Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matters of	)	
	)	
Row 44, Inc.	)	FCC File Nos.
	)	
Application For Authority To Operate Up To 1,000 Technically-Identical Aeronautical-Mobile Satellite Service Transmit/Receive Earth Stations Aboard Commercial And Private Aircraft	)	SES-LIC-20080508-00570; SES-AMD-200800619-00826; SES-AMD-20080819-01074; SES-AMD-20080829-01117; Call Sign: E080100
	)	
Application for Special Temporary Authority	)	SES-STA-20080711-00928; Call Sign: E080100
	)	
Application for Special Temporary Authority	)	SES-STA-20080811-01049; Call Sign: E080100

SUPPLEMENT TO PETITION TO DENY OF VIASAT, INC.

John P. Janka
Jarrett S. Taubman
LATHAM & WATKINS LLP
555 Eleventh Street, N.W.
Suite 1000
Washington, D.C. 20004
Telephone: (202) 637-2200

Counsel for ViaSat, Inc.

October 10, 2008

TABLE OF CONTENTS

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matters of	)	
	)	
Row 44, Inc.	)	FCC File Nos.
	)	
Application For Authority To Operate Up To 1,000 Technically-Identical Aeronautical-Mobile Satellite Service Transmit/Receive Earth Stations Aboard Commercial And Private Aircraft	)	SES-LIC-20080508-00570; SES-AMD-200800619-00826; SES-AMD-20080819-01074; SES-AMD-20080829-01117; Call Sign: E080100
	)	
Application for Special Temporary Authority	)	SES-STA-20080711-00928; Call Sign: E080100
	)	
Application for Special Temporary Authority	)	SES-STA-20080811-01049; Call Sign: E080100

SUPPLEMENT TO PETITION TO DENY OF VIASAT, INC.

In response to the application amendments of Row 44, Inc. ("Row 44") filed on August 19, 2008 and August 29, 2008, and placed on public notice on September 10, 2008, ViaSat, Inc. ("ViaSat") supplements its Petition to Deny (the "Petition")[1] the application of Row 44 for authority to provide aeronautical-mobile satellite service ("AMSS") in the Ku-band (the "Application"). Because the Application provides the technical underpinnings for the special temporary authority ("STA") requests referenced above, ViaSat is also submitting this Supplement for consideration in connection with the proceedings initiated by those requests.

I. BACKGROUND AND SUMMARY

Row 44's Application, initially filed on May 8, 2008, seeks authority to provide AMSS in the Ku-band using the Horizons-1, AMC-2, and AMC-9 geostationary satellites.

---

1 *See* Petition to Deny of ViaSat, Inc. (filed Jun. 27, 2008).

ViaSat's June 27, 2008 Petition highlighted numerous technical deficiencies in the Application. Among other things, ViaSat noted that Row 44 had failed to: (i) include representative link budgets covering both the forward and return links with respect to all three satellites that Row 44 proposes to use; (ii) provide transmit elevation patterns at the bottom, middle, and top of the 14.05-14.47 GHz band, as required by Section 25.132(b) of the Commission's rules; (iii) demonstrate that its proposed system could operate with the significant pitch, yaw, and roll of flight and without causing harmful interference into adjacent satellite operations; (iv) demonstrate compliance with the power density limits specified in Section 25.134(g)(1) of the Commission's rules; (v) adequately account for its proposed use of Time Division Multiple Access (TDMA) protocols; (vi) demonstrate the ability to comply with a peak antenna pointing accuracy of 0.2 degrees, as required by Section 25.222(a)(6) of the Commission's rules; (vii) demonstrate the ability to cease transmissions within 100 milliseconds once its antenna is mispointed by more than 0.5 degrees, as required by Section 25.222(a)(7) of the Commission's rules; and (viii) explain discrepancies in its reported antenna gain. Accordingly, ViaSat respectfully requested that the Commission dismiss or deny the Application.

After ViaSat filed its Petition, the Commission issued two deficiency letters – one on August 7, 2008 (the "August 7 Deficiency Letter") and the other on August 25, 2008 (the "August 25 Deficiency Letter") – noting the incomplete nature of Row 44's initial Application, and requiring Row 44 to file corrective amendments or face dismissal.[2] Among other things, those letters specifically asked Row 44 to provide the Commission with: (i) the *peak* mispointing

---

2 *See* Letter from Scott A. Kotler, Chief, Systems Analysis Branch, Satellite Division, International Bureau to David S. Keir (Aug. 7, 2008); Letter from Scott A. Kotler, Chief, Systems Analysis Branch, Satellite Division, International Bureau to David S. Keir (Aug. 25, 2008).

error associated with Row 44's antenna;[3] (ii) more detailed information regarding the maximum EIRP density into the geostationary arc should Row 44's antenna be maximally misoriented;[4] and (iii) additional link budgets to assist the Commission in evaluating Row 44's Application.[5]

On August 19, 2008 and August 29, 2008, Row 44 filed "corrective" amendments purporting to respond to the Deficiency Letters. These amendments were placed on public notice on September 10, 2008. As detailed below, those amendments are not fully responsive to the Commission's inquiries, and otherwise fail to address all of the technical deficiencies in the Application. Accordingly, ViaSat reiterates its request that the Commission dismiss or deny the Application and all associated requests for STA.

II. ROW 44 STILL FAILS TO DEMONSTRATE COMPLIANCE WITH THE COMMISSION'S ANTENNA POINTING ACCURACY REQUIREMENTS

In its initial Application submission, Row 44 claimed that its proposed system would be capable of meeting a pointing accuracy of 0.2 degrees *root mean squared* ("RMS"),[6] despite the requirement of Section 25.222(a)(6) to meet a *peak* antenna pointing accuracy of 0.2 degrees.[7] As ViaSat explained in its Petition, an RMS approach provides insight only into the "average" value of the signal under the peak, such that a signal with a huge momentary excursion from the base to peak could have the same RMS value as a signal with a smaller but

---

3 August 7 Deficiency Letter at 1-2.

4 August 25 Deficiency Letter at 2.

5 *Id.*

6 Application, System Description and Technical Information, at 10 (filed May 8, 2008) ("Row 44 System Description").

7 In promulgating Section 25.222(a)(6), the Commission made clear its intent to make the rule "consistent with the technical parameters contained in Resolution 902," which requires a tracking accuracy within 0.2 degrees peak. *See Procedures to Govern the Use of Satellite Earth Stations on Board Vessels in the 5925-6425 MHz/3700-4200 MHz Bands and 14.0-14.5 GHz/ 11.7-12.2 GHz Bands*, 20 FCC Rcd 674, at ¶ 104 n.271 (2005).

longer duration excursion from the base. In other words, the RMS value does not indicate the degree by which an antenna might be maximally mispointed at any given time. As a result, in the case of an antenna operating at the near-maximum power levels that Row 44 proposes, reference to a 0.2 degrees RMS pointing accuracy limit would not adequately protect adjacent satellites from harmful interference during a large excursion.[8]

While largely sidestepping ViaSat's analysis, Row 44's Opposition asserted that Row 44 had fully complied with the Commission's rules, and suggested that Row 44 was not required to demonstrate compliance with a 0.2 degrees peak pointing accuracy limit.[9] Notwithstanding, in the August 7 Deficiency Letter, the Commission required Row 44 to provide data regarding the peak mispointing error associated with its proposed antenna.[10]

In response, Row 44 now summarily states that its antenna is capable of meeting the 0.2 degrees *peak* pointing accuracy requirement during "typical" aircraft operations.[11] Significantly, Row 44 fails to provide any explanation of how its proposed antenna is now capable of meeting this requirement – an explanation that is particularly critical given Row 44's previous assertion that it did not need to meet this limit. Moreover, Row 44 provides no justification for attempting to limit application of the 0.2 degree pointing accuracy requirement to "typical" flights, a term that Row 44 fails to define. More fundamentally, reference to a "typical" operating scenario is not meaningful because the pointing accuracy requirement

8 *See* Petition at 6 and Exh. A at 6.

9 Row 44 Inc.'s Statement Pursuant to Section 25.154(e) of the Commission's Rules and Opposition to ViaSat, Inc.'s Petition to Deny, at 8 (filed Jul. 23, 2008) ("Opposition").

10 August 7 Deficiency Letter at 1-2.

11 Amendment Response, FCC File No. SES-AMD-20080819-01074, at 1 (filed Aug. 19, 2008).

specified in Section 25.222(a)(6) is intended to address, essentially, a worst-case operating scenario.

More problematic, however, is the fact that the hardware on which Row 44 proposes to rely for antenna pointing simply would not support a peak pointing accuracy of 0.2 degrees, regardless whether the flight is "typical."

Row 44 proposes to use data from the aircraft's Inertial Reference Unit ("IRU") to drive the pointing solution of its antenna control unit ("ACU"). As explained in the attached Supplemental Technical Annex, the IRUs typically installed in commercial airliners have peak accuracies of approximately 0.6 degrees in heading and 0.15 degrees in pitch and roll.[12] Thus, data from the IRU itself would not be accurate enough to ensure compliance with the Commission's 0.2 degree pointing accuracy requirement. Moreover, the error values inherent in the design of the IRU are compounded by external factors, such as: (i) imprecision in the installation of the IRU on the airplane (e.g., imperfect alignment);[13] (ii) imprecision in the installation of Row 44's antenna on the airplane; (iii) bending of the airframe due to loading of fuel, passengers, and freight; (iv) bending of the airframe due to in-flight dynamics, including turbulence; and (v) static and dynamic errors associated with the AeroSat antenna (which ViaSat estimates would total 0.241 degrees peak, exclusive of the other errors noted above). The effects

---

12 *See* Supplemental Technical Annex at 2.

13 Notably, as explained in the attached Supplemental Technical Annex, a physical IRU mis-alignment of 0.2 degrees is to be expected, because an alignment within that tolerance still meets ARINC installation specifications. *See* Supplemental Technical Annex at 2 and Att. 2. Even greater installation mis-alignments would not preclude proper aircraft navigation and in fact are contemplated by the IRU manufacturer. *Id.* Of course, such navigational tolerances have nothing to do with ensuring effective antenna pointing for radiofrequency interference purposes.

of all of these errors would be additive, and would total significantly more than 0.2 degrees peak.[14]

As such, there is no justification for Row 44 to claim compliance with the 0.2 degrees peak pointing accuracy requirement. Row 44 should be required to submit a detailed engineering analysis substantiating its claim, certified by a registered professional engineer, to ensure its accuracy and integrity.

