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May 15, 2002

Via Electronic Filing and Hand Delivery

Marlene H. Dortch
Secretary
Federal Communications Commission
The Portals
445 Twelfth Street, S.W.
Washington, DC 20554

Re: ***Ex Parte Presentation***:
IB Docket No. 01-185;
Motient Services Inc. and Mobile Satellite Ventures Subsidiary LLC
File No. SAT-ASG-20010302-00017 et al.;
TMI Communications and Company, Limited Partnership
File No. SES-ASG-20010116-00099 et al.

Dear Ms. Dortch:

Enclosed on behalf of Inmarsat Ventures plc is a paper entitled "Inmarsat Response to MSV *Ex Parte* of March 28 Concerning 'Monitoring and Control of Ancillary Terrestrial Emissions by MSV's Space Segment.'"

An original and five copies are enclosed.

Respectfully submitted,

/s/ John P. Janka
John P. Janka

Enclosure

cc (w/ encl.):

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Inmarsat Response
to MSV *Ex Parte* of March 28
Concerning
"Monitoring and Control of Ancillary Terrestrial Emissions by MSV's Space Segment"

Inmarsat Ventures plc

May 15, 2002

IB Docket No. 01-185

1. Introduction

In the referenced *ex parte* submission, MSV has provided all the evidence necessary to confirm beyond doubt Inmarsat's previous conclusion that the proposed MSV monitoring system is seriously flawed and cannot fulfill the purpose for which it is intended.[1]

MSV has clearly recognized the crucial need to monitor the uplink interference from its proposed ATC (Ancillary Terrestrial Component) part of its MSS system into MSV's own MSS satellite uplink receiver. MSV also suggests that the purpose of the monitoring is to measure co-channel interference into other MSS satellite uplinks, such as those of Inmarsat.

Inmarsat is concerned about both of these interference problems, as previously explained. The self-interference generated by ATC into the MSV spacecraft would result in MSV requiring additional L-band spectrum for its ATC system, beyond the spectrum that MSV needs to provide "pure" MSS service and therefore would cause MSV and the US government to violate their obligations under the Mexico City MOU. The harmful interference to other MSS systems is clearly of direct impact to Inmarsat as it would reduce the Inmarsat system performance in terms of link availability, thereby causing disruption to vital communications services, and reduction in the Inmarsat system capacity. Even if it were feasible for MSV to monitor interference into the Inmarsat system (which it is not), it is absurd to suggest that MSV should be expected to monitor and report on the level of interference that MSV is causing to Inmarsat, MSV's main competitor in the U.S.

2. MSV's Proposed Monitoring System Design

MSV has explained the operation of its proposed monitoring system as follows:

- Co-frequency ATC transmissions will only take place in the "vicinity" area of the six beams surrounding the beam in which satellite uplinks at those frequencies are taking place (the "central" beam). This consists of the parts of the surrounding beams outside of the white "exclusion ring" shown in Figure 5 of the referenced MSV *ex parte* submission.

- The signals from the six surrounding beams, that are co-frequency with the satellite uplinks in the central beam, will be combined and the aggregate power will be measured with the objective of quantifying the ATC interference arising from the "vicinity" area.

MSV has provided an analysis in the referenced *ex parte* submission, in the form of an interference link budget, to determine the signal and noise levels of its monitoring system. This has been reproduced (with some additions) in Table 1 below. The significant additions, relevant to MSV's table are as follows:

[1] See Section 1 of Supplemental Technical Annex to the Reply Comments of Inmarsat Ventures PLC, November 13, 2001.

(a) In line 5 the "Allowable Interfering Signal Spectral Density" has been calculated, based on a 0.25 dB degradation (line 1) to the "MSV Satellite Receiver Noise Spectral Density" that is given in line 4. This was added because it is very pertinent to an understanding of the operation of the monitoring system;

(b) The right hand column has been added to identify whether the table entries are relevant or not to the calculation of interfering signal and noise density levels for the proposed monitoring system. In addition, the entries with a "YES" in the right hand column have been shaded to highlight that they alone are relevant to the analysis here.[2]

Table 1:

	Parameter	Units	Values	Relevant or not?
1	**Link Margin Degradation**	**dB**	**0.25**	**YES**
2	MSV Satellite Antenna Gain	dBi	41	NO
3	MSV Satellite Receiver Noise Temperature	K	450	**YES**
4	MSV Satellite Receiver Noise Spectral Density	dBW/Hz	-202.1	**YES**
5	**Allowable Interfering Signal Spectral Density**	**dBW/Hz**	**-214.3**	**YES**
6				
7	Maximum MSV Ancillary Terminal EIRP	dBW	0	NO
8	MSV Terminal Carrier Bandwidth (ancillary mode)	kHz	200	NO
9	MSV Terminal EIRP Spectral Density	dBW/Hz	-53.0	NO
10				
11	Free Space Loss	dB	188.8	NO
12	Average Shielding	dB	10	NO
13	MSV Satellite Receive Antenna Discrimination (Average)	dB	10	NO
14	Average Power Reduction due to Closed-Loop Power Control	dB	6	NO
15	Average Power Reduction due to Variable-Rate Vocoder	dB	7.4	NO
16	Average Polarization Isolation (Linear to Circular)	dB	3	NO
17	Voice Activity Factor	dB	1	NO
18	Received Interfering Signal Spectral Density (per ATC carrier)	dBW/Hz	-238.2	NO
19	Max Number of Co-Channel ATC Carriers per Co-Channel Spot Beam Vicinity		243.8	NO
20	Number of Users per Carrier		7	NO
21	Maximum Number of ATC Users per Co-Channel Spot Beam Vicinity		1,706	NO
22	Number of Co-Channel Satellite Beam Vicinities over CONUS		10	NO
23	**Total Number of Allowed Ancillary Co-Channel Carriers Over CONUS**		**2,438**	NO

MSV's analysis of its proposed monitoring system, based on the data in Table 1, proceeds as follows:

1. The allowable interference level received by the central beam is –214.3 dBW/Hz (line 5), based on the requirement to not degrade the satellite receive system noise temperature (derived from lines 3 and 4) by more than 0.25 dB (line 1) due to ATC transmissions in the "vicinity" area of the six adjacent beams;

2. The ATC transmissions that take place in the "vicinity" area of the adjacent beams, at the frequency used for MSV satellite uplinks in the central beam, are received by the six adjacent beams and summed to produce the aggregate from the "vicinity" area. These beams are assumed to have 10 dB more average gain than the average gain of the central

[2] Note that Inmarsat does not agree with some of the parameters in Table 1, as previously stated in its submissions to the Commission, but the disputed parameters do not include the relevant parameters in Table 1 indicated by a "YES" in the right hand column.

beam towards the “vicinity” area.

3. Based on 2 above, the allowable received signal power in the summed adjacent beams, due to the ATC signals transmitted from the “vicinity” area, is assumed to be 10 dB higher than the allowable interfering signal level in the central beam, which was derived above to be –214.3 dBW/Hz. The allowable received signal power in the adjacent beams (which are providing the monitoring signal) is therefore equal to –204.3 dBW/Hz (i.e., -214.3 + 10 dB).

4. The receive system noise spectral density for the six summed adjacent beams is calculated, starting with the receive system noise spectral density of each beam, given in line 4 of Table 1 as –202.1 dBW/Hz. Because of the combining of six beams this noise spectral density is increased six times, to give a value of –194.29 dBW/Hz (i.e., -202.1 + 10log(6)).

5. The monitoring system is then expected to be able to identify when the interfering signal reaches a level of –204.3 dBW/Hz in the presence of a noise density of –194.29 dBW/Hz. Note that the interference, even in these monitoring beams is 10.05 dB below the noise level. The effect of this is that the monitoring system is expected to accurately detect an increase in the noise floor of 0.4 dB to determine when the interference level has become unacceptable.

Note that the above description of the monitoring system operation, based on MSV’s explanation, does not address at all how the monitoring system will determine uplink interference levels to Inmarsat’s (or any other MSS satellite operator’s) satellite. It only addresses monitoring with respect to self-interference to the MSV MSS satellite system. Issues with respect to monitoring harmful interference into the Inmarsat system are addressed in Section 4 of this document.

There are fundamental problems with this proposed monitoring system, and with MSV’s analysis of it, as explained in the following sections.

3. Problems with Measurement of Self-Interference Using the Proposed Monitoring System

In this Section we will explain the problems with the proposed MSV interference monitoring system which will prevent it from producing any meaningful results regarding MSV’s self-interference into its own MSS satellite uplinks.

3.1 Proposed MSV Monitoring System is Not Sufficiently Sensitive to Interference

Even if the monitoring system could operate as suggested by MSV, its very low sensitivity makes it almost useless. To reliably detect a 0.4 dB increase above the thermal noise floor of a satellite uplink, based on the re-transmitted downlink signal, is impossible. To accurately measure the noise+interference to determine a 0.4 dB increase would require an absolute power measurement accuracy that is typically an order of magnitude better than 0.4 dB, which implies an accuracy of 0.04 dB. This is way beyond any reasonable measurement set-up. The accuracy will be further compromised by the time varying fades introduced by the Ku-band feeder downlink, and which would create an uncertainty in the absolute measurement of the uplink noise floor that could entirely mask any additional uplink interference that the system is supposed to be measuring.

3.2 MSV Satellite Uplink Signals Will Further Desensitize the Monitoring System

The six adjacent "monitoring" beams will receive not only the interfering ATC signals that are intended to be monitored but also co-frequency satellite uplink transmissions in the central beam that is adjacent to them. This is because the gain of the monitoring beams is still quite high over the whole of the central beam from which wanted MSV satellite uplinks will take place.

MSV discusses this issue but fails to take account of it in its numerical analysis of the monitoring system.[3] Instead, MSV seems to suggest that the additional satellite uplink interference to the monitoring beams means that the monitoring system will somehow underestimate the interference. This creates the impression that this undesirable interference to the monitoring system is an advantage whereas in fact it is a significant disadvantage.

Table 2 below has been prepared to show the parameters of the MSV satellite uplink. The MSV satellite antenna gain (peak) and receive system noise temperature are consistent with Table 5 in the referenced MSV *ex parte* submission. The parameters concerning the MSV satellite mobile terminal transmitter are consistent with the latest information provided by MSV to the Commission.[4] The resulting MSV satellite receive signal spectral density at the –3 dB relative gain contour is shown in Table 2 to be –191.3 dBW/Hz. This signal level could be received by any one of the six adjacent "monitoring" beams and it would have the effect of raising the noise floor of the monitoring system.[5] Without this satellite uplink interference to the monitoring system, the noise floor would be at –194.29 dBW/Hz (see Section 2 above), so the effect of the interfering signal at –191.3 dBW/Hz would be to raise the noise+interference floor of the monitoring system to –189.52 dBW/Hz. In such a situation, the ability to detect ATC uplink interference (at the –204.3 dBW/Hz level given in Section 2 above) by the proposed MSV monitoring system would require MSV to detect a mere 0.14 dB increase in the noise+interference floor of the monitoring system. This compares with the 0.4 dB increase that MSV claims would be necessary, and which has already been discussed above as being too low to accurately measure.

[3] See subject *ex parte* submission by MSV, Section 2, Page 9, 2nd paragraph.

[4] See MSV *ex parte* submission dated March 7, 2002.

[5] Such interference from the MSV satellite uplink to the MSV monitoring system would occur when an MSV satellite mobile terminal is located close to the edge of the beam. If it were at the very edge of the beam the interference would be even higher.

Table 2:

Parameter	Units	Values
MSV Satellite Antenna Gain (Peak)	dBi	42.5
MSV Satellite Receiver Noise Temperature	K	450
MSV Satellite Receiver Noise Spectral Density	dBW/Hz	-202.1
MSV Satellite Mobile Terminal EIRP	dBW	5
MSV Satellite Mobile Terminal Carrier Bandwidth (satellite mode)	kHz	50
MSV Satellite Mobile Terminal EIRP Spectral Density	dBW/Hz	-42.0
Free Space Loss	dB	188.8
Average Shielding	dB	0
MSV Satellite Receive Antenna Discrimination (at -3 dB gain contour)	dB	3
Received Interfering Signal Spectral Density (into monitoring beam from MSV satellite uplink in central beam)	**dBW/Hz**	**-191.3**

Other co-frequency MSV satellite uplink transmissions from the rest of the MSV service area will further de-sensitize the proposed MSV monitoring system. Although these transmissions will be received by the monitoring beams at a lower satellite antenna gain, their aggregate effect could still be very significant. These have not been taken into account in Table 2 above.

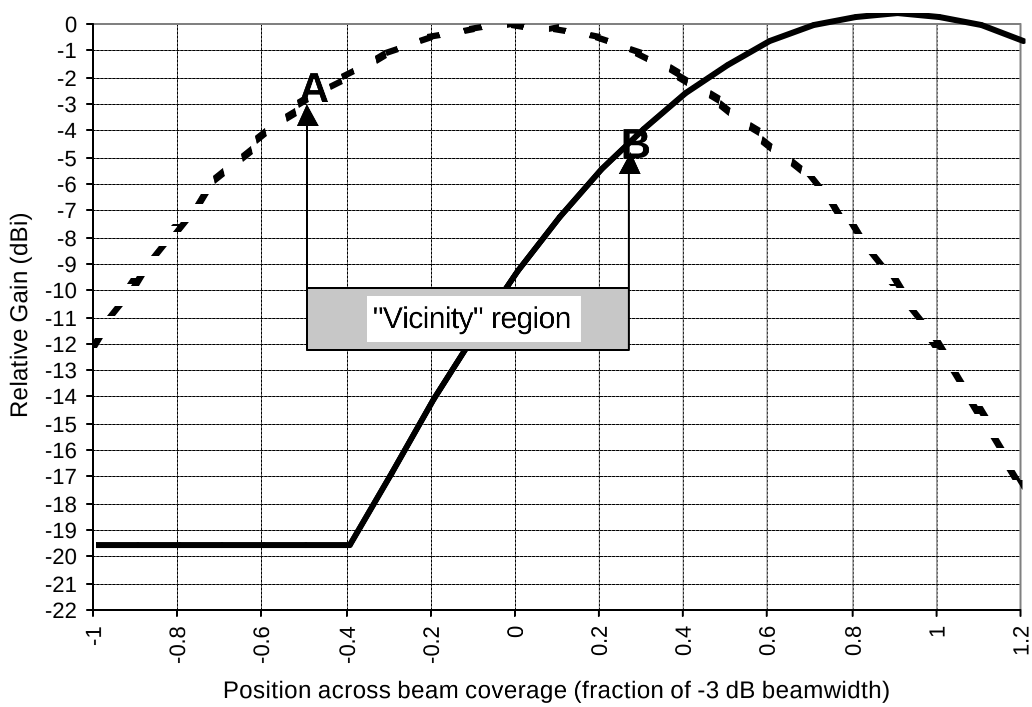
3.3 Gain Profile of Monitoring Beams is Totally Different from the Gain Profile of the Beam Experiencing ATC Interference

The entire MSV approach to monitoring the levels of ATC interference to the satellite uplinks relies on average gain differences between the beam being interfered with and the beams used to measure the ATC interference. The use of averages in this way implicitly assumes that the interfering ATC transmitters are distributed evenly over the "vicinity" area. Such an assumption is highly unlikely to be accurate in all, or even many, cases. Rather, the use of the proposed ATC in metropolitan and suburban areas will lead to a concentration of ATC interference in certain geographic areas as viewed by the MSS satellite, which is significantly different from the "even distribution" scenario assumed by the monitoring system design.

Figure 1 illustrates the gain profile of adjacent MSV satellite beams across a portion of the coverage area. The beam profile indicated by the dashed line is meant to represent one of the adjacent beams that is being used to monitor the ATC interference experienced by the beam whose profile is indicated by the solid line. The gain contours, which are Gaussian in roll-off, are made to cross over just below the –3 dB point, which is approximately the same as indicated by MSV for its proposed system. The plateau at –20 dB relative gain is merely an assumption. The cross-hatched rectangle is meant to indicate the "vicinity" region over which ATC transmissions will take place that are co-frequency with the intended MSV satellite transmissions in the central (solid) beam. Point "A" at the left end of this rectangle coincides with the –3 dB gain contour of the monitoring (dashed) beam. Point "B" at the right end of the rectangle is meant to indicate the outer extreme of the "white ring" exclusion zone that MSV has identified. The exact position of point "B", in terms of the gain contour of the central (solid) beam, has not been accurately defined by MSV, but it is presumed to correspond with a central beam gain level significantly higher than –10 dB in order to achieve an "average" gain level of –10 dB across the "vicinity" region. The exact position of point "B" is not important to the point being addressed here.

Compare the gain levels of the "monitoring" (dashed) beam and the "interfered-with" (solid) beam over the "vicinity" region. The former is from –3 dB to 0 dB relative gain. The latter is from somewhere in the region of -20 dB to somewhere significantly higher than –10 dB (in fact a value of –5 dB is shown in Figure 1 for illustrative purposes. The calibration of the proposed MSV monitoring system relies completely on the ATC interferers being distributed evenly across the "vicinity" region because of this difference in gain profile of the two adjacent beams over this region. If the ATC interferers are distributed non-uniformly then the monitoring results are meaningless. For example, if the majority of ATC interferers are concentrated towards the left end of the "vicinity" region then the monitoring (dashed) beam will over-estimate the interference received by the central (solid) beam. Conversely, if the ATC interferers are biased towards the right end of the "vicinity" region then the monitoring beam will under-estimate the interference received by the central beam.

Figure 1:



Therefore, there is a fundamental problem here in the fact that the characteristics of the antenna being used to monitor the interference are very different from those of the antenna experiencing the interference, at least in the direction from which the interference originates. This creates huge uncertainty about the actual levels of interference being generated, and therefore means that the proposed monitoring solution is simply not feasible.

3.4 Monitoring System Cannot Identify Where the Unacceptable ATC Uplink Interference is Originating From Or Control The Interfering ATC Transmitter

Even if the proposed MSV interference monitoring system could detect with any kind of accuracy the levels of ATC interference, the question still remains as to what MSV can do about the interference that it would generate into Inmarsat and into itself. Fundamental to MSV's proposal to somehow control interference generated by MSV's proposed ATC system is the determination of where the interference is originating. The approach proposed by MSV, which relies on the summation of the signals from a ring of adjacent monitoring beams, does not identify where the dominant interferers are located.

If harmful interference is detected (which Inmarsat believes is not possible as explained in Sections 3.1, 3.2 and 3.3 above) MSV can only conclude that the dominant interference is generated somewhere in the general direction of the ring of six monitoring beams. The geographic area contained by the combined –3 dB gain contours of the six monitoring beams is many hundreds of thousands of square miles, and would likely encompass many hundreds or even thousands of MSV's ATC base stations.

In fact the situation is even worse than this. The first ring of six monitoring beams will also receive interference from the second (outer) ring of twelve adjacent beams due to the fact that the beam gain levels are still quite high over large areas of this outer ring of beams. This creates even more uncertainty about the location of the dominant interferers.

Therefore, in the event that MSV concludes that ATC interference has reached harmful levels, what course of action can MSV take? All it knows (albeit with huge uncertainty for the reasons indicated above) is that the aggregate interference needs to be reduced. As has clearly been shown by Inmarsat in previous submissions to the Commission, the interference levels produced by individual ATC mobile transmitters varies over a very wide range, due primarily to the different amounts of signal blockage that would exist. This ranges from clear line-of-sight interferers, of which only a relatively small number would produce harmful interference, to relatively benign interferers operating in situations with 10 or 20 dB of signal blockage, and of which many more can be tolerated. Would MSV arbitrarily terminate ATC user calls, or put an entire stop on the establishment of new calls over an enormous geographic region, until the unacceptable levels of ATC interference naturally subside? The practicalities of this whole approach to the essential control of ATC interference are extremely troublesome, and exacerbated by the inability to identify the precise location of the interfering signals.

4. Problems with Measurement of Interference to Inmarsat Using the Proposed Monitoring System

MSV fails to mention how it will employ its proposed monitoring system to adequately protect other MSS satellite uplinks, such as Inmarsat's, from harmful interference. Instead MSV relies on the false assumption that, if the MSV satellite uplinks are adequately protected, then the Inmarsat uplinks must also be protected. This is not the case, as will be explained further below.

The first point where MSV is wrong concerns the assumption that the average interference level to all orbital positions is constant and therefore Inmarsat is protected if MSV's own satellite is protected. MSV rightly states that "… over a wide area, like the United States, all possible morphologies will be encountered by users, some with greater shielding towards the Inmarsat satellite and some with greater shielding towards the MSV satellite." The point where MSV errs is in their conclusion that the variance about the mean level of the interfering signal will be small based on the incorrect assumption that a "…large population of ATC users … is necessary to cause a noticeable co-channel effect."[6] As Inmarsat has repeatedly demonstrated in the past, only a small number of co-channel ATC users, operating with little or no shielding, can cause harmful interference into the Inmarsat uplinks.[7] Therefore the average or mean interference level from the ATC transmitters is not the relevant measure to assess the uplink interference. The instantaneous aggregate interfering signal level from the ATC transmitters will vary widely about the mean level and the high levels of interference will be harmful to the Inmarsat uplink.

Annex 1 provides additional information that illustrates this point. In the annex we show the following:

1. The azimuth pointing directions from the ATC transmitters will vary widely towards the different Inmarsat satellites and the MSV satellite. Therefore the blockage on the "monitored interference path" will, under general conditions, be quite uncorrelated with the interference on the "actual interference path."

2. The cities shown in the annex happen to have street alignments that could result in low blockage to an Inmarsat satellite and high blockage to the MSV satellite, or vice versa. This will result in extremely high fluctuations in the aggregate ATC uplink interference levels, for the reasons explained previously by Inmarsat.[8] Furthermore, the "monitored interference path" levels will tend to be low when the "actual interference path" levels are high because of the tunnel effect of the streets which can cause low blockage to the Inmarsat satellite and high blockage to the MSV satellite. Therefore the proposed monitoring system will inevitably be unable to make any assessment of the interference to the Inmarsat satellite, even if it had the necessary sensitivity.[9]

Even ignoring the problems caused by the wide orbital separation between the MSV and Inmarsat satellites, which are addressed above, the MSV satellite beams are just not suitable for measuring the interference received by the Inmarsat satellite. This is true because the gain profile of the Inmarsat receive beams over the territory of the USA are vastly different from the effective gain profile of the rings of MSV beams that form the basis of the proposed monitoring

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6 See subject *ex parte* submission by MSV, Footnote 1.

7 See Section 3.1 of Technical Annex to the Comments of Inmarsat Ventures PLC, October 19, 2001. A single MSV ATC transmitting carrier could cause in excess of 0.2% increase in the Inmarsat satellite receive system noise temperature, and therefore only a small number of such co-channel transmitting carriers would cause harmful interference.

8 See Section 3.4 of Supplemental Technical Annex to the Reply Comments of Inmarsat Ventures PLC, November 13, 2001.

9 See Section 3 of this document for a detailed discussion of the sensitivity problems with the proposed MSV monitoring system that will make it totally ineffective.

system. Therefore the monitored signal power received by the MSV beams simply would not be representative of the interference received by Inmarsat.

Finally, the proposed MSV monitoring system would not measure interference over the relevant geographic area. The MSV monitoring system is designed to only protect individual MSV uplink beams, because it sums the interfering signals from a ring of beams. Inmarsat, however, would be susceptible to ATC interference generated across the entire USA which could be more than ten times greater than the interference from a single ring of beams. MSV does not even attempt to address this issue.

5. Summary of Conclusions

In this document we have considered carefully MSV's proposed interference monitoring system, and found it to be lacking in all important respects, as follows:

1. The proposed monitoring system is extremely insensitive to the interference it is designed to measure. At the level where the interference is unacceptable even to MSV's own satellite uplinks the monitoring system is expected to determine accurately an increase in the noise floor, according to MSV's own calculation, of only 0.4 dB. There are inherent inaccuracies in a measurement of this type, particularly where the uplink noise floor is to be determined based on a downlink measurement, and these inaccuracies will likely exceed the level being measured and therefore make any measurement meaningless for purposes of protecting Inmarsat.

2. Based on the analysis presented in section 3.2 above, which also includes the effect of MSV's own satellite uplinks, the proposed monitoring system is considerably less sensitive than MSV claims. Instead of needing to measure a 0.4 dB increase in the noise floor, the level at which unacceptable interference occurs corresponds to only a 0.14 dB increase. Such a miniscule increase is not measurable as a practical matter.

3. Quite separate from the sensitivity problem described in 1 and 2 above, the proposed interference monitoring system is flawed because of the vastly different gain profiles of the beams used for monitoring compared to the beams receiving the actual interference. This is true with regard to the self-interference to MSV as well as the harmful interference generated into Inmarsat. The correlation between the monitored interference and the actual interference will therefore vary dramatically depending on the geographic distribution of the interfering ATC transmitters, so the monitoring results will be meaningless.

4. Even if the MSV monitoring system could determine the self-interference arriving at the MSV satellite, it cannot be concluded that the interference received at the Inmarsat spacecraft at different orbital locations will be the same. The relatively small number of MSV ATC transmitters necessary to cause harmful interference into Inmarsat means that there could be very large differences between the interference levels generated into widely spaced orbital locations. In other words, Inmarsat could suffer harmful

interference at one orbital location even though the MSV spacecraft at another location might be shielded from those same signals, and therefore would not recognize those signals as harmful interferers. The effects of the street directions in metropolitan areas will be a significant contributor to this problem, as illustrated in Annex 