licensees must meet five milestones: (1) enter into a binding non-contingent contract to construct the satellite system within one year of licensing; (2) complete critical design review of the licensed system within two years of licensing; (3) begin construction of the first satellite in the licensed system within two years, six months of licensing; (4) launch and operate the first satellite within three years, six months; and (5) bring all of the licensed satellites into operation within six years of licensing.²⁰⁷ GSO licensees must

²⁰² See NGSO March 2004 Amendment, Technical Appendix at 2.

²⁰³ The Commission's Table of Frequency Allocations addresses frequencies between 9 KHz and 400 GHz. 47 C.F.R. § 2.102. Optical frequencies are above 400 GHz. The ITU Radio Regulations do not include any allocations above 275 GHz. However, Footnote 5.565 of the Radio Regulations Table of Frequency Allocations lists a number of potential uses of these frequencies and urges consideration of the uses until such time a table of allocations is developed in those bands.

²⁰⁴ 47 C.F.R. §§ 25.164(a) and (b).

²⁰⁵ NGSO March 2004 Amendment at 20 and n. 27.

²⁰⁶ Amendment of the Commission's Space Station Licensing Rules and Policies, *First Order on Reconsideration and Fifth Report and Order*, 19 FCC Rcd 12637, 12655 (2004) (*Space Station Licensing Reform First Reconsideration Order*).

²⁰⁷ 47 C.F.R. § 25.164(b).

meet four milestones: (1) enter into a binding non-contingent contract to construct the licensed satellite(s) within one year of licensing; (2) complete critical design review within two years of licensing; (3) begin construction of the satellite(s) within three years; and (4) launch and operate the satellite(s) within five years of licensing.²⁰⁸ In addition, licensees must submit certifications of milestone compliance on or before the date for completion of each milestone.²⁰⁹ Northrop Grumman has provided no reason to deviate from Commission policy for hybrid GSO/NGSO systems by consolidating the GSO and NGSO milestones. Indeed, doing so could result in confusion as to which milestones have been met and which part of the authorization is cancelled in the event Northrop Grumman fails to meet a milestone. Thus, we incorporate separate NGSO and GSO milestones in this license.²¹⁰ Northrop Grumman is, of course, free to proceed with both components of its system on parallel tracks if it wishes to do so.

2. License Term

106. The license term for both GSO FSS and NGSO FSS satellites is 15 years. The term for each GSO satellite begins on the date the licensee certifies to the Commission that the satellite has been placed in orbit and its operations conform to the conditions in its authorization.²¹¹ For NGSO FSS satellites, the term commences when the licensee certifies to the Commission that its initial satellite has been placed in orbit and is operating in compliance with its authorization.²¹² Consequently, the time at which the license term begins to run will likely vary for Northrop Grumman's GSO FSS and NGSO FSS satellites.

3. Reporting Requirements

107. Northrop Grumman must follow the Part 25 rules for reporting requirements for FSS systems, including an annual report describing the status of satellite construction and anticipated launch date, and the use made of each transponder on its in-orbit satellites.²¹³ Northrop Grumman must file this report on June 30 of each year, containing information current as of May 31 of that year. Additionally, within 30 days after preliminary in-orbit testing is completed, Northrop Grumman must submit antenna measurements of both co-polarized and cross-polarized performance on all antennas employed by space stations both within the primary coverage area, to facilitate coordination with other Commission licensees, and outside the primary coverage area, to facilitate international frequency coordination with other Administrations.²¹⁴

4. International Coordination

²⁰⁸ 47 C.F.R. § 25.164(a).

²⁰⁹ 47 C.F.R. §§ 25.164(c), (d), and (e).

²¹⁰ Because we are not granting Northrop Grumman launch or operating authority for its NGSO constellation at this time, we will not include those milestones in this Order. Rather, we will impose them at the time we grant launch and operating authority. Further we note that, in the *V-band Second Report and Order*, the Commission deferred certain V-band issues to a future rulemaking—including conditions under which FSS operations in the 37.5-40.0 GHz band can exceed the clear-air PFD limits to compensate for rain fade. *V-band Second Report and Order*, 18 FCC Rcd at 25440-41 (para. 29). Although this authorization only allows Northrop Grumman to operate its system consistent with the clear-air PFD limits that have already been established, any proposed modification to Northrop Grumman's system that exceeds these clear-air PFD limits would be subject to any future rules that deal with this issue.

²¹¹ 47 C.F.R. § 25.121(d)(1).

²¹² 47 C.F.R. § 25.121(d)(2).

²¹³ See 47 C.F.R. §§ 25.210(l), 25.217(b)(1), and 25.217(c)(1).

²¹⁴ See 47 C.F.R. §§ 25.210(k), 25.217(b)(1), and 25.217(c)(1).

108. In general, we will follow the applicable advance publication, coordination, due diligence and notification procedures as set forth in the ITU Radio Regulations in coordinating Northrop Grumman's satellites with other affected administrations. No protection from interference caused by radio stations authorized by other administrations is guaranteed unless coordination procedures are timely completed or, with respect to individual administrations, by successfully completing coordination agreements. In order to do so, we require that Northrop Grumman provide the Commission with the international coordination information specified in our rules.²¹⁵ This information shall include, but is not limited to, providing the Satellite Division a copy of all operator-to-operator summary records and/or coordination arrangements obtained from all coordination meetings with foreign commercial satellite operators. This information should be submitted with a request for confidential treatment and Administration-to-Administration approval. Northrop Grumman will be responsible for all cost recovery fees associated with any ITU filings on behalf of its system.

5. Bond

109. In the *First Space Station Licensing Reform Order*, the Commission eliminated the financial requirements then in place and replaced them with a bond requirement.²¹⁶ The bond requirement is intended to deter speculative space station applications and ensure that satellites are timely launched and service is provided to customers. Entities awarded a license for an NGSO satellite constellation must execute a \$5 million performance bond, and entities awarded a license for a GSO satellite must execute a \$3 million performance bond for each satellite, payable to the U.S. Treasury, within 30 days of the date the license is granted.²¹⁷ In the case of hybrid GSO/NGSO systems in which the GSO satellites operate in the same frequencies as the NGSO satellites, licensees may post a single \$5 million bond.²¹⁸ The bond is payable upon failure to meet any implementation milestone in the license, where adequate justification for extending the license is not provided.²¹⁹ In its *First Space Station Licensing Reform Order*, the Commission stated that it would entertain requests for complete or partial waivers of this bond requirement, but limited its discussion to waivers "for satellite operators proposing satellites designed to provide public safety services."²²⁰

110. Northrop Grumman seeks a partial waiver of this requirement. Northrop Grumman asserts we should not require it to post bonds for each GSO satellite because it is only seeking a single system license.²²¹ Rather, Northrop Grumman asserts that we should require it to post only the \$5 million bond applicable to NGSO systems. In clarifying that it would require a \$5 million bond for hybrid GSO/NGSO systems operating in the same frequency band, the Commission noted that if the licensee intends to operate the GSO satellites in a different frequency band than the NGSO satellite, it must post a \$3 million bond for each GSO satellite. Northrop Grumman has presented no justification for waiving this requirement, which is designed to ensure that operators are financially able to implement and are committed to implementing all the spectrum they have authority to use. Thus, we require Northrop Grumman to post a \$3 million bond for each of its four GSO satellites and a \$5 million bond for its NGSO constellation. Failure to post any of these bonds within 30 days of the grant of this license will render the authorization for that component of Northrop Grumman's

²¹⁵ 47 C.F.R. § 25.111(b).

²¹⁶ *First Space Station Licensing Reform Order*, 18 FCC Rcd at 10824.

²¹⁷ 47 C.F.R. §§ 25.165(a)(1), (2).

²¹⁸ 47 C.F.R. § 25.165(a)(3).

²¹⁹ *First Space Station Licensing Reform Order*, 18 FCC Rcd at 10826.

²²⁰ *First Space Station Licensing Reform Order*, 18 FCC Rcd at 10825.

²²¹ *See, e.g.*, NGSO March 2004 Amendment at 13.

system null and void.

IV. CONCLUSION AND ORDERING CLAUSES

111. Upon review of Northrop Grumman Space & Mission Systems Corporation's application, as amended, we find that Northrop Grumman Space & Mission Systems Corporation is qualified to be a Commission licensee and that, pursuant to Section 309 of the Communications Act of 1934, as amended, 47 U.S.C. §309, grant of this application will serve the public interest, convenience, and necessity. Accordingly, IT IS ORDERED, that Application File Nos. SAT-LOA-19970904-00080, SAT-AMD-19971222-00219, SAT-AMD-20031104-00324, SAT-AMD-20040312-00030, SAT-AMD-20040719-00136, SAT-AMD-20051118-00227, SAT-AMD-20070209-00033 (Call Sign S2254); SAT-LOA-19970904-00081, SAT-AMD-20040312-00032, SAT-AMD-20040719-00138, SAT-AMD-20051118-00230, SAT-AMD-20070209-00030 (Call Sign S2256); SAT-LOA-19970904-00082, SAT-AMD-20040312-00033, SAT-AMD-20040719-00140, SAT-AMD-20051118-00232, SAT-AMD-20070209-00031 (Call Sign S2257); SAT-LOA-19970904-00083, SAT-AMD-20040312-00034, SAT-AMD-20040719-00139, SAT-AMD-20051118-00231, SAT-AMD-20070209-00032 (Call Sign S2258); and SAT-LOA-19970904-00084, SAT-AMD-20040312-00031, SAT-AMD-20040719-00137, SAT-AMD-20051118-00229, SAT-AMD-20070209-00029 (Call Sign S2255) ARE GRANTED, to the extent indicated herein and are subject to the conditions specified in this Order.

112. IT IS FURTHER ORDERED that Application File No. SAT-WAV-19971222-00220 IS DISMISSED as moot.

113. IT IS FURTHER ORDERED that Northrop Grumman Space & Mission Systems Corporation is authorized to construct three NGSO FSS satellites (Call Sign S2254) capable of using the 28.6-29.1 GHz (uplink) and 18.8-19.3 GHz (downlink) frequency bands on a primary basis, the 29.5-30.0 GHz (uplink) frequency band on a secondary basis, and the 37.5-42.0 GHz (downlink) and 47.2-50.2 GHz (uplink) frequency bands on a co-primary basis. This authorization is subject to the technical specifications in Northrop Grumman Space & Mission Systems Corporation's applications, the Commission's rules, unless waived herein, the terms and conditions in this Order, and any technical requirements applicable to part or all of any of these frequency bands that the Commission may adopt in any future proceeding. Northrop Grumman shall complete coordination with all Federal FSS systems in the 18.8-19.3 GHz frequency band under 47 C.F.R. § 2.106, Footnote US 334, prior to the launch of its first NGSO FSS satellite in the 18.8-19.3 GHz (downlink) frequency band.

114. IT IS FURTHER ORDERED that Northrop Grumman Space & Mission Systems Corporation's NGSO FSS operations in the 29.5-30.0 GHz band must not cause harmful interference to any Federal or non-Federal systems authorized to operate on a primary basis in the 29.5-30.0 GHz frequency band. Further, Northrop Grumman Space & Mission Systems Corporation must accept any interference from primary systems, and must terminate operations immediately upon notification of harmful interference. Further, Northrop Grumman Space & Mission Systems Corporation's NGSO FSS operations in the 29.5-30.0 GHz band are subject to any rules the Commission adopts governing NGSO FSS satellite operations in spectrum designated for GSO FSS primary use.

115. IT IS FURTHER ORDERED that Northrop Grumman Space & Mission Systems Corporation's request for a waiver of the Ka-band Plan IS GRANTED, and Northrop Grumman Space & Mission Systems Corporation is authorized to construct three NGSO FSS satellites (Call Sign S2254) capable of operating in the 19.7-20.2 GHz (downlink) frequency band on a non-conforming basis. Northrop Grumman Space & Mission Systems Corporation's NGSO FSS operations in the 19.7-20.2 GHz band must accept any interference from any non-Federal or Federal station authorized to use the 19.7-20.2 GHz band. In addition, Northrop Grumman Space & Mission Systems Corporation's NGSO FSS operations in the 19.7-20.2 GHz band shall not cause harmful interference to any authorized space station operating in compliance with the Table of Allocations and the Ka-band Plan, or authorized Federal FSS GSO or NGSO system. Northrop

Grumman Space & Mission Systems Corporation shall immediately cease NGSO FSS operations in the 19.7-20.2 GHz band upon notification of such harmful interference resulting from its operations. Northrop Grumman Space & Mission Systems Corporation shall complete coordination with Federal FSS systems in the 19.7-20.2 GHz band under 47 C.F.R. § 2.106, Footnote US334 prior to the launch of its first NGSO FSS satellite in the 19.7-20.2 GHz (downlink) frequency band.

116. IT IS FURTHER ORDERED that Northrop Grumman Space & Mission Systems Corporation's NGSO FSS satellite operations in the 18.8-19.3 GHz, 19.7-20.2 GHz, 28.6-29.1 GHz, and 29.5-30.0 GHz frequency bands are subject to the sharing method with non-Federal systems specified in the Establishment of Policies and Service Rules for the Non-Geostationary Satellite Orbit, Fixed Satellite Service in the Ka-band, *Report and Order*, 18 FCC Rcd 14708 (2003).

117. IT IS FURTHER ORDERED that Northrop Grumman Space & Mission Systems Corporation must submit, no later than 30 days following the date of its Critical Design Review milestone for its NGSO satellite system, an application to modify its authorization for construction specifying its end-of-life operations for its NGSO FSS satellites.

118. IT IS FURTHER ORDERED that Northrop Grumman Space & Mission Systems Corporation IS AUTHORIZED to construct and launch four GSO FSS satellites, and to operate one satellite at each of the 125° W.L. (Call Sign S2255), 73° W.L. (Call Sign S2256), 68.5° E.L. (Call Sign S2257), and 116.5° E.L. (Call Sign S2258) orbital locations, using the 47.2-50.2 GHz (uplink) and 37.5-42.0 GHz (downlink) frequency bands on a co-primary basis; the 29.25-30.0 GHz (uplink), 28.35-28.6 GHz (uplink), 19.7-20.2 GHz (downlink), 18.3-18.8 GHz (downlink) frequency bands on a primary basis; and the 28.6-29.1 GHz band on a secondary basis; subject to the technical specifications in its applications, the Commission's rules, unless waived herein, the terms and conditions in this Order, and any technical requirements applicable to part or all of any of these frequency bands that the Commission may adopt in any future proceeding.

119. IT IS FURTHER ORDERED that Northrop Grumman Space & Mission Systems Corporation's GSO FSS satellites must not cause harmful interference to any Federal or non-Federal station authorized to operate on a primary basis in the 28.6-29.1 GHz frequency band and must accept any interference from these systems, and must terminate operations immediately upon notification of harmful interference. Further, Northrop Grumman Space & Mission Systems Corporation's operations are subject to any rules the Commission adopts governing GSO FSS satellite operations in spectrum designated for NGSO FSS primary use.

120. IT IS FURTHER ORDERED that Northrop Grumman Space & Mission Systems Corporation's request for a waiver of the Table of Allocations, 47 C.F.R. § 2.106, IS GRANTED, and Northrop Grumman Space and Mission Systems Corporation IS AUTHORIZED to operate its four GSO FSS satellites in the 18.8-19.3 GHz band on a non-conforming basis. Northrop Grumman Space and Mission Systems Corporation's GSO FSS operations in the 18.8-19.3 GHz must accept any interference from any Federal or non-Federal station authorized to use the 18.8-19.3 GHz frequency band. In addition, Northrop Grumman Space and Mission Systems Corporation's GSO FSS operations in the 18.8-19.3 GHz band shall not cause harmful interference to any authorized space station operating in compliance with the Table of Allocations and the Ka-band Plan, or authorized Federal FSS GSO or NGSO system, and shall immediately cease operations upon notification of such harmful interference resulting from its operations. Northrop Grumman Space & Mission Systems Corporation's GSO FSS operations in the 18.8-19.3 GHz band are subject to any rules the Commission adopts governing GSO FSS satellite operations in spectrum designated for NGSO FSS primary use.

121. IT IS FURTHER ORDERED that Northrop Grumman Space & Mission Systems Corporation's request for a waiver of Section 25.140(b)(2) of the Commission's rules, 47 C.F.R. § 25.140(b)(2), to permit it to operate antennas as small as 0.25 meters at the powers proposed in its application IS GRANTED subject to the condition that Northrop Grumman Space & Mission Systems Corporation notify its customers, in writing, prior to commencement of service in the 28.6-

29.1 GHz and 18.8-19.3 GHz bands on a GSO satellite, that service in these bands is being provided on a non-interference basis to other services authorized in these bands, that the service may be degraded as the result of interference from other authorized services, and that service will be terminated if Northrop Grumman Space & Mission Systems Corporation's operations cause harmful interference to any authorized service.

122. IT IS FURTHER ORDERED that, pursuant to Section 1.3 of the Commission's Rules, 47 C.F.R. § 1.3, Northrop Grumman Space & Mission Systems Corporation IS GRANTED a waiver of Sections 25.143(b)(2)(ii) and (iii), 25.145(c)(1) and (2), and 25.217(b)(1) of the Commission's Rules, 47 C.F.R §§ 25.143(b)(2)(ii) and (iii); 25.145(c)(1) and (2); and 25.217(b)(1), for purposes of using the four GSO satellites authorized in this Order to meet the geographic service area requirements applicable to its NGSO satellites.

123. IT IS FURTHER ORDERED that Northrop Grumman Space & Mission Systems Corporation IS GRANTED a waiver of Sections 25.156(d)(5), 25.157(c)(2), and 25.157(e)(2) of the Commission's rules, 47 C.F.R. §§ 25.156(d)(5), 25.157(c)(2), and 25.157(e)(2), for purposes of processing its applications.

124. IT IS FURTHER ORDERED that Northrop Grumman Space & Mission Systems Corporation's request for a waiver of Section 25.156(d)(3) of the Commission's rules, 47 C.F.R. § 25.156(d)(3), IS DISMISSED AS MOOT.

125. IT IS FURTHER ORDERED that Northrop Grumman Space & Mission Systems Corporation must coordinate its downlink operations in the 17.8-20.2 GHz band with the U.S. Federal systems, including Federal operations to earth stations in foreign countries, in accordance with Footnote US334 to the Table of Frequency Allocations, 47 C.F.R. § 2.106. In addition to meeting the terms of the coordination agreement, the non-conforming Northrop Grumman GSO operations at 18.8-19.3 GHz and NGSO operations at 19.7-20.2 GHz shall not cause harmful interference to, nor claim protection from, present and future Federal, non-Federal, International GSO and NGSO systems or any non-conforming services previously authorized on a non-harmful interference basis and shall immediately cease operations upon notification of such harmful interference resulting from its operations.

126. IT IS FURTHER ORDERED that Northrop Grumman Space & Mission Systems Corporation must abide by the terms specified in FCC News Release , DA 04-234, Report No. SPB-199 (May 28, 2002) ("FCC and Industry Canada Sign Arrangement on Principles Governing Use of 37.5-42.5 GHz Band").

127. IT IS FURTHER ORDERED that Northrop Grumman Space & Mission Systems Corporation may not begin V-band downlink operations in the 37.5-38.0 GHz and 40.0-40.5 GHz frequency bands until it has successfully coordinated these operations with Federal Systems Space Research Service (SRS) facilities, pursuant to Recommendation ITU-R SA 1396, "Protection Criteria for the Space Research Service in the 37-38 GHz and 40-40.5 GHz Bands."

128. IT IS FURTHER ORDERED that Northrop Grumman Space & Mission Systems Corporation must coordinate with Federal operations in the 37.5-38.6 GHz, 39.5-41.0 GHz, and 48.2-50.2 GHz frequency bands through the Interdepartmental Radio Advisory Committee and its Frequency Assignment Subcommittee.

129. IT IS FURTHER ORDERED that Northrop Grumman Space & Mission Systems Corporation must operate its NGSO FSS satellites in the 37.5-42.0 GHz band consistent with the power flux-density requirements of 47 C.F.R. § 25.208(r), (s), and (t) and Article 21 of the International Telecommunication Union Radio Regulations.

130. IT IS FURTHER ORDERED that Northrop Grumman Space & Mission Systems Corporation must operate its GSO FSS satellites in the 37.5-42.0 GHz band consistent with the power flux-density requirements of 47 C.F.R. § 25.208(q), (s), and (u) and Article 21 of the

International Telecommunication Union Radio Regulations.

131. IT IS FURTHER ORDERED that Northrop Grumman Space & Mission Systems Corporation must operate its GSO and NGSO FSS satellites in the 18.8-19.3 GHz band consistent with the power flux-density requirements of 47 C.F.R. § 25.208(e) and Article 21 of the International Telecommunication Union Radio Regulations.

132. IT IS FURTHER ORDERED that Northrop Grumman Space & Mission Systems Corporation must operate its 125° W.L., 73° W.L., 68.5° E.L., and 116.5° E.L. GSO FSS satellites in the 18.3-18.8 GHz band consistent with the power flux-density requirements of §§ 47 C.F.R. 2.106, fn.US255, 47 C.F.R. 25.138(a)(6), 47 C.F.R. 25.208(c), and 47 C.F.R. 25.208(d).

133. IT IS FURTHER ORDERED that Northrop Grumman Space & Mission Systems Corporation must operate its 125° W.L., 73° W.L., 68.5° E.L., and 116.5° E.L. GSO FSS satellites in the 19.7-20.2 GHz, 28.35-28.6 GHz, 29.25-30.0 GHz bands consistent with the power flux-density requirements of 47 C.F.R. § 25.138(a)(6).

134. IT IS FURTHER ORDERED that Northrop Grumman Space & Mission Systems Corporation must operate its NGSO FSS satellites in the 19.7-20.2 GHz and 29.5 -30.0 GHz bands at least 15 dB below the equivalent power flux-density requirements of Article 22 of the International Telecommunication Union Radio Regulations.

135. IT IS FURTHER ORDERED that Northrop Grumman Space & Mission Systems Corporation's use of beacons intended for uplink power control in the 29.999-30.0 GHz band shall not exceed an equivalent isotropically radiated power of +10 dBW in the direction of adjacent satellites on the geostationary-satellite orbit in accordance with Article 5, Footnote 5.538 (WRC-2007) of the ITU Radio Regulations.

136. IT IS FURTHER ORDERED that, in accordance with International Telecommunication Union Resolution 750, Northrop Grumman Space & Mission Systems Corporation must operate its earth stations transmitting to GSO and NGSO FSS satellites in the 49.7-50.2 GHz band so that the level of unwanted emissions from the transmit power density at the input of a fixed-satellite service earth station antenna in the band 49.7-50.2 GHz falling into the 50.2-50.4 GHz EESS (Passive) band shall not exceed -20 dBW/200 MHz for VSAT/user-type terminals and -10 dBW/200 MHz for gateway/Hub applications under clear sky conditions. During fading conditions, these transmit power density levels can be exceeded by the amount that is needed to maintain link availability during fading conditions. Northrop Grumman Space & Mission Systems Corporation's operations in the 49.7-50.2 GHz band will be subject to any other service rules that the Commission adopts for this band.

137. IT IS FURTHER ORDERED that Northrop Grumman Space & Mission Systems Corporation must coordinate its NGSO FSS satellite system in the 19.7-20.2 GHz band with specific earth stations in geostationary-satellite networks in the fixed-satellite service that are located within the United States for domestic service or outside the United States for international service, under No. 9.7A of Article 9 of the International Telecommunication Union Radio Regulations.

138. IT IS FURTHER ORDERED that Northrop Grumman Space & Mission Systems Corporation must coordinate its operations in the 48.94-49.04 GHz band with radio astronomy stations operating on a co-primary basis in this band.

139. IT IS FURTHER ORDERED that Northrop Grumman Space & Mission Systems Corporation must coordinate its operations in the 18.3-18.4 GHz band with the meteorological satellite service, which is authorized to operate GSO satellites on a co-primary basis in this band in Regions 1 and 3.

140. IT IS FURTHER ORDERED that Northrop Grumman Space & Mission Systems Corporation's operations in the 37.5-40.0 GHz (downlink) and 47.2-48.2 GHz (uplink) frequency bands are limited to communications with gateway earth stations, in accordance with Footnote 15 of

47 C.F.R. §25.202(a)(1).

141. IT IS FURTHER ORDERED that Northrop Grumman Space & Mission Systems Corporation, in accordance with 47 C.F.R § 25.210(k), must, within 30 days after preliminary in-orbit testing is completed, submit antenna measurements of both co-polarized and cross-polarized performance on all antennas employed by space stations both within the primary coverage area and outside the primary coverage area.

142. IT IS FURTHER ORDERED that Northrop Grumman Space & Mission Systems Corporation, in accordance with 47 C.F.R § 25.111(b), must prepare the necessary information for submission to the ITU to initiate and complete the advance publication, international coordination, due diligence, and notification process of this satellite system, in accordance with the International Telecommunication Union Radio Regulations. This information must include, but is not limited to, providing the Satellite Division a copy of all operator-to-operator summary records and/or coordination arrangements obtained from all coordination meetings with foreign commercial satellite operators. This information should be submitted with a request for confidential treatment and Administration-to-Administration approval. Northrop Grumman Space & Mission Systems Corporation shall be held responsible for all cost recovery fees associated with these ITU filings. No protection from interference caused by radio stations authorized by other administrations is guaranteed unless coordination and notification procedures are timely completed or, with respect to individual administrations, by successfully completing coordination agreements. Any radio station authorization for which coordination has not been completed may be subject to additional terms and conditions as required to effect coordination of the frequency assignments of other administrations.

143. IT IS FURTHER ORDERED that Northrop Grumman Space & Mission Systems Corporation must maintain an electronic web site bulletin board to list the satellite ephemeris data, for each satellite in the Ka-band (and V-band) NGSO constellation, using the North American Aerospace Defense Command (NORAD) two-line orbital element format. The orbital elements shall be updated at least once every three days.

144. IT IS FURTHER ORDERED, that by March 26, 2009, Northrop Grumman Space & Mission Systems Corporation must file a certification with the Satellite Division that demonstrates, based on computer simulation software developed in accordance with specifications outlined in ITU-R Recommendation S.1503-1, the maximum uplink EPFD limits calculated for its NGSO satellites satisfy the requirements of Article 22 of the International Telecommunication Union Radio Regulations.

145. IT IS FURTHER ORDERED that the license term for each GSO FSS and NGSO FSS space station is fifteen years, as set forth in 47 C.F.R. § 25.121.

146. IT IS FURTHER ORDERED that Northrop Grumman Space & Mission Systems Corporation, in accordance with 47 C.F.R § 25.210(l), must file an annual report describing the status of satellite construction and anticipated launch date, and a detailed description of the use made of each of its in-orbit satellites. Northrop Grumman Space & Mission Systems Corporation must file this report on June 30 of each year, containing information current as of May 31 of that year.

147. IT IS FURTHER ORDERED that Northrop Grumman Space & Mission Systems Corporation's authorization to construct an NGSO satellite constellation shall become NULL and VOID, with no further action on the Commission's part, in the event its space stations are not constructed in accordance with the technical parameters and terms and conditions of this authorization by the following dates:

Milestone	Deadline
Enter Non-contingent Satellite Manufacturing Contract for System	February 24, 2010
Complete Critical Design Review of System	February 24, 2011

Begin Physical Construction of First NGSO Satellite

August 24, 2011

148. IT IS FURTHER ORDERED that each of Northrop Grumman Space & Mission Systems Corporation's four authorizations to construct, launch, and operate GSO satellites at the 125° W.L., 73° W.L., 68.5° E.L., and 116.5° E.L. orbital locations shall become NULL and VOID, with no further action on the Commission's part, in the event the space station at issue is not constructed, launched, and placed into operation in accordance with the technical parameters and terms and conditions of this authorization by the following dates:

Milestone	Deadline
Enter Non-contingent Satellite Manufacturing Contract	February 24, 2010
Complete Critical Design Review	February 24, 2011
Begin Physical Construction	February 24, 2012
Launch and Operate	February 24, 2014

149. IT IS FURTHER ORDERED, that Northrop Grumman Space and Mission Systems Corporation's request for a partial waiver of the Commission's bond requirement, 47 C.F.R. § 25.165, IS DENIED. Northrop Grumman Space & Mission Systems Corporation must file bonds in the amounts of \$5 million for the NGSO system and \$3 million for each of the four GSO satellites, pursuant to the procedures set forth Section 25.165 of the Commission's rules, 47 C.F.R. § 25.165, within 30 days of the release date of this Order.

150. IT IS FURTHER ORDERED that Northrop Grumman Space & Mission Systems Corporation is afforded thirty days from the date of the release of this order and authorization to decline this authorization as conditioned. Failure to respond within that period will constitute formal acceptance of the authorization as conditioned.

151. This Order is issued pursuant to Section 0.261 of the Commission's rule on delegated authority, 47 C.F.R. § 0.261, and is effective upon release.

FEDERAL COMMUNICATIONS COMMISSION

John V. Giusti
Acting Chief
International Bureau