III. ROW 44 STILL FAILS TO DEMONSTRATE COMPATIBILITY WITH A TWO-DEGREE SPACING ENVIRONMENT

In its Application, Row 44 asserts that its proposed user terminal would constantly monitor the "skew angle" between the terminal and the satellite to which it is transmitting, and cease transmissions if this angle exceeds +/- 25 degrees.[15] In its Petition, ViaSat expressed concern that Row 44's calculation of this angle might be based on the aircraft's geographic location alone, and that it might not account for pitch, yaw, and roll resulting from normal aircraft maneuvers, such as banking at angles in the range of 25 to 30 degrees.[16] Row 44 failed to address this point in its Opposition.

The Deficiency Letters encompassed this issue by asking Row 44 to provide graphs showing maximum EIRP densities "into the geostationary satellite orbital plane when the antenna is *maximally misoriented,*"[17] regardless of the cause. Misorientation is relevant to an assessment of interference, regardless of whether the misorientation is caused by (i) mispointing the main beam of the antenna away from the service satellite, or (ii) "tilting" the non-compliant elevation pattern of the antenna toward an adjacent satellite (while still keeping the main beam

---

14 *See* Supplemental Technical Annex at 2-3.

15 Row 44 System Description at 9.

16 Petition at 4 n.8.

17 August 25 Deficiency Letter at 1 (emphasis supplied).

properly pointed). In its amended Application, Row 44 reiterates its claim that "[a]ntenna orientation is monitored at a 10 millisecond rate with transmission inhibited if the antenna orientation exceeds 25 degrees from the orbital plane,"[18] but again fails to address whether this value accounts for both geographic skew and banking angle.

Row 44's claim that it would inhibit transmissions if its antenna were "tilted" toward an adjacent satellite by more than +/- 25 degrees is apparently intended to ensure that the elevation pattern of its antenna – which Row 44 concedes would not comply with Section 25.209 of the Commission's rules[19] – is separated from the GSO arc by at least 65 degrees. As an initial matter, Row 44 does not substantiate its claim that a 65 degree separation angle would be sufficient to prevent harmful interference into the GSO arc. Moreover, this claim appears premised on the assumption that Row 44's system otherwise would comply with Commission requirements, including pointing accuracy and EIRP density limits. Since Row 44 has not established that its proposed system would be capable of complying with these limits, there also is no basis to assume that 65 degrees of separation would be the correct operational limit for the Row 44 system. In fact, it is very possible that the 65 degree separation angle selected by Row 44 is too permissive, and that a larger separation angle would be required to protect adjacent operations from harmful interference.

Even assuming *arguendo* that a 65 degree separation angle is correct, Row 44 fails to account for the effects of aircraft banking on antenna misorientation. To ensure the adequate protection of adjacent operations, this separation angle must be maintained regardless of the cause of the Row 44 antenna "tilting" toward an adjacent satellite – geographic skew,

---

18 Amendment Response, FCC File No. SES-AMD-20080819-01074, at 2 (filed Aug. 19, 2008).

19 Row 44 System Description at 8.

aircraft pitch, yaw or roll, or any other factor. For example, in the case of a user in Fairbanks, Alaska accessing the Horizons 1 satellite, the geographic skew of a Row 44 antenna toward an adjacent satellite would be 8.61°. In this case, any bank angle of greater than 16.39° would create an angular separation of less than 65°, and therefore pose an interference risk to the adjacent satellite.[20]

Given even negligible levels of geographic skew, normal aircraft banking could result in antenna misorientation that would cause an unacceptable interference risk to adjacent spacecraft. For example, in the case of a Row 44 terminal in Colby, Kansas accessing the AMC-2 satellite, geographic skew toward an adjacent satellite would be only 0.82 degrees, and any bank angle toward that satellite in excess of 24.18 degrees would result in a misorientation exceeding 25 degrees.[21] In areas with higher levels of geographic skew, Row 44 would need to inhibit transmissions at much lower bank angles to protect adjacent satellite operations.

In light of the interference risks posed by Row 44's proposed operations, the Commission should require Row 44 to explain precisely how it would inhibit transmissions when misorientation exceeds the appropriate angular limit. As explained in the attached Supplemental Technical Annex, under conservative assumptions of aircraft banking, there would be 2-3 million transmit inhibit episodes per year on Southwest Airlines alone, if Southwest deployed Row 44 terminals on its aircraft.[22] Further, on many routes Row 44 would be unable to provide service during even 5 degree banks – likely precluding *any* meaningful service during flight.[23] Row 44 has provided no explanation of how it would manage these transmit inhibit

---

20 *See* Supplemental Technical Annex at 9-12.

21 *Id.* at 12-15.

22 *Id.* at 16.

23 *Id.* at 16-17.

episodes, or these "no service" zones. Further, Row 44 has provided no explanation of how it would identify circumstances in which the relevant angular limit would be exceeded, or how it would manage customer expectations about Row 44's ability to provide continuous service across the country.

The record of this proceeding provides ample reason to question Row 44's ability to inhibit transmissions whenever the combined effect of geographic skew and aircraft maneuvers would result in misorientation exceeding the relevant angular limit. At a minimum, therefore, the Commission should require Row 44 to provide detailed explanations of (i) its derivation of 25 degrees as the maximum allowable degree of misorientation; (ii) the exact circumstances in which it would inhibit transmissions, accounting for both geographic skew and banking angle (and any other relevant factors); (iii) how it would determine if its antenna were misoriented by more than 25 degrees; (iv) how its system would inhibit transmissions if this threshold were exceeded; (v) how its system would manage skew, power levels, and other link parameters during handle hand-offs between satellites; (vi) the specific geographic areas in which Row 44 would not be able to offer service to the public during banks of 5, 10, 15, 20, 25, and 30 degrees; and (vii) the manner in which it plans to communicate its geographic service limitations to the public in order to manage consumer expectations.

IV. ROW 44 STILL FAILS TO PROVIDE REPRESENTATIVE LINK BUDGETS REFLECTING THE TECHNICAL PARAMETERS OF ITS SYSTEM

Row 44's initial Application submission included only two link budgets, both return link budgets assuming a remote user terminal located over the vicinity of Fairbanks, Alaska and using the Horizons-1 satellite. In its Petition, ViaSat noted that these link budgets were not representative and did not reflect the technical parameters of Row 44's proposed system.[24] Row 44's amended Application once again fails to provide representative link budgets, which prevents a full and complete evaluation of its Application.

Notably, since filing its initial Application, Row 44 has modified a number of the technical parameters of its proposed system. For example: (i) Row 44 now proposes to use spread spectrum modulation[25] (having made no mention of spreading in its initial filing); (ii) Row 44 proposes to reduce transmit power from a maximum EIRP of 40.6 dBW to 38.6 dBW;[26] and (iii) Row 44 has provided a spectrum analyzer plot incorporating a spectral mask suggesting that the signal from its proposed user terminal would occupy a noise bandwidth of only approximately 1024 kHz, as opposed to the 1.6 MHz reflected in the limited link budgets it has filed, and as suggested by its chosen emission designator.[27] These changes have a substantial impact on Row 44's ability to provide service, and do so without causing harmful interference. For example, the specified 2 dB reduction in power would substantially increase the scope of those geographic areas in which spacecraft G/T would be inadequate to sustain service.[28] In other words, the size of Row 44's "no service" zones will increase with this decrease in power.

Inexplicably, though, Row 44 has not submitted new link budgets to reflect the technical changes in its amendments, and thus continues its failure to provide link budgets that are representative of its proposed service. As a result, the record does not contain all of the information needed to fully evaluate the performance of Row 44's proposed system, and whether

---

24 Petition at 3.

25 Opposition at 6.

26 Amendment Response, FCC File No. SES-AMD-20080829-01117, at 1 (filed Aug. 29, 2008).

27 *Id.* at Att. 4.

28 *See* Supplemental Technical Annex at 19.

that system could be expected to operate in compliance with the Commission's rules.[29] Notably, the link budgets that Row 44 has submitted in its amendments already suggest that Row 44's system design is not compliant with those rules. An evaluation of updated link budgets could well reveal additional instances of noncompliance.[30]

Nor has Row 44 yet provided link budgets that represent the differences in the coverage patterns of each of the three satellites it proposes to use.[31] Row 44 concedes that the link characteristics of Horizons-1, AMC-2 and AMC-9 would vary over the proposed coverage area, and even recognizes that "there are some potential flight paths where G/T would be too low to close the inroute link."[32] However, Row 44 fails to provide link budgets reflecting these variations, which makes it impossible to ascertain where Row 44 actually would or would not be able to provide service in a manner consistent with its link budgets. Without this information, the Commission would be unable to enforce Row 44's commitment that airlines would not fly airplanes with Row 44 equipment on flight paths where the service link could be closed.[33]

---

29 *See* Reply of ViaSat, Inc., FCC File No. SES-LIC-20080508-00570, at 5-6 and n.16 (filed Aug. 7, 2008) (noting importance of link budgets to analysis of non-compliant earth station applications, and that the Commission's original rules for non-compliant VSATs explicitly required earth station applicants to submit link budgets) (citing *Routine Licensing of Large Networks of Small Antenna Earth Stations Operating in the 12/14 GHz Frequency Bands*, 6 FCC Rcd 7372, at ¶ 13 (1991)).

30 The AMC-2 and AMC-9 link budgets reflect a downlink EIRP density of 11 dBW/4 kHz, which exceeds the maximum EIRP density of 10 dBW/4 kHz permitted by Section 25.134 of the Commission's rules. 47 C.F.R. § 25.134. Row 44 has not sought a waiver of this Section. *See also* Supplemental Technical Annex at 19-20.

31 *See* Petition at 3.

32 Opposition at 7 n.11.

33 In fact, Row 44 has made contradictory claims as to how it would deal with its inability to provide service on certain routes. Row 44's Opposition suggested that the "solution" to low G/T would be "to avoid the affected flight paths" but in its meetings with Commission staff Row 44 has stated that it would not expect airlines to alter flight paths, but instead would not install its user terminals on airplanes that would use such flight

Accordingly, the Commission should require Row 44 to supply updated link budgets for the forward and return links at the edge of coverage of each of the three satellites that Row 44 proposes to use.[34] In addition, the Commission should require Row 44 to obtain an affidavit from each of its airline customers affirming that it would either alter its flight paths as required to keep the satellite link closed without increasing power, or not operate Row 44 terminals on such flight paths.

* * * * *

As explained above, Row 44's amended Application is technically deficient. Accordingly, ViaSat respectfully requests that the Commission dismiss or deny the Application and all associated requests for special temporary authority.

Respectfully submitted,

John P. Janka
Jarrett S. Taubman
LATHAM & WATKINS LLP
555 Eleventh Street, N.W.
Suite 1000
Washington, D.C. 20004
Telephone: (202) 637-2200

Counsel for ViaSat, Inc.

October 10, 2008

---

paths. *Compare id. with* Letter from John P. Janka, Counsel for ViaSat, Inc., to Marlene H. Dortch, Secretary, Federal Communications Commission (Sep. 24, 2008).

34 The link budgets Row 44 submitted previously were based on operations from Fairbanks, Alaska, which lies within a portion of the Horizons-1 footprint with a particularly strong signal.

EXHIBIT A

SUPPLEMENTAL TECHNICAL ANNEX

This Supplemental Technical Annex provides technical support for arguments presented in the foregoing Supplement to ViaSat's Petition to Deny the Application of Row 44, Inc. ("Row 44") for authority to provide aeronautical-mobile satellite service ("AMSS") in the Ku-band. This Annex is intended to supplement the Technical Annex provided in ViaSat's initial Petition to Deny.

I. ROW 44'S FAILURE TO DEMONSTRATE COMPLIANCE WITH THE COMMISSION'S POINTING ACCURACY REQUIREMENTS

Row 44's amended Application fails to demonstrate that its proposed system would comply with Section 25.222(a)(6) of the Commission's rules, which has been applied to require blanket licensed aeronautical earth stations ("AESs") to maintain a pointing error of less than 0.2 degrees between the orbital location of the target satellite and the axis of the main lobe of the earth station antenna. In its initial Application, Row 44 claimed to meet a tracking accuracy of 0.2 degrees root mean square ("RMS") – a metric that provides insight only into the "average" mispointing error.[1] As noted in ViaSat's Petition, Row 44 made no claim that its proposed system would be able to provide a tracking accuracy of within 0.2 degrees peak, in a manner consistent with Annex 2 to ITU RES 902-4 and the Commission's rules.

In the August 7 Deficiency Letter,[2] the Commission asked Row 44 to provide data regarding the peak mispointing error associated with its proposed antenna. In response, Row 44 claimed, without explanation, that its proposed antenna would be able to provide a tracking accuracy of within 0.2 degrees *peak*.[3] Row 44 does not substantiate this stated change in pointing accuracy.

---

1 *See* Petition at 6 and Exh. A at 6.

2 *See* August 7 Deficiency Letter.

3 *See* Amendment Response, FCC File No. SES-AMD-20080819-01074, at 1 (filed Aug. 19, 2008).

Other technical information indicates that Row 44's peak tracking accuracy would in fact be lower than 0.2 degrees.

As an initial matter, in response to the issues ViaSat raised with respect to Row 44's use of E_s/N_o data to support closed loop tracking,[4] Row 44 indicated that use of E_s/N_o data would be a "back-up" to data from the aircraft's Inertial Reference Unit ("IRU").[5] Specifically, Row 44 indicates that it proposes to use IRU data from an ARINC 429 or 664 bus to drive the pointing solution of its antenna control unit ("ACU").[6]

The typical stated 2σ (95.4%) accuracy of IRUs used in commercial airliners is 0.4° in the heading axis, and 0.1° in each of the pitch and roll axes.[7] Assuming 3σ (99.7%) as a reasonable value for peak,[8] the peak accuracy of the IRU is then 0.6° in the heading axis and 0.15° in each of the pitch and roll axes. This simple calculation shows that using IRU data would not allow Row 44 to meet a tracking accuracy of 0.2° peak.

Moreover, a number of factors would affect antenna pointing, and would not be captured in IRU data that Row 44 is gathering to drive its antenna pointing.

- First, to be compliant with ARINC characteristic # 704, an IRU need only be installed to within an accuracy of +/- 0.2 deg.[9] The installation instructions for an IRU specifically acknowledge that less accuracy may be acceptable to the aircraft operator, in which case,

---

4 *See* Petition at 6-7 and Exh. A at 6.

5 *See* Opposition at 8 and Opposition Technical Annex at 3.

6 *See* Row 44 System Description at 9.

7 Attachment 1 hereto contains specifications for the Honeywell Air Data Inertial Reference System, which is commonly installed on commercial airliners.

8 ViaSat assumes, in the absence of information to the contrary, that antenna mispointing would occur at error values that represent a normal statistical distribution. With a normal distribution of values, almost all (99.7%) values lie within three standard deviations of the mean. ViaSat thus uses 3σ as an indication of the peak inaccuracy for these purposes. *See, e.g.,* Distribution Tables, *at* http://www.statsoft.com/textbook/sttable.html (last visited Oct. 10, 2008).

9 Attachment 2 hereto contains an excerpt from the installation manual from the Honeywell Global Positioning Inertial Reference Unit.

even that level of alignment precision would not be warranted.[10] Stated another way, the acceptable accuracy for an installation that meets the ARINC characteristic # 704 is the base accuracy of the IRU itself of +/- 0.1 deg in attitude, plus up to an additional +/- 0.2 degrees in installation error. That is what is considered a highly accurate installation for purposes of aircraft navigation, and it would be expected to result, from the outset, in more that 0.2 degrees of antenna pointing error.

- Second, in virtually all cases the terminal's antenna would be installed imperfectly in the airframe, resulting in an inherent offset (pointing) error with the antenna.

- Third, bending and torsional deflection of the airframe due to static and dynamic loads likely would result in the airplane itself contributing to the pointing error.

- Fourth, "gear lash" and other mechanical factors create both inherent static and dynamic error in the AeroSat antenna; ViaSat estimates a 0.073° static error and 0.168° dynamic error, for a total error of 0.241° peak, exclusive of the other errors identified above.

The effects of all of these errors would be additive, and obviously would be significantly greater than the claimed 0.2° peak level.

Notably, Row 44's claims are inconsistent with the known performance capabilities of other airborne FSS antenna systems. For example, Connexion by Boeing used a high performance reflector antenna with local rate gyros to enhance dynamic pointing performance. Even using this high performance antenna, Boeing still estimated its 1σ (68.3%) pointing error to be 0.25° in azimuth and 0.6° in elevation.[11] The equivalent peak (3σ, or 99.7%) pointing error for Boeing was then 0.75° in azimuth and 1.8° in elevation.

---

[10] *Id.* ("If less accuracy is acceptable for a given installation, a highly precise alignment is not warranted.").

[11] *See* Application of The Boeing Company, SES-MOD-20020308-00429, Technical Appendix at 4-5 (filed Mar. 8, 2002).

Given these factors, and Row 44's failure to substantiate its claimed ability to meet the Commission's pointing accuracy requirement, Row 44 should be required to submit a detailed engineering analysis, signed by a registered professional engineer, explaining how Row 44 would achieve the claimed 0.2° pointing error.

II. ROW 44'S FAILURE TO ACCOUNT FOR AIRCRAFT BANKING

Row 44 proposes to inhibit transmissions from its proposed antenna if the "skew angle" exceeds ± 25°.[12] This ± 25° limit apparently is intended to bring the elevation pattern of the antenna (which does not comply with Section 25.209) no closer than 65° to the GSO arc, and thereby prevent the combination of (i) higher than allowed off-axis EIRP density signals and (ii) Row 44's non-compliant elevation pattern from causing interference to adjacent satellites.

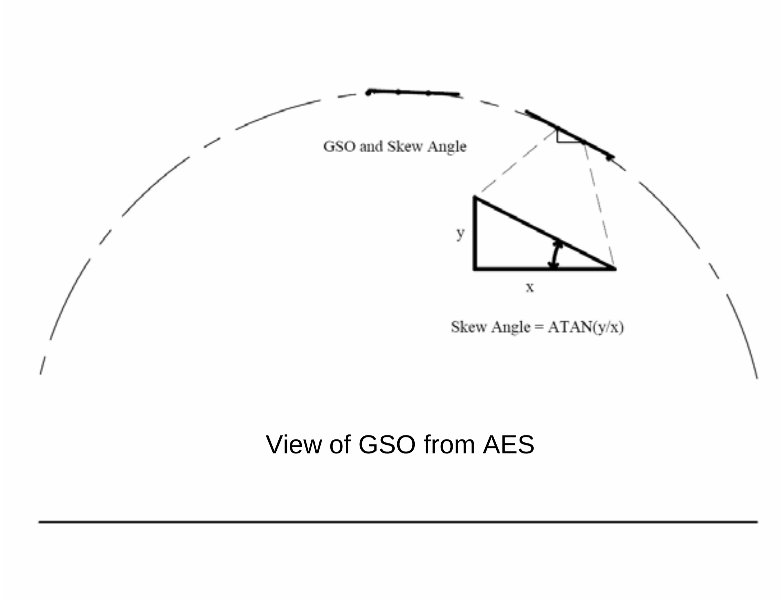
Row 44's choice of a ± 25° limit apparently assumes that the rest of its proposed system would meet FCC requirements. However, ViaSat has noted numerous technical deficiencies in the Application, and otherwise has demonstrated that Row 44's proposed system would not meet the FCC's requirements. In particular, Row 44's failure to satisfy pointing accuracy requirements and uplink power limits would require a greater angular separation between the elevation pattern from Row 44's proposed antenna and the GSO arc to ensure the protection of adjacent operations. Thus, unless and until the rest of Row 44's technical parameters are firmly established, it is not possible to calculate whether Row 44's proposed ± 25° limit is appropriate.

Even if 65° were the appropriate separation angle, Row 44 fails to account for the effects of aircraft banking in discussing its implementation of the proposed 25° limit. Figure 1 shows the derivation of the geographic skew angle based on the relative position of the "target" and "victim" satellite on the GSO arc:

---

[12] Row 44 System Description at 9.

Figure 1: Derivation of Geographic Skew Angle



While Row 44 acknowledges the importance of geographic skew, Row 44 does not discuss the effects that aircraft banking would have on the alignment of the azimuth and elevation axes of its antenna. In level flight, the elevation axis of the antenna would be vertical and perpendicular to the GSO arc when the aircraft is due North of the operating satellite. However, when the aircraft banks, the elevation antenna pattern would be tilted with respect to the GSO arc because the AeroSat antenna Row 44 proposes to use does not have a mechanism to adjust for this tilt. Depending on the direction of the bank, the tilt would either add to or subtract from geographic skew.

Commercial aircraft follow Instrument Flight Rules ("IFR"). A common maneuver during IFR flight is the "standard rate" turn – a turn at a rate of 360° per 2 minutes (or 3° per second) at speeds below approximately 250 knots, and 180° per 2 minutes (or 1.5° per second) at higher speeds.[13] Aircraft follow Air Traffic Control ("ATC") flight corridors, which are designed with specific turn radii and true airspeeds ("TASs") in mind. The appropriate bank angle for a level coordinated turn is a physical function of turn, velocity, and gravity, and is given by the formula:

---

[13] *See* FAA INSTRUMENT FLYING HANDBOOK, FAA-H-8083-15A, at 5-19 – 5-20 (2007).

$$Bank\_Angle = \tan^{-1}\left(\frac{True\_Airspeed \times Rate\_of\_Turn}{g}\right)$$

Turn radius is a function of velocity and bank angle, and is given by the formula:

$$Radius = \left(\frac{True\_Airspeed^2}{g \times \tan(Bank\_Angle)}\right)$$

G-force is a function solely of bank angle, and is given by the formula:

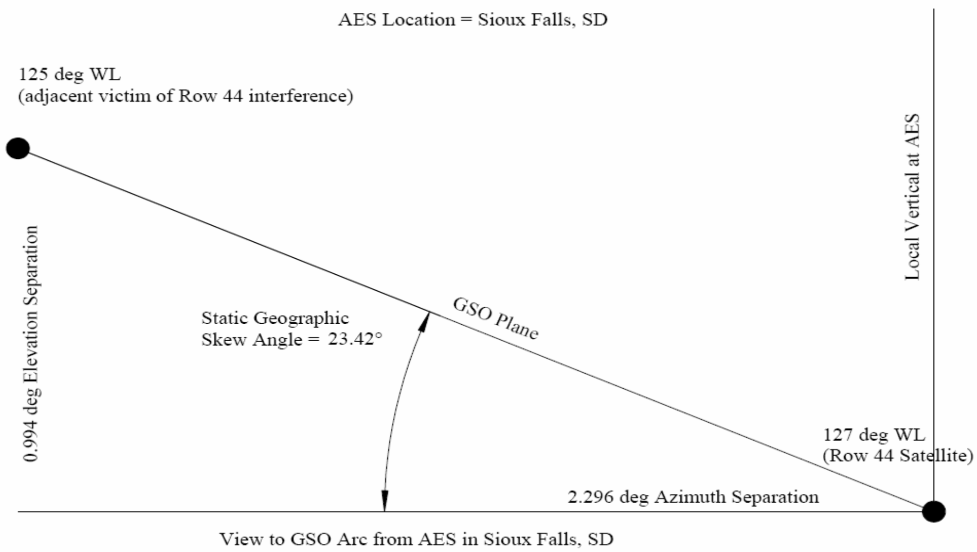
$$G\_Force = \left(\frac{1}{\cos(Bank\_Angle)}\right)$$

Notably, a 30° bank angle yields a G-force of approximately 1.15 G, which normally is not objectionable to passengers, and therefore is common during commercial flight.

The following figures show the effect that a 30° bank angle would have on angular separation between the elevation pattern from Row 44's antenna and the GSO arc. A 30° bank angle is used because this degree of banking is expected to be the upper limit during normal commercial flight, and, as stated above, is not objectionable to passengers. These figures assume that the aircraft is banking toward the victim satellite, such that banking angle and geographic skew are additive.

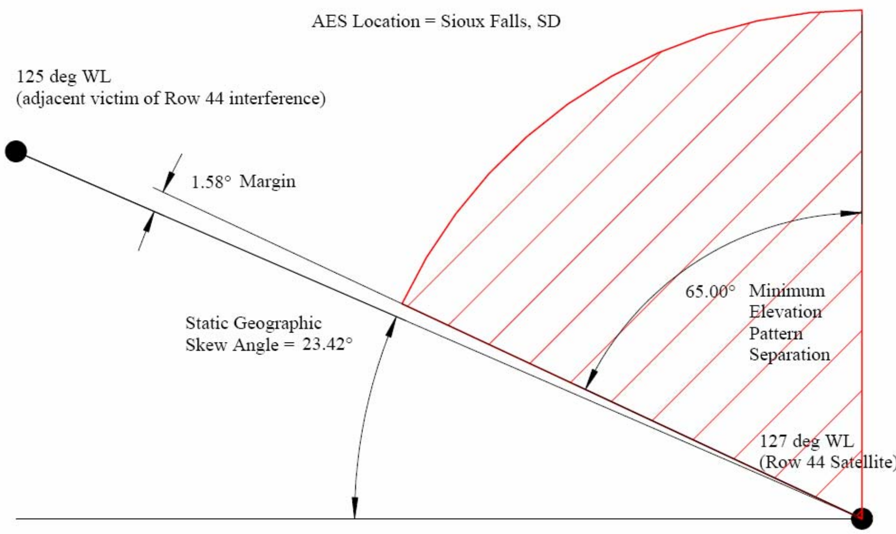
Figures 2 through 4 depict an AES located in the vicinity of Sioux Falls, South Dakota and pointed at the Horizons-1 satellite, located at 127° WL, which Row 44 plans to utilize. As shown in Figure 2, the relevant geographic skew angle from this location is 23.42° – barely less than the ± 25° limit specified by Row 44, without taking into account the effects of aircraft banking.

Figure 2: Geographic Skew at Sioux Falls, SD



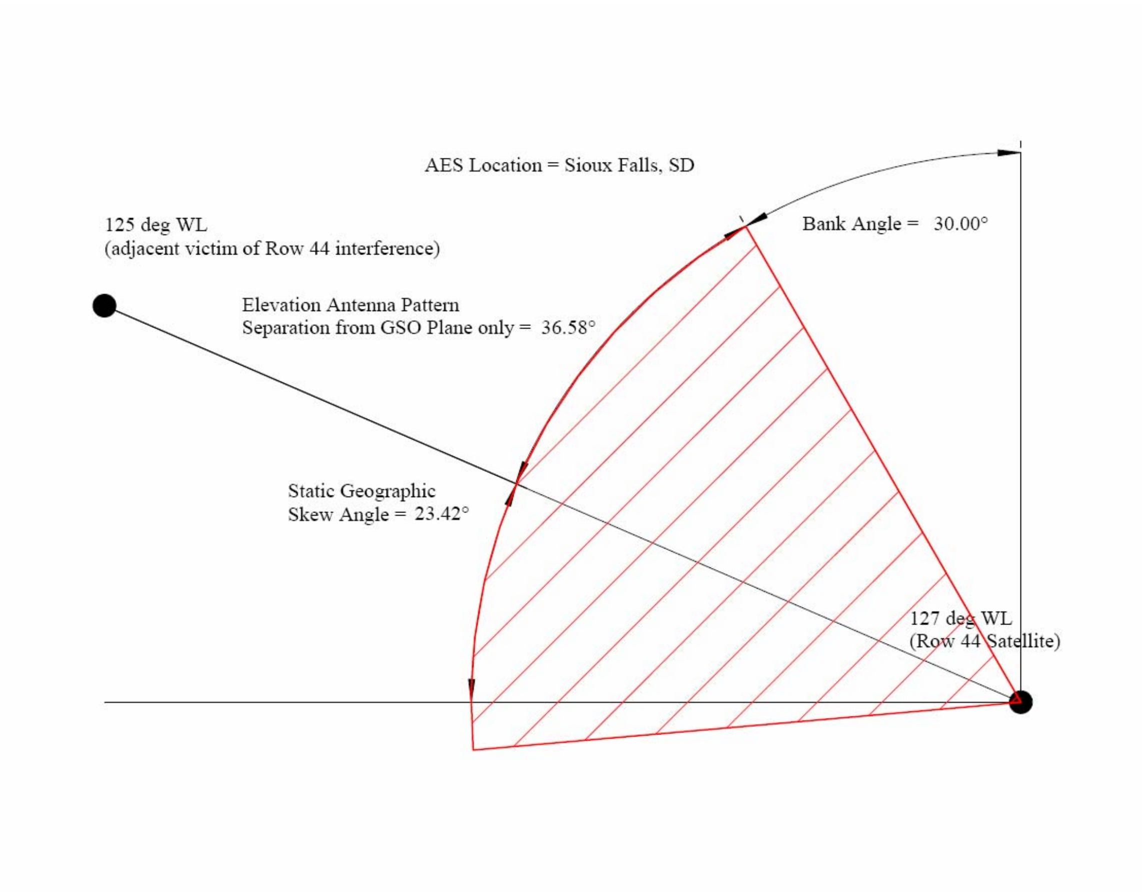
As shown in Figure 3, when the aircraft is level, the angular separation between the elevation antenna pattern from Row 44's proposed antenna and the GSO arc is approximately 66.58° – approximately 1.58° more than the 65° separation angle that Row 44 suggest would prevent harmful interference into adjacent satellites.

Figure 3: Angular Separation from the GSO Arc During Level Flight at Sioux Falls, SD



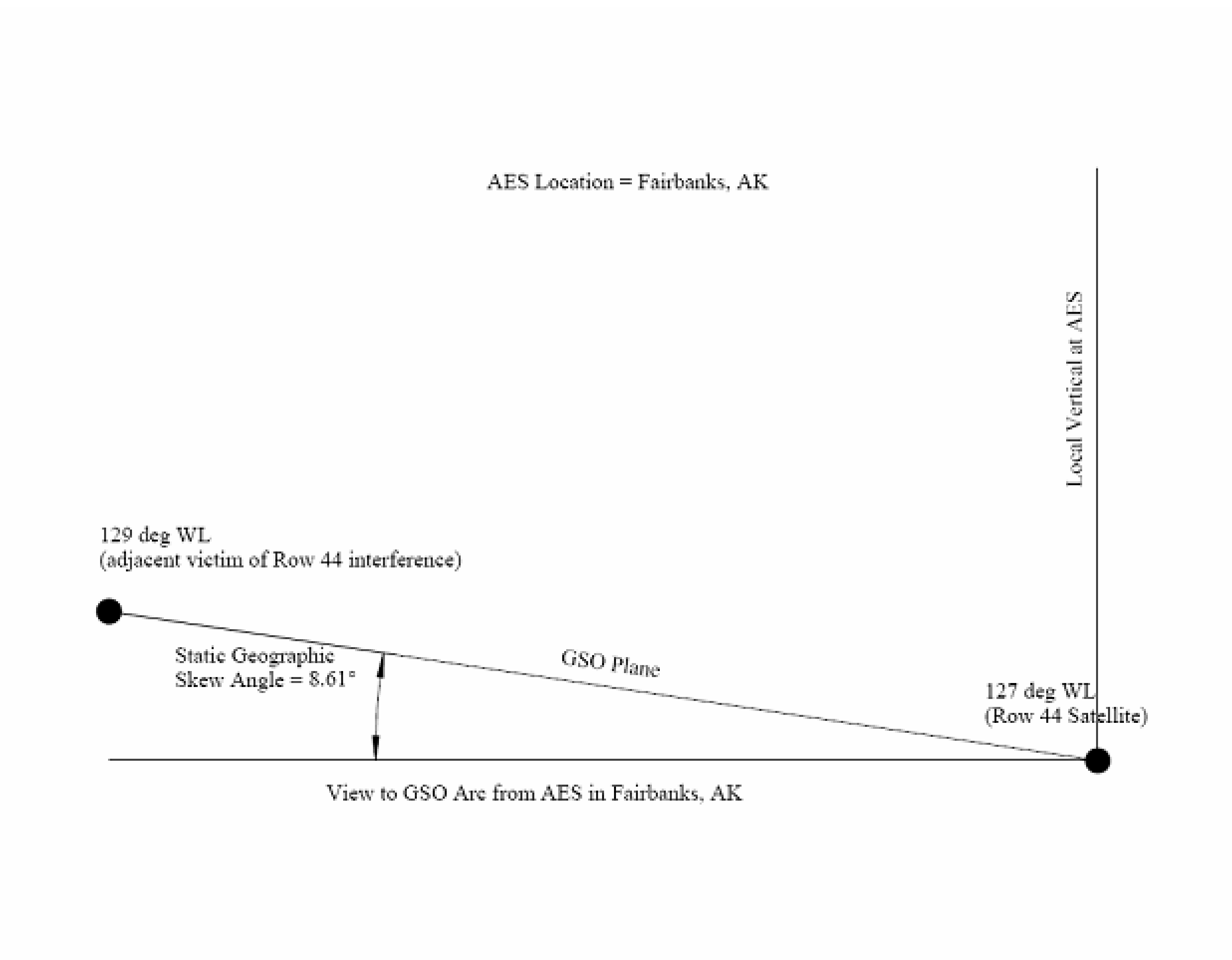
However, as shown in Figure 4, when an aircraft with a Row 44 terminal banks by more than 1.58°, it achieves an angular separation of less than 65°, and, therefore, presents an interference risk to adjacent spacecraft. When banking at 30°, the angular separation between the elevation antenna pattern from Row 44's proposed antenna and the GSO arc shrinks to approximately 36.58° – far less than the 65° separation angle that Row 44 suggests would be necessary to prevent harmful interference into adjacent satellites.

Figure 4: Effects of 30° Bank on Angular Separation from the GSO Arc at Sioux Falls, SD



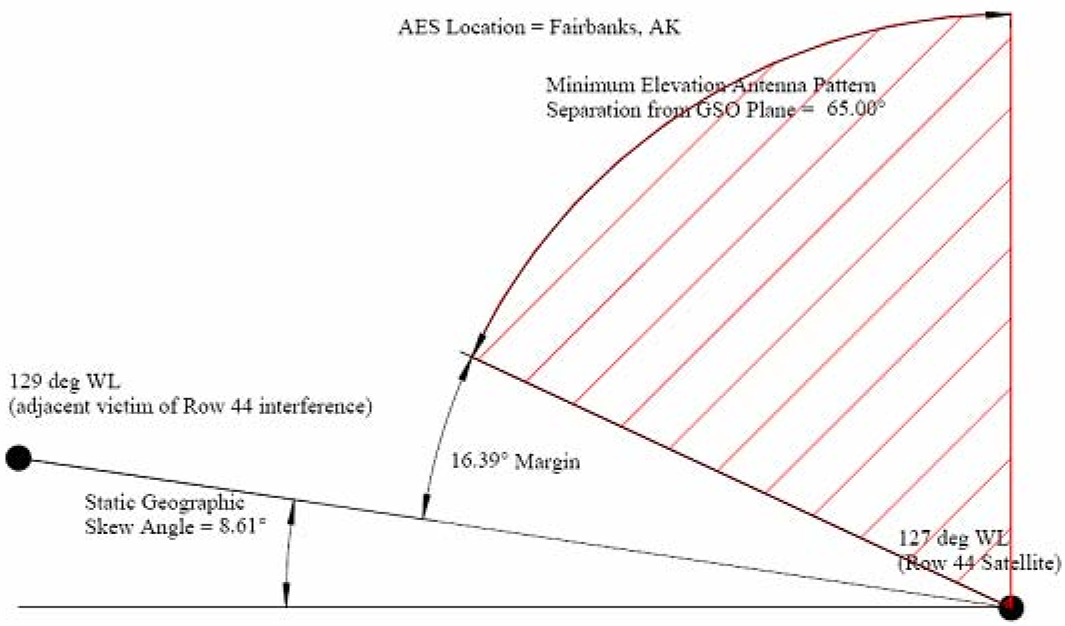
Banking can have a similar impact even where geographic skew is modest. Figures 5 through 7 depict an AES located in the vicinity of Fairbanks, Alaska and again pointed at the Horizons-1 satellite. As shown in Figure 5, the relevant geographic skew angle from this location is 8.61° – less than the ± 25° limit specified by Row 44.

Figure 5: Geographic Skew at Fairbanks, AK



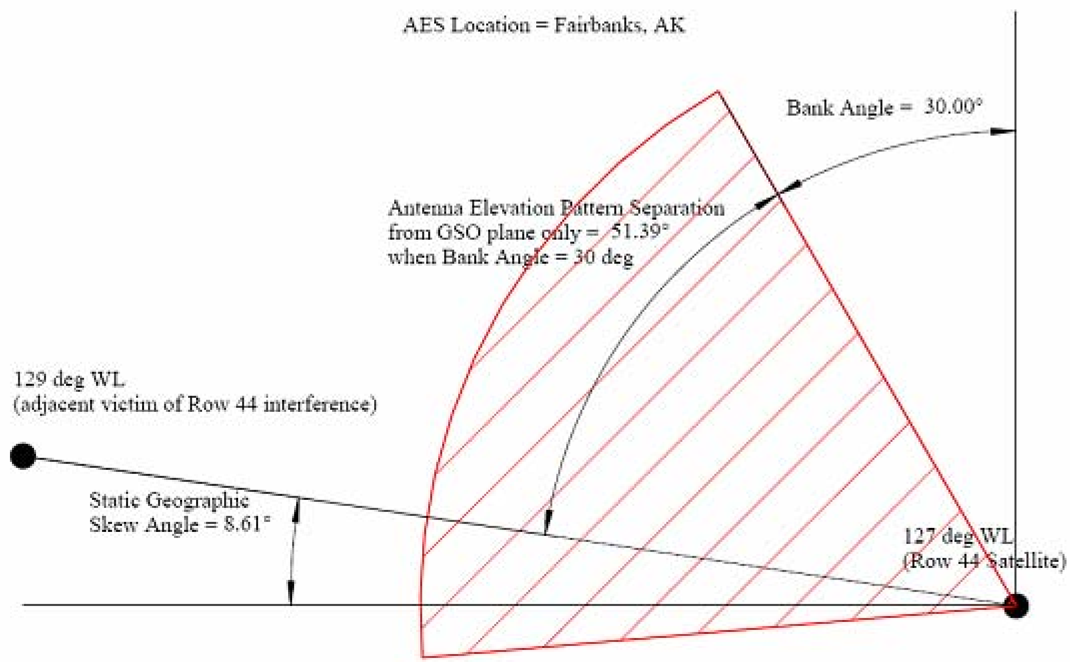
As shown in Figure 6, when the aircraft is level, the angular separation between the elevation antenna pattern from Row 44's antenna and the GSO arc is approximately 81.39° – thus, there is approximately 16.39° of margin from the 65° separation angle that Row 44 suggests would be necessary to prevent harmful interference into adjacent satellites.

Figure 6: Angular Separation from the GSO Arc During Level Flight at Fairbanks, AK



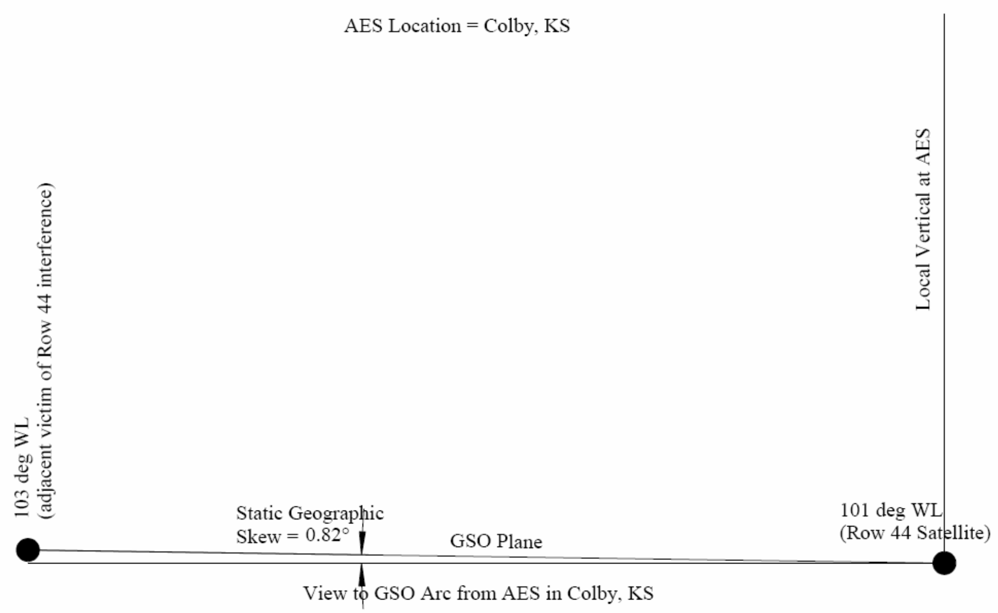
However, as shown in Figure 7, when the aircraft banks by 30°, the angular separation between the elevation antenna pattern from Row 44's proposed antenna and the GSO arc shrinks to approximately 51.39° – less than the 65° separation angle that Row 44 suggests would be necessary to prevent harmful interference into adjacent satellites. Here, any bank angle of greater than 16.39° would create an angular separation of less than 65°, and, therefore, pose an interference risk.

Figure 7: Effects of 30° Bank on Angular Separation from the GSO Arc at Fairbanks, AK



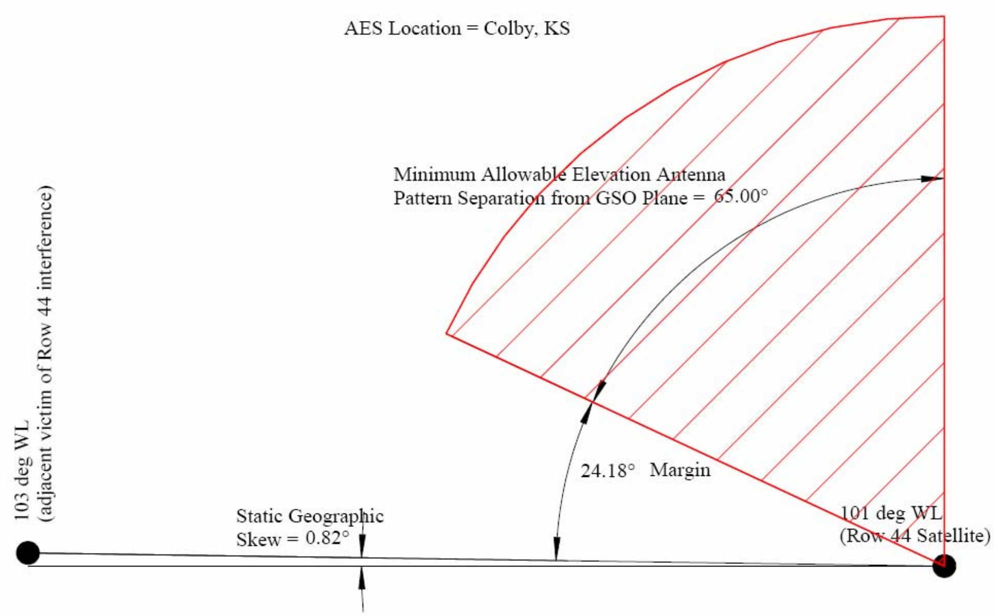
Banking also can have a similar impact where geographic skew is virtually non-existent. Figures 8 through 10 depict an AES located in the vicinity of Colby, Kansas and pointed at the AMC-2 satellite, located at 101° WL, which Row 44 also proposes to use. As shown in Figure 8, the relevant geographic skew angle from this location is 0.82° – practically negligible.

Figure 8: Geographic Skew at Colby, KS



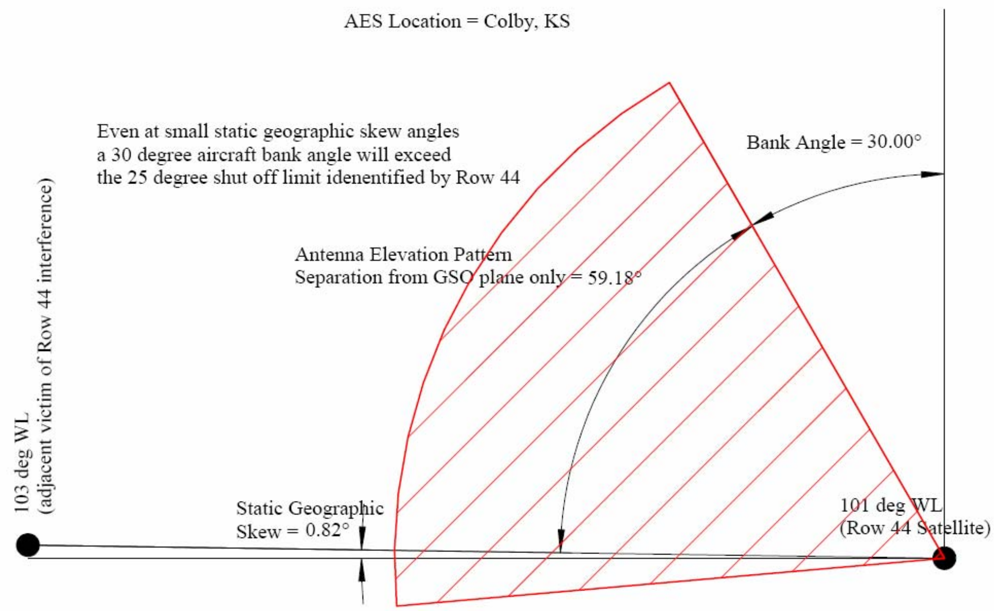
As shown in Figure 9, when the aircraft is level, the angular separation between the elevation antenna pattern from Row 44's proposed antenna and the GSO arc is approximately 89.18° – yielding approximately 24.18° of margin from the 65° separation angle that Row 44 suggests would be necessary to prevent harmful interference into adjacent satellites.

Figure 9: Angular Separation from the GSO Arc During Level Flight at Colby, KS



However, as shown in Figure 10, when the aircraft banks by 30°, the angular separation between the elevation antenna pattern from Row 44's proposed antenna and the GSO arc shrinks to approximately 59.18°, and therefore does not provide the 65° of separation that Row 44 suggests would be necessary to prevent harmful interference into adjacent satellites. In fact, any bank angle of greater than 24.18° would create an angular separation of less than 65°, and pose such a interference risk.

Figure 10: Effects of 30° Bank on Angular Separation from the GSO Arc at Colby, KS



As the preceding figures demonstrate, banking can reduce angular separation between the Row 44 antenna elevation pattern and the GSO arc to unacceptably low levels, even with modest or virtually non-existent levels of geographic skew. In such circumstances, the elevation pattern from Row 44's antenna likely would point toward adjacent satellites and create an unacceptable risk of harmful interference. In order to eliminate this risk, Row 44 would need to inhibit transmissions whenever geographic skew *plus* banking angle exceeds ± 25°, or whatever appropriate aggregate angular limit is determined after the power levels and other relevant operational characteristics of the Row 44 system are established.

Row 44 has not responded to ViaSat's previous observations that banking and other maneuvers by aircraft employing Row 44's antenna would create a risk of harmful interference into adjacent satellites, unless Row 44 adequately constrains the power levels used by its system. In particular, Row 44 has not committed to inhibit transmissions when geographic skew plus banking angle exceeds ± 25°. Even if Row 44 were to make such a commitment, though, there would still be serious questions regarding Row 44's ability to fulfill this commitment.

First, Row 44 has not explained how it would ensure that transmission would be inhibited when the angular "tilt" of the elevation pattern of its antenna exceeds the relevant limit in the direction of adjacent spacecraft. Nor is it clear how the Commission could monitor compliance with such a limit. In particular, Row 44 has not explained how it would measure geographic skew and banking angle, combine their effects after accounting for factors such as aircraft direction, or implement a transmit inhibit function in its proposed system. Row 44 also has not made any commitments to log data (critical to allow the Commission to hold Row 44 accountable for interference events) or file additional data regarding interference events and the implementation of inhibit methodologies in its annual reports.

Notably, as a result of the combined effect of geographic skew and banking angle, Row 44 would need to inhibit transmissions millions of times in any given year. As an illustration, Southwest Airlines has a fleet of 535 aircraft. More than 75% of those aircraft are flown on any given day, with each aircraft turned around an average of 7 times per day, for a total of approximately 1.06 million flights per year.[14] Under the conservative estimate that each aircraft banks 2-3 times during flight where bank angle and geographic skew combine to 25° or more (e.g., during take-off and landings, while circling) there would be 2-3 million transmit inhibit episodes per year for Southwest Airlines alone. Row 44 has not explained how it would track or manage this volume of transmit inhibit events.

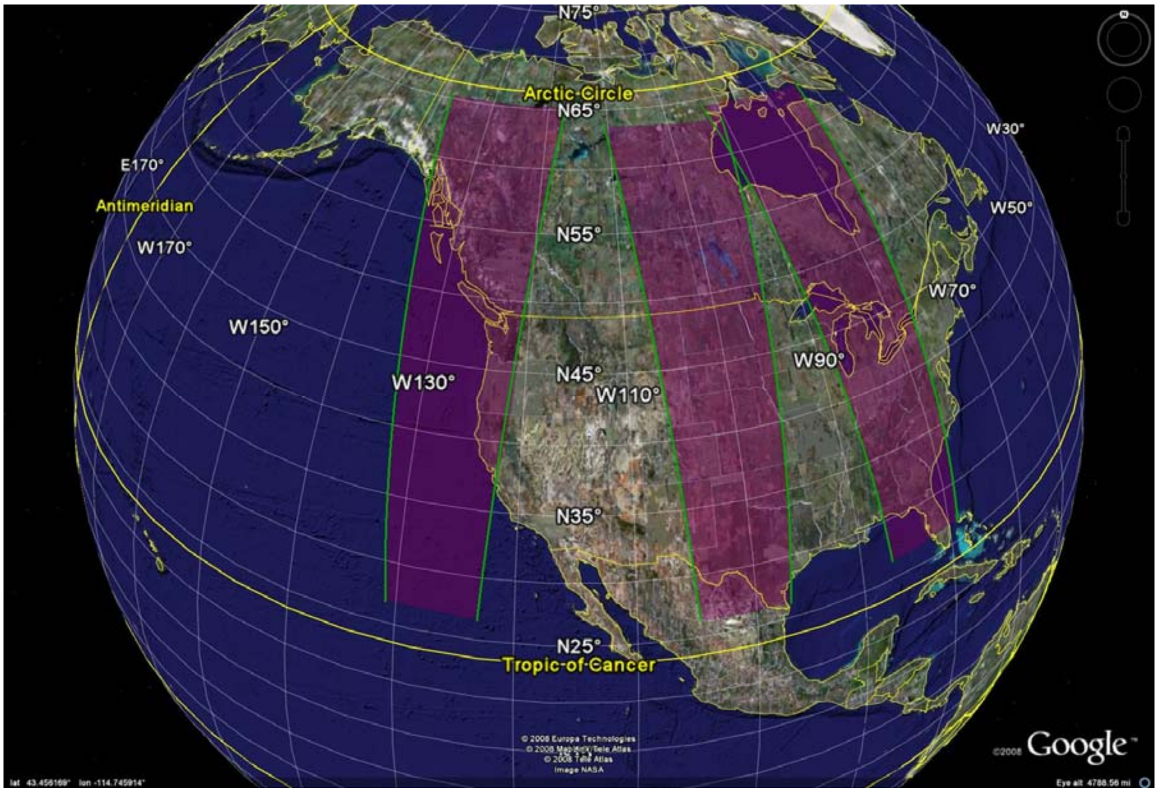
Further, Row 44 has not clearly depicted those areas in which it would not be able to provide service while banking. On many routes, Row 44 would be unable to provide service during even 5 degree banks – likely precluding any meaningful service during flight. Figure 11 is a Google Earth map depicting, approximately, the ±5° geographic skew zones associated with each satellite with which Row 44 proposes to provide service. Within each zone (i.e., each pink area), an aircraft could bank from 20° (at the edges) to 25° (at the center) without exceeding a

---

[14] *See* Southwest Airlines Fact Sheet, *available at* http://www.southwest.com/about_swa/press/factsheet.html (May 25, 2008).

combined ± 25° skew limit. However, outside of the zones, the allowable bank angle decreases to 0° when skew reaches 25°.

Figure 11: Representative ±5° Geographic Skew Angle Zones For Each of the Row 44 Satellites



At a minimum, before it considers granting Row 44's application, the Commission should require Row 44 to provide a detailed explanation of (i) its derivation of ± 25° as the combined angular limit; (ii) the exact circumstances in which it would inhibit transmissions, accounting for both geographic skew and banking angle (and any other relevant factors); (iii) how it would determine if its antenna were misoriented by more than 25 degrees; (iv) how its system would inhibit transmissions if this threshold were exceeded; (v) how its system would manage skew, power levels, and other link parameters during hand-offs between satellites; (vi) the specific geographic areas in which Row 44 would not be able to offer service to the public during banks of 5, 10, 15, 20, 25, and 30 degrees; and (vii) the manner in which Row 44 plans to communicate its geographic service limitations to the airlines and the public in order to manage consumer expectations.

In addition, for the reasons provided in the next section, each of Row 44's airline customers should be required to provide an affidavit affirming that it would either alter its flight paths as required to keep the satellite link closed without impermissibly increasing power, or not operate Row 44 terminals on airplanes that operate over flight paths where the satellite link would not be expected to close.[15]

III. ROW 44'S FAILURE TO SUPPLY REPRESENTATIVE LINK BUDGETS

Row 44's Application initially included only two link budgets, both return link budgets assuming a remote user terminal located in the vicinity of Fairbanks, Alaska and using only one of the three spacecraft Row 44 plans to use – Horizons-1. Row 44's amended Application once again fails to provide representative link budgets – both because the link budgets provided by Row 44 do not reflect recent changes to the technical parameters of Row 44's proposed system, and do not reflect variations in the coverage patterns of all three satellites Row 44 proposes to use.

Notably, since filing its initial Application, Row 44 has modified a number of the technical parameters of its proposed system. For example: (i) Row 44 now proposes to use spread spectrum modulation, although it made no mention of spreading in its initial application filing;[16] (ii) Row 44 proposes to reduce transmit power from a maximum EIRP of 40.6 dBW to 38.6 dBW;[17] and (iii) Row 44 has provided a spectrum analyzer plot incorporating a spectral mask suggesting that the signal from its proposed user terminal would occupy a noise bandwidth of only approximately 1024 kHz, as opposed to the 1.6 MHz reflected in its link budgets and suggested by its chosen

---

15 Row 44 has made contradictory claims as to how it would deal with its inability to provide service on certain routes. Row 44's Opposition suggested that the "solution" to low G/T would be "to avoid the affected flight paths" but in its meetings with Commission staff Row 44 has stated that it would not expect airlines to alter flight paths, but instead would not install its user terminals on airplanes that would use such flight paths. *Compare id. with* Letter from John P. Janka, Counsel for ViaSat, Inc., to Marlene H. Dortch, Secretary, Federal Communications Commission (Sep. 24, 2008).

16 Opposition at 6.

17 Amendment Response, FCC File No. SES-AMD-20080819-01074, at 1 (filed Aug. 19, 2008).

emission designator.[18] These changes have substantial impacts on Row 44's application; for example, the specified 2 dB reduction in power would substantially increase the scope of those geographic areas in which G/T would be inadequate to sustain service without increasing power over the specified limits. Using Row 44's now outdated link budgets, and applying the reduced maximum allowable EIRP of 38.6 dBW as specified in Row 44's August 29, 2008 amendment, the minimum satellite G/T is -0.8 dB/K for 256 kbit/s links and 2.2 dB/K for 512 kbit/s links. Row 44 has not furnished G/T contour plots for the proposed satellites, but performance data available to ViaSat for Horizons-1 suggests considerable coverage gaps, especially in the Alaska to CONUS flight paths.

Inexplicably, though, Row 44 has not submitted new link budgets to reflect these changes, and as such once again has failed to ensure that its link budgets are representative of its proposed service. This failure adversely affects the ability to evaluate the performance of Row 44's proposed system, and whether that system would comply with the Commission's rules. Notably, the link budgets that Row 44 has submitted in its amended Application already suggest that Row 44's proposed system would not comply those rules, and that a further evaluation of updated link budgets would reveal additional instances of noncompliance. For example; the AMC-2 and AMC-9 link budgets reflect a downlink EIRP density of 11 dBW/4 kHz, which exceeds the maximum EIRP density of 10 dBW/4 kHz permitted by Section 25.134 of the Commission's rules. Row 44 has not sought a waiver of this Section.

Lingering technical discrepancies in Row 44's amended Application also strongly suggest the need to carefully review updated link budgets for technical consistency and compliance with the Commission's rules. For example, Row 44's August 29, 2008 amendment claims that Row 44's proposed system would incorporate a flexible waveguide with a loss of 0.05 dB per foot.[19] However, commercially-available manufacturer specifications confirm that the expected loss for a

---

[18] *See* Amendment Response, FCC File No. SES-AMD-20080829-01117, at Att. 4 (filed Aug. 29, 2008).

[19] Amendment Response, FCC File No. SES-AMD-20080829-01117, at 3 (filed Aug. 29, 2008).

flexible waveguide at that frequency is 0.15 to 0.18 dB/ft[20] – an error of more than 300%. Further, the radiation hazard analysis included in Row 44's initial Application states that transmit power is 12.5 W, or 20 W minus 2 dB of cable, connector, and rotary joint loss, whereas Row 44 claims 3.85 dB of loss between the power amplifier and antenna input in its August 29, 2008 amendment.[21] To add to the confusion and inconsistencies, the System Description appended to Row 44's initial Application states that the satellite antenna assembly ("SAA") would be connected to avionics equipment via two coaxial and one multi-core control cable – as opposed to using the flexible waveguide.[22]

In addition, Row 44 has failed to explain adequately certain discrepancies in its stated antenna gain. In the Technical Annex to its Petition to Deny, ViaSat calculated that the transmit gain from ViaSat's proposed antenna would be approximately 33.64 dBi - or 5.05 dB over Row 44's claimed transmit gain of 28.6 dBi.[23] The 33.64 dBi figure is consistent with specifications published by AeroSat, the manufacturer of the antenna that Row 44 proposes to employ. Further, this number is consistent with data furnished by Row 44 itself in its radiation hazard analysis. Specifically, Row 44 supplies values for the area of the antenna (3.4 in. • 24.6 in. • 2 rows of elements • 1 m / 39.37 in. = 0.108 m^2), antenna efficiency (70%), and a formula for linear antenna gain ($gTX = (\eta \bullet 4 \bullet \pi \bullet A)/\lambda^2$).[24] $10 \cdot \log(x)$ of the resulting linear antenna equals 33.44 dBi, again consistent with the antenna transmit gain calculated by ViaSat, and inconsistent with the antenna transmit gain specified by Row 44 in its original Application submission.

In addition, Row 44 once again fails to provide link budgets that represent the differences in the coverage patterns of all three satellites it proposes to use. In the Technical Annex to its Petition to Deny, ViaSat noted that the link characteristics of Horizons-1, AMC-2 and AMC-9

---

20 For example, Attachment 3 hereto contains specifications for the Andrew F075AAS1 Flexible Twist, which has a published attenuation of 0.18 db/ft.

21 Amendment Response, FCC File No. SES-AMD-20080829-01117, at 3 (filed Aug. 29, 2008).

22 Row 44 System Description at 4.

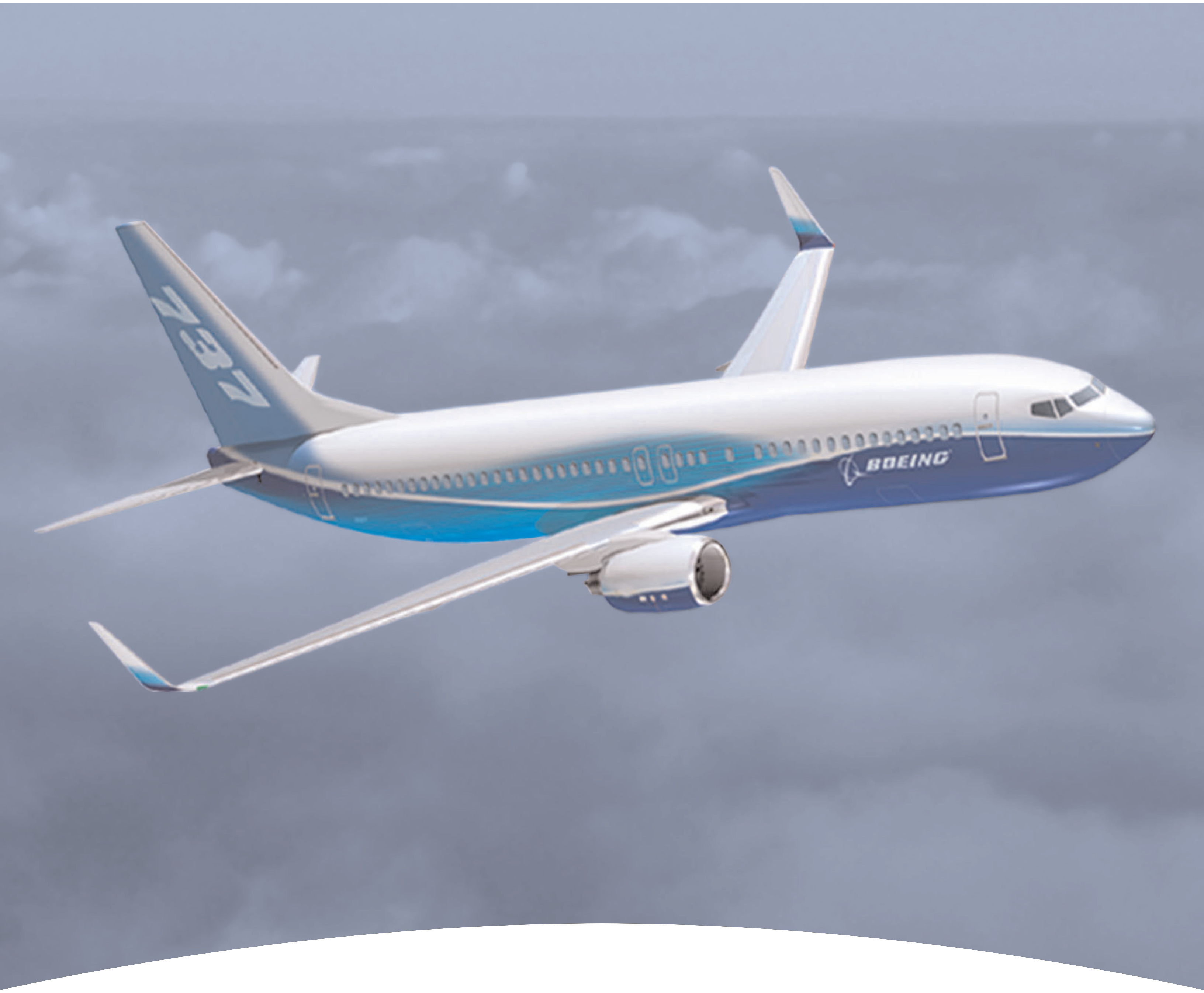
23 *Compare* Row 44 System Description at C-2 *with* Petition, Exh. A at 8.

24 Application, Radiation Hazard Analysis for 0.6 meter AeroSat Antenna, FCC File No. SES-LIC-20080508-00570 (filed May 8, 2008).

vary over their proposed coverage areas, and that spacecraft G/T likely would fall to 0 dB/K or less for some flight paths. Row 44 apparently concedes as much, but fails to provide multiple link budgets reflecting these variations, or to describe in any form those specific areas in which Row 44 actually would or would not be able to provide service in a manner consistent with its link budgets. In order to fully assess the Row 44 system, it is important that Row 44 supply updated link budgets for the forward and return links at the edge of coverage of all three of the satellites that Row 44 proposes to use.

ATTACHMENT 1

Air Data Inertial Reference System (ADIRS)



Increased reliability and performance for Boeing operators

Honeywell

Air Data Inertial Reference System (ADIRS)

Highest reliability in the industry

Lowest cost of ownership

The Honeywell third-generation Air Data Inertial Reference System (ADIRS) with digital gyros provides the industry's highest reliability and performance in a 4MCU package. It is interchangeable with earlier 4MCU ADIRS and 10MCU ADIRS (with a tray adapter). High system reliability reduces operating and maintenance costs for operators.

System Features

- Automatic re-alignment eliminates the requirement to manually select down-mode align between flights or while waiting for dispatch.
- Automatic gyro/accelerometer calibration lowers maintenance cost
- Simplified sensor replacement allows repair of individual sensors without recalibration
- High latitude magnetic map, 82.5 degrees
- Shortened alignment times (typically 5 to 7 minutes)
- Enhanced BITE provides performance monitoring and predictive maintenance messages
- Digital gyro with self-contained electronics improves performance and simplifies ADIRU repair.
- Current gyro fleet reliability exceeds 250,000 MTBF

HIGH Integrity

To provide 100% availability of RNP 0.1 navigation performance and immunity to GPS outages, an optional Honeywell Inertial GPS Hybrid (HIGH) upgrade is available. HIGH combines raw measurement from each satellite in view from the MMR with a Kalman filter to provide a highly calibrated solution ensuring operators of their exact position. This capability is available for retrofit and forward fit applications to maximize airline and route efficiencies.

Certified Boeing Applications

- BBJ
- B717
- B737-600/700/800/900
- B747-100/200/300/SP (Retrofit)
- B757-300
- B767-400
- MD-10

Characteristics

Size	4 MCU, 4.9" x7.6"x15.1", 564 cu. In.
Weight	17.2 lbs
Power (typical)	41 Watts
Attitude	0.1 degree
Heading	0.4 degree
Position (Inertial)	2 NMPH RNP 10 flights up to 13 hours
Velocity (Inertial)	8 knots
TSO	C4c, C5e, C6d
Current Fleet Reliability	Exceeds 30,000 MTBF
Interfaces	ARINC-429
Connector	ARINC-600
Accelerometer Sensor Technology	Quartz
Gyro Sensor Technology	Digital Ring Laser
	Accuracy 2 sigma or 95%

Honeywell Aerospace
1944 E. Sky Harbor Circle
Phoenix, AZ 85034
Tel: 800.601.3099
International: 602.365.3099
www.honeywell.com

C61-0122-000-001
May 2007

Honeywell

ATTACHMENT 2

INSTALLATION AND REMOVAL

1. General

This section contains instructions for the installation and removal of the following units:

- GPIRU Mounting Tray
- Interconnect Cables
- Fan Assemblies
- GPIRU Fan Filter
- GPIRU
- Dzus Mounting Rails
- MSU

2. Installation

A. GPIRU Mounting Tray

The GPIRU Mounting Tray (figure 701) is designed as a four–point Mounting Tray in order to provide an adjustable, stable platform for the GPIRU. The four–point configuration allows the pitch axis to be adjusted without affecting the previous roll adjustment. Honeywell recommends that installers review mounting procedures to ensure that the four–point configuration is achieved when the GPIRU is aligned and leveled.

(1) Accuracy

(a) The accuracy of the GPIRU attitude angle outputs is directly dependent upon the accuracy with which the GPIRU Mounting Tray is aligned with the aircraft axes during installation.

1 To satisfy ARINC characteristic no. 704, the GPIRU Mounting Tray must be installed with an accuracy of ±12 arc minutes (± 0.2°) in yaw with respect to the longitudinal axis of the aircraft.

2 If the GPIRU provides attitude outputs for flight director instruments or for an autopilot, the GPIRU Mounting Tray must be installed with an accuracy of ± 12 arc minutes (± 0.2°) with respect to the aircraft pitch and roll axes.

(b) The final alignment accuracy is dependent upon the procedure used, measuring equipment used, and facilities available.

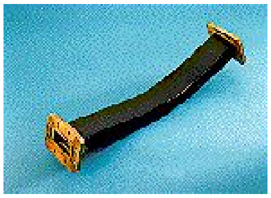
(c) If less accuracy is acceptable for a given installation, a highly precise alignment is not warranted. The following installation and alignment procedures provide attitude accuracies per ARINC characteristic no. 704.

ATTACHMENT 3

Product Specifications

F075AAS1

Flexible Twist for WR75, 10.0–15.0 GHz, with interface types MIL-F-3922/59-010 and MIL-F-3922/59-010, 300 mm



CHARACTERISTICS

Electrical Specifications

Operating Frequency Band	10.0 – 15.0 GHz
Attenuation	0.18 db/ft | 0.59 db/m
Average Power	750 W
Peak Power	140.0 kW
VSWR	1.10

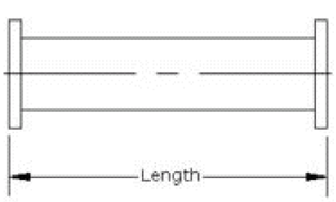
General Specifications

Component	Flexible Twist
Waveguide Size	WR75 | WG17 | R120
Interface	MIL-F-3922/59-010
Interface 2	MIL-F-3922/59-010
Length	300 mm | 12 in

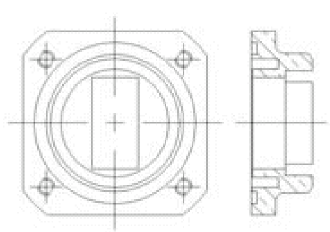
Mechanical Specifications

Maximum Twist	360.00 °/m | 110.00 °/ft
Minimum Bend Radius, Multiple Bends (E Plane)	64.00 mm | 2.50 in
Minimum Bend Radius, Multiple Bends (H Plane)	115.00 mm | 4.50 in
Pressurization, maximum	45 psi | 310 kPa

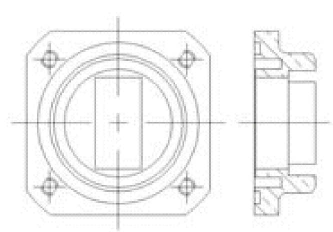
Component



Interface



Interface 2



Regulatory Compliance/Certifications

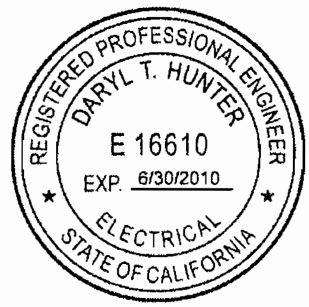
Agency	Classification
RoHS 2002/95/EC	Compliant by Exemption
China RoHS SJ/T 11364-2006	Above Maximum Concentration Value (MCV)

From North America, toll free
Telephone: 1-800-255-1479
Fax: 1-800-349-5444

Outside North America
Telephone: +1-708-873-2307
Fax: +1-779-435-8579

ENGINEERING INFORMATION CERTIFICATION

I hereby certify that I am the technically qualified person responsible for reviewing the engineering information contained in the foregoing submission, that I am familiar with Part 25 of the Commission's rules, that I have either prepared or reviewed the engineering information submitted in this pleading, and that it is complete and accurate to the best of my knowledge and belief.



Daryl T. Hunter, P.E.
ViaSat, Inc.
6155 El Camino Real
Carlsbad, CA 92009-1699

Dated: October 10, 2008

DECLARATION

I, Daryl T. Hunter, hereby make the following declarations under penalty of perjury. I understand that this Declaration will be submitted to the Federal Communications Commission.

1. I am Director, Regulatory Affairs of ViaSat, Inc.

2. I have reviewed the foregoing Supplement to Petition to Deny of ViaSat, Inc.

3. I certify that the facts set forth in the foregoing Supplement to Petition to Deny of ViaSat, Inc. are true and correct to the best of my knowledge.

Daryl T. Hunter

Daryl T. Hunter

Executed October 10, 2008

CERTIFICATE OF SERVICE

I, Jarrett S. Taubman, hereby certify that on this 10th day of October, 2008, I served a true copy of the foregoing Supplement to Petition to Deny of ViaSat, Inc. by first class mail, postage pre-paid upon the following:

David S. Keir
Leventhal Senter & Lerman PLLC
2000 K Street, NW
Suite 600
Washington, DC 20006

Jarrett S. Taubman