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

In the Matter of:	)	
AERONAUTICAL RADIO INC.	)	File No. SES-LIC-20030910-01261, Call Sign E030205
Application for Blanket Authority to Operate Aboard Aircraft Up To 1000 Technically-Identical Transmit and Receive Mobile Earth Stations in the 11.7-12.2 and 14.0-14.5 GHz Frequency Bands	)	

To: The Commission

COMMENTS OF THE BOEING COMPANY

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November 14, 2003

SUMMARY

The Boeing Company ("Boeing"), licensee of the Connexion by Boeing[SM] system, hereby submits these comments on the Aeronautical Mobile-Satellite Service ("AMSS") earth station application filed by Aeronautical Radio Inc. ("ARINC") for its proposed SKYLink system. The SKYLink application, as well as the Commission's recent allocation of the 14.0-14.5 GHz band to the Mobile-Satellite Service, including AMSS, on a secondary basis (which implements domestically the international AMSS allocation adopted at the 2003 World Radiocommunication Conference), confirm the strong demand for these innovative broadband communications services in the United States and around the world.

Boeing fully supports the entry of competitive AMSS service providers in the Ku-band. As discussed more fully herein, however, additional technical information is required concerning certain aspects of the SKYLink system in order to conclude that ARINC's proposed operations would be consistent with the Commission's AMSS licensing precedent and Recommendation ITU-R M.1643, and would adequately protect co-frequency operations in the 14.0-14.5 GHz band. In particular, the SKYLink system's contention protocol and off-axis e.i.r.p. management schemes raise questions regarding the potential for harmful interference to other operations in the 14.0-14.5 GHz band. Accordingly, in the context of this and future AMSS licensing proceedings, Boeing urges the Commission to establish a level regulatory playing field and ensure that all AMSS systems are designed and operated with the same commitment to protecting other authorized users of the Ku-band as the Connexion system.

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COMMENTS OF THE BOEING COMPANY

The Boeing Company ("Boeing"), by its attorneys, hereby submits these comments on the above-captioned blanket aircraft earth station ("AES") application filed by Aeronautical Radio Inc. ("ARINC").[1] Boeing fully supports the entry of multiple Aeronautical Mobile-Satellite Service ("AMSS") service providers in the 11.7-12.2 GHz and 14.0-14.5 GHz bands (collectively, the Ku-band), as reflected in the Comments it recently filed in support of its rulemaking petition to adopt licensing and service rules for such systems.[2] As discussed more fully below, however, additional technical information is required with respect to certain aspects

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[1] *See* Aeronautical Radio Inc., Application for Blanket Authority to Operate Aboard Aircraft Up To 1000 Technically-Identical Transmit and Receive Mobile Earth Stations in the 11.7-12.2 and 14.0-14.5 GHz Frequency Bands, File No. SES-LIC-20030910-01261, Call Sign E030205 (Sept. 2, 2003) ("*ARINC Application*").

[2] *See* Comments of The Boeing Company, filed in RM No. 10800, Amendment of Parts 2 and 25 of the Commission's Rules To Allocate Spectrum in the 14-14.5 GHz Band to the Aeronautical Mobile-Satellite Service ("AMSS") and To Adopt Licensing Rules for AMSS Operations in the Ku-Band, (Nov. 3, 2003).

of ARINC's proposed AMSS operations in order to determine whether such operations can be performed in a manner that adequately protects other authorized users of the Ku-band.

I. BACKGROUND

Boeing is the leading proponent of real-time, two-way advanced broadband satellite communications services for commercial, government and private aircraft customers through its Connexion by Boeing[SM] ("Connexion") service.[3] In developing the Connexion service, Boeing has devoted substantial resources to establishing the technical basis, operational infrastructure and regulatory framework, as well as the business case, for broadband communications to aircraft.[4] Boeing views the existence of another U.S. provider seeking to offer Ku-band AMSS services in the United States -- in the form of ARINC's proposed SKYLink service -- as additional confirmation of the strong demand for these innovative communication services.

Boeing has worked closely with the Commission, other U.S. government departments and interested parties over the last several years to facilitate the domestic licensing of the Connexion system, and to develop the international regulatory framework to permit AMSS

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[3] *See* Radio Station Authorization, Call Sign E000723, File No. SES-MOD-20020308-00429; *see also The Boeing Company,* Order and Authorization, 16 FCC Rcd. 22645 (Int'l Bur./OET 2001) (blanket license to operate 800 phased array antenna earth stations on-board aircraft within the United States)("*Connexion Transmit/Receive Order*"). A modification application to substitute 675 phased array antennas with a like number of reflector antennas with improved operational characteristics remains pending before the Commission. *See* Boeing Application to Modify Blanket Authorization to Operate up to Eight Hundred Technically Identical Transmit and Receive Mobile Earth Stations Aboard Aircraft in the 11.7-12.2 and 14.0-14.5 GHz Frequency Bands, File No. SES-MOD-20030512-00639 (filed May 12, 2003).

[4] Boeing already has achieved significant commercial progress in launching this new broadband service, with the signing of several international airline carriers, such as Lufthansa, Scandinavian Airlines System ("SAS"), All Nippon Airways ("ANA"), Japan Airlines ("JAL"), and most recently Singapore Airlines ("SIA"), to install Connexion service on their long-haul aircraft, and has teamed with Rockwell Collins to bring high-speed connectivity to the business aviation market. In addition, Boeing has recently entered into agreements with several satellite operators to extend its Connexion service around the world.

operations worldwide in the Ku-band.[5] In addition, Boeing filed with the Commission a petition for rulemaking to adopt licensing and service rules for Ku-band AMSS systems,[6] which remains pending; and the Commission recently implemented domestically the secondary AMSS allocation in the 14.0-14.5 GHz band adopted at the 2003 World Radiocommunication Conference ("WRC-03").[7] Thus, an appropriate domestic regulatory framework is currently being developed to regularize the licensing of Ku-band AMSS systems.

In the interim, and indeed even after the adoption of AMSS service rules, the Commission's licensing of AMSS operations in the Ku-band should ensure that all AMSS providers compete on a level regulatory playing field, and that proposed AMSS operations adequately protect co-frequency operations in the Ku-band. In licensing the Connexion system, the Commission established certain standards and conditions for authorizing Ku-band transmit/receive AMSS operations, and ARINC's blanket AES application should be evaluated under similar standards and conditions. Specifically, ARINC must demonstrate that its proposed SKYLink system affords adequate protection to other co-frequency operations in the Ku-band, including other AMSS systems.

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[5] *See, e.g.,* Recommendation ITU-R M.1643 on the "Technical and Operational Requirements for Aircraft Earth Stations of Aeronautical Mobile-Satellite Service Including Those Using Fixed-Satellite Service Network Transponders in the Band 14-14.5 GHz (Earth-to-space);" *see also* Provisional Final Acts of WRC-03, Article 5 (adopting an international AMSS allocation by removing the exclusion against aeronautical mobile-satellite in the existing secondary Mobile-Satellite Service ("MSS") (Earth-to-space) allocation at 14.0-14.5 GHz).

[6] *See Petition for Rulemaking*, Amendment of Parts 2 and 25 of the Commission's Rules To Allocate Spectrum in the 14-14.5 GHz Band to the Aeronautical Mobile-Satellite Service ("AMSS") and To Adopt Licensing Rules for AMSS Operations in the Ku-Band, RM No. 10800, filed by The Boeing Company (July 21, 2003).

[7] *See* Amendment of Parts 2, 25, and 87 of the Commission's Rules to Implement Decisions from World Radiocommunication Conferences Concerning Frequency Bands Between 28 MHz and 36 GHz and to Otherwise Update the Rules in this Frequency Range, ET Docket No. 02-305, FCC 03-269 (rel. Nov. 4, 2003) at ¶¶ 72-78 and App. B.

II. ADDITIONAL TECHNICAL INFORMATION IS REQUIRED TO EVALUATE FULLY ARINC'S PROPOSED KU-BAND AMSS OPERATIONS

ARINC seeks to operate up to 1000 technically identical transmit and receive AESs in Ku-band frequencies to provide its proposed SKYLink service to passengers and crew of commercial airlines, corporate business jets and other aircraft owners.[8] As part of its application, ARINC includes a technical appendix describing its proposed AMSS system, including a discussion of its system components, network management, spectrum usage, and protection of Fixed-Satellite Service ("FSS") operations and other co-frequency operations in the Ku-band.[9]

Boeing's review of ARINC's application suggests that additional information concerning certain aspects of its proposed operations is necessary to evaluate fully the SKYLink system, and to ensure that the proposed system will operate in accordance with the Commission's requirements, as set forth in the *Connexion Transmit/Receive Order*, for AMSS operations. The specific technical issues needing further information or clarification are outlined below.

A. Contention Protocols

The SKYLink system uses contention protocols for both return link acquisition (*i.e.*, AES login)[10] and AES data transmissions.[11] In contrast, the Connexion system uses a transmit-on-command system to maintain positive control of AES transmissions at all times. It is not clear that the contention protocol access scheme described in ARINC's application is consistent with Commission precedent and Recommendation ITU-R M.1643, or will afford adequate protection to co-frequency operations in the 14.0-14.5 GHz band.

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[8] *See generally ARINC Application.*

[9] *See id.* at Exh. 3 ("Technical Description").

[10] *See* Technical Description at 7.

[11] *See id.* at 8, 45.

Boeing's concerns regarding the potential for harmful interference caused by the SKYLink system are fundamentally two-fold. First, as an authorized user of the 14.0-14.5 GHz band that utilizes Ku-band FSS satellite capacity to provide service, Boeing is concerned about the effects of harmful interference on its service offerings. Second, because of the potential difficulty of identifying an AES that may be causing interference, Boeing is concerned that an affected FSS satellite operator may look to all AMSS systems to alter their operations in the event of a harmful interference event.

The Commission has authorized use of the 14.0-14.5 GHz uplink band by mobile-satellite terminals on both a secondary and non-conforming use basis.[12] For example, in 1989, the Commission authorized Qualcomm, Inc. to operate OmniTRACS land mobile-satellite earth stations on a secondary basis in the Ku-band.[13] In addressing the requirement to avoid interference into primary FSS operations, the Commission stated:

> rather than placing a strict numerical limit on mobile terminal operations, we will permit Qualcomm to operate any number of mobile units simultaneously provided that the deterministic aggregate adjacent satellite interference potential does not exceed, at any time, that which would be caused by a single earth station operating with a power into the antenna of -14 dBW/4 KHz and an antenna that complies with the sidelobe requirements of Section 25.209(a) of the Commission's rules for all angles along the visible portion of the geostationary-satellite orbit. *Finally, to ensure that the aggregate adjacent satellite interference is controlled, we condition Qualcomm's operations to require that individual mobile units may transmit only on command from the hub terminal via the forward link . . . .*[14]

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[12] Because secondary and non-conforming uses of the 14.0-14.5 GHz band must not cause harmful interference to primary FSS operations in the band, precedent relating to both categories of services are equally applicable.

[13] Qualcomm, Inc., *Memorandum Opinion, Order and Authorization*, 4 FCC Rcd 1543 (1989) (authority to operate 20,000 OmniTRACS earth stations); *see also* Qualcomm, Inc., *Order and Authorization,* 6 FCC Rcd 735 (1991) (authority to operate an additional 20,000 OmniTRACS earth stations on the same terms and conditions as set forth in the original license).

[14] Qualcomm, Inc., 4 FCC Rcd 1543 (1989) at ¶17 (emphasis added).

This transmit-on-command requirement was included as an explicit condition in the OmniTRACS authorization.[15]

Boeing adopted a similar transmit-on-command approach for the Connexion system -- it maintains positive control over AESs at all times and allows them to transmit only when authorized. Indeed, the Commission specifically found that Boeing would be able to prevent harmful interference to authorized users of the Ku-band by using its "Network Operation Control center to restrict the number of airborne terminals operating concurrently and also to control their maximum data rates, power levels and other relevant factors."[16] This positive control/transmit-on-command requirement was memorialized in the ordering clauses of the Connexion authorization.[17] This approach was also repeatedly discussed during the ITU study group process for evaluating AMSS operations, and is reflected in Recommendation ITU-R M.1643, Annex 1 (Part A, Section 4) as follows: "AES should be subject to the monitoring and control by an NCMC or equivalent facility. AES must be able to receive at least 'enable transmission' and 'disable transmission' commands from the NCMC."[18]

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[15] *See id.*, ¶ 22(f) ("Individual mobile units are not permitted to transmit unless commanded to do so from the hub terminal via the satellite forward link. . . .").

[16] *See Connexion Transmit/Receive Order* at ¶ 17.

[17] *See id.*, ¶ 19(h)(3) ("AMSS mobile terminals [shall be] monitored and controlled by a ground-based Network Control and Monitoring Center ("NCMC") or equivalent facility"); ¶ 19(h)(4.1) (AMSS mobile terminals shall "be able to receive at least 'enable transmission' and 'disable transmission' commands from the NCMC"); and ¶ 20 (Boeing shall operate its "transmit and receive AMSS stations in the 14.0-14.5 GHz and 11.7-12.2 GHz bands, consistent with the technical parameters specified in its application and supporting documents, and the conditions set forth in this Order").

[18] *See* Recommendation ITU-R M.1643 at Annex 1 (Part A, Section 4).

Certain aspects of ARINC's contention protocol approach appear to underscore Boeing's concerns. For example, the SKYLink system's login protocol allows an AES to transmit a login burst at any time once it receives the forward link.[19] If the AES is not acknowledged by the Network Management System ("NMS"), it increases its power and tries again.[20] However, if some failure prevents the AES login transmission from being received by the NMS, there will be no record of the transmission and the AES may continue to transmit at up to the maximum power of the terminal for an unknown period of time (potentially indefinitely). It is also not clear how the off-axis e.i.r.p. of the AESs attempting to login is treated in the overall aggregate power determination for the SKYLink system since the NMS cannot be aware of which or how many AESs may be attempting to login at any given time, and will become aware of such AESs only once they have successfully logged in.

The contention protocol access scheme used for data transmissions raises similar concerns. This scheme allows an AES that has been logged in and acknowledged by the NMS to transmit user data in burst mode over the return link without receiving an individual "enable transmission" command.[21] Although ARINC suggests that it can monitor and control traffic in real time,[22] it appears that the NMS may not be able to react quickly enough before a transmission burst is over (*e.g.*, if the burst duration is shorter than the NMS reaction time). Because the SKYLink NMS seems to adjust AES operations only after potentially offending transmissions have occurred, this approach may result in interference to other users of the band.

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[19] *See* Technical Description at 7.

[20] *Id.*

[21] *See id.* at 10-11, 45.

[22] *See id.* at 10-11.

In the contention protocol approach proposed by ARINC, control of AES duty cycles is essential to maintaining control over the number of AESs transmitting at one time. ARINC's application, however, does not appear to address critical questions relating to the use of these duty cycles.[23] For example, does the SKYLink system exert any control on the duty cycle of an AES attempting to log in? How does the SKYLink system control the duty cycle of its AESs during normal operations and what is a typical duty cycle? How is duty cycle control affected by constant bit rate applications such as streaming media or video teleconferencing?

Finally, the ability of an AMSS system to locate and isolate a malfunctioning terminal was a significant issue raised in Boeing's transmit/receive licensing proceeding.[24] At that time, Boeing noted that burst mode operations are more likely to lead to transient interference events that are difficult to identify.[25] ARINC should address the special circumstances of locating a malfunctioning terminal that is mobile and intermittently transmitting in burst mode.

Therefore, the Commission should require that ARINC provide additional information regarding its proposed approach to network management and, in particular, how its contention protocol scheme is consistent with FCC precedent governing the control of transmissions from mobile terminals in the 14.0-14.5 GHz band and Recommendation ITU-R M.1643.

B. Aggregate Off-Axis E.I.R.P.

Certain aspects of ARINC's application regarding control of aggregate off-axis e.i.r.p. also require additional clarification. For example, it is not clear that the SKYLink system

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[23] *See id.* at 10-11.

[24] *See Comments of PanAmSat Corporation*, FCC File No. SES-LIC-20001204-02300 (Mar. 23, 2001).

[25] *See Response of The Boeing Company*, FCC File No. SES-LIC-20001204-02300 (April. 5, 2001).

accounts for antenna mis-pointing and e.i.r.p. variation in the calculation of off-axis e.i.r.p.[26] Indeed, the off-axis e.i.r.p. masks shown in Figures 5-1 and 5-2 of the Technical Description apparently only account for the 10.25 dB reduction necessary to make an AES with perfect pointing and e.i.r.p. control comply with the off-axis e.i.r.p. mask.[27] ARINC suggests that it takes these factors into account and points to other sections of the Technical Description where pointing error and the power control loop resolution are quantified,[28] but these sections do not describe how the above-referenced errors are accounted for in the calculation of off-axis e.i.r.p. Failure to account for these variables would be inconsistent with Annex 1 (Part A, Section 2) of Recommendation ITU-R M.1643, as well as the Commission's AMSS licensing precedent.[29]

The underlying treatment of antenna mis-pointing and e.i.r.p. variation errors also merits consideration. The total root mean square ("rms") pointing error of less than 0.1° does not appear to be plausible for the pointing scheme proposed for SKYLink. This value apparently only includes the resolution of the inertial navigation system ("INS") data and the control resolution of the mechanical pointing system. The pointing error value does not account for the accuracy of the INS data or other factors such as the accuracy of the installation/calibration process, or the aircraft body bending between the antenna and the INS installation, etc. Boeing estimates that the actual rms pointing error would be several times greater than the given value based on its evaluation of similar systems.[30]

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[26] *See id.* at 45.

[27] *See id.* at 43-44.

[28] *See id.* at 44; *see also id.* at 5-6, 16 (Sections 2.2.1.3 and 3.1.3.2).

[29] *See* Recommendation ITU-R M.1643 at Annex 1 (Part A, Section 2); *see also Connexion Transmit/Receive Order* at ¶ 19(h)(5).

[30] For comparison purposes, the Boeing reflector antenna has a pointing error of 0.25

Likewise, the link budgets provided by ARINC in Section 4 of the Technical Description show an e.i.r.p. variation of more than 3 dB from location to location for the same data rate, and ARINC recognizes this variation in Section 5.2.1.2.[31] However, it remains unclear how this variation is accounted for in the e.i.r.p. aggregation. In equation (2) in Section 3.3.1, which ARINC uses to compute the aggregate power spectral density ("PSD"), the number of users for each data rate is multiplied by a constant PSD value for each data rate. This treats every user at a given data rate as having the same PSD and thus makes no allowance for e.i.r.p variation.

In addition, ARINC must account for the accuracy with which it knows the e.i.r.p. of its AESs. Section 2.4.4 of the Technical Description states that the receive Eb/No at the earth station can be used as a measure of the AES e.i.r.p. because the NMS knows the location of the AES within the satellite G/T pattern. A similar statement is made regarding the determination of AES e.i.r.p. in Section 5.2.1.2. This is a valid means of estimating the AES e.i.r.p., but it is subject to many errors that must be accounted for in the aggregation. The tolerance build up from each element of the link budget used to "reverse calculate" the AES e.i.r.p. for received Eb/No must be evaluated, and the errors in individual error terms may be substantial. In considering satellite G/T, for example, many satellite operators will only guarantee satellite G/T to +/- 2 dB. While the gain component of G/T is generally constant, the temperature component undergoes diurnal, seasonal, and lifetime variation. Interference from adjacent satellite systems

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degrees in azimuth despite having a beam width that is one third that of the SKYLink antenna and employing a more sophisticated pointing system that includes local rate gyros mounted near the antenna to augment INS data. The use of the local rate gyros greatly reduces the effects of latency in the INS data and body bending between the antenna and the INS installation.

[31] The ARINC link budgets do not include the considerable variation due to rain loss if the system were used on the ground, as might be expected of some business jet customers who use their aircraft as a mobile office when traveling. This practice will likely increase with the availability of high-speed Internet access on business jets.

can also change the effective noise temperature of the satellite receiver on an unpredictable basis.[32] Since the temperature term of G/T is common to the calculation of the e.i.r.p. of all AES, an error or 2 dB will cause the entire aggregate to be off by 2 dB (the errors are not statistically independent so cannot be statistically aggregated across many different transmitters). Boeing estimates that the actual e.i.r.p. error for the SKYLink system would be several dB based on its evaluation of similar systems.[33]

Lastly, the SKYLink system employs a Paired Carrier Multiple Access ("PCMA") scheme whereby the forward and return links operate co-frequency in the same transponder.[34] While the off-axis e.i.r.p of the forward uplink emissions from the earth station aggregates with the return uplink emissions from the AESs, it is not clear that ARINC is including the forward uplink off-axis e.i.r.p. in the system aggregate.

C. Other Technical Issues

Several other technical questions arise in connection with ARINC's proposed AMSS operations that require further clarification and review. These issues are discussed below.

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[32] The effect of interference on a system employing "reverse calculation" and closed loop power control creates another potential interference situation. If, for example, a mis-pointed satellite news gathering ("SNG") truck or a mis-installed VSAT were to commence operating in the SKYLink transponder, the AES received Eb/No would be degraded and the closed loop power control system would increase the AES e.i.r.p. to compensate. This would cause the aggregate off-axis e.i.r.p. to rapidly exceed the off-axis limits, unless a real time measurement of satellite receiver noise temperature is made to catch such interference incidents.

[33] When first conceived, the Boeing AMSS system used a reverse calculation method to estimate the AES e.i.r.p. While Boeing determined that such a system is technically feasible, it also found that accounting for the errors inherent in this method would reduce its system capacity by several dB. Boeing also found that it was necessary to measure the satellite receiver noise temperature in real time to account for interference into the Boeing system from adjacent satellite systems. Ultimately, Boeing abandoned this method in favor of having the AESs directly report their e.i.r.p. to the Network Operation Control center ("NOC"), which proved to be much more accurate.

[34] *See* Technical Description at 2.

With respect to the SKYLink system's approach to AES power control, there is no indication of the power control cycle update rate in the application, which affects the ability of the system to control adequately AES transmit power.[35] In addition, ARINC suggests that the SKYLink system controls interference to a confidence level of 99.999%, but the Technical Description also states that the peak number of simultaneous transmissions "is less than capacity 99% of the time."[36] The relationship between these two claims is not entirely clear.

Additional information on the SKYLink system's spectrum usage is also necessary. Figure 3-3 provides information concerning the use of two 14.4 MHz channels corresponding to the 32 kpbs waveform.[37] However, what is the band plan when alternative transmissions are used (*e.g.*, the 28.8 MHz waveform for the 64 and 128 kpbs data rate)?

There are also certain inconsistencies in the ARINC Application that hinder a full evaluation of the proposal. For example, in Section 5.2.1 of the Technical Description, input power spectral density to the antenna and e.i.r.p. appear to be confused.[38] In particular, the aggregate input power spectral density of -24.25 dBW/4kHz is referred to as aggregate e.i.r.p., and Figures 5-1 and 5-2 are in units of input PSD rather than e.i.r.p. spectral density. In addition, ARINC's power flux density calculations included in Sections 5.2.2 and 5.2.4 of the Technical Description to demonstrate compatibility with the terrestrial Fixed Service and Radio Astronomy Service appear to be off by about 30 dB.[39] The SKYLink system will likely require operational

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[35] *See id.* at 8-9.

[36] *See id.* at 10-11.

[37] *See id.* at 18.

[38] *See id.* at 42-45.

[39] *See id.* at 46-49.

limitations in the vicinity of radio astronomy sites, additional frequency off-set from the radio astronomy band, and possibly additional filtering to meet the radio astronomy PFD limits. Clarification is needed with respect to these inconsistencies.

III. THE COMMISSION SHOULD DESIGNATE THE ARINC APPLICATION PROCEEDING AS "PERMIT-BUT-DISCLOSE" UNDER THE COMMISSION'S *EX PARTE* RULES

Given the significant technical and policy issues raised in the ARINC Application, Boeing requests that this proceeding be designated as "permit-but-disclose" under the Commission's *ex parte* rules.[40] In particular, the public interest would be served by "permit-but-disclose" communications between the Commission and interested parties because the complex issues implicated by the ARINC Application will likely require additional comment and consideration beyond that afforded in the standard application pleading cycle. Moreover, in the absence of comprehensive AMSS licensing and service rules, the Commission's determinations with respect to the ARINC Application could impact ongoing and future AMSS licensing proceedings. Finally, because the issues raised in this proceeding may overlap issues raised in RM-10800 (the AMSS rulemaking proceeding), which is a "permit-but-disclose" proceeding, grant of this request would be consistent with FCC precedent.[41]

IV. THE COMMISSION SHOULD INCLUDE CONDITIONS IN ANY ARINC AMSS AUTHORIZATION CONSISTENT WITH THOSE IMPOSED ON BOEING'S CONNEXION SERVICE

When the Commission authorized Boeing to conduct Ku-band AMSS transmit/receive operations in December 2001, it imposed detailed system design and operating conditions on the

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[40] 47 C.F.R. § 1.1200, *et seq.*

[41] *See, e.g., Application of COMSAT Corporation*, Order, 12 FCC Rcd 11618 (Int'l Bur. 1997).

Connexion system.[42] Until the Commission adopts comprehensive AMSS licensing and service rules that would replace such license-specific conditions, it must impose licensing conditions on future Ku-band AMSS licensees similar to those included in the Connexion authorization.

In particular, Boeing urges the Commission to adopt system design and operating conditions for the SKYLink system that adequately protect other authorized users of the Ku-band. These conditions should include the off-axis e.i.r.p. envelope and positive control/ transmit-on-demand requirements embodied in the *Connexion Transmit/Receive Order*, Recommendation ITU-R M.1643 and other Commission precedent. In addition, ARINC should be required to coordinate its proposed operations with the National Science Foundation ("NSF") to protect radio astronomy operations,[43] and with the National Aeronautics and Space Administration ("NASA") to protect space research operations.[44] Finally, prior to commencing commercial operations, ARINC should be required to submit a report verifying its ability to comply with all AMSS license conditions imposed by the Commission.[45]

Adopting these and related AMSS licensing conditions in the context of authorizing ARINC's proposed operations will ensure that the SKYLink system can share spectrum

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[42] *See Connexion Transmit/Receive Order* at ¶ 19.

[43] *See supra* at 12-13 (discussing the SKYLink system's power flux density calculations and protection of radio astronomy sites).

[44] *See Connexion Transmit/Receive Order* at ¶¶ 6, 19(f); *see also* Amendment of Parts 2, 25, and 87 of the Commission's Rules to Implement Decisions from World Radiocommunication Conferences Concerning Frequency Bands Between 28 MHz and 36 GHz and to Otherwise Update the Rules in this Frequency Range, ET Docket No. 02-305, FCC 03-269 (rel. Nov. 4, 2003) at ¶¶ 76 (citing to a July 2002 Memorandum of Understanding between the Commission and NTIA requiring the Commission to impose conditions to protect U.S. Government radio astronomy and space research operations on future AMSS licensees).

[45] *See id.*, ¶ 19(h)(5).

successfully with other authorized users of the Ku-band. It also will ensure that all Ku-band AMSS providers operate on a level regulatory playing field.

V. CONCLUSION

As both a user of Ku-band FSS satellite capacity and as an AMSS licensee that has carefully designed its system to protect co-frequency operations in accordance with FCC precedent and relevant ITU provisions, Boeing urges the Commission to ensure that the SKYLink system is implemented with a similar commitment to protecting other authorized users of the Ku-band. Additional technical information is required on certain aspects of the SKYLink system in order to conclude that ARINC's proposed operations would be consistent with the Commission's AMSS licensing precedent and Recommendation ITU-R M.1643, and would adequately protect co-frequency operations in the 14.0-14.5 GHz band.

Respectfully submitted,

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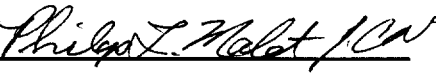
By: 

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CERTIFICATE OF SERVICE

I, Carlos M. Nalda, hereby certify that copies of the foregoing Comments of the Boeing Company were served via first-class mail, postage prepaid, upon the following:

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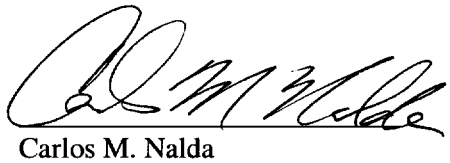

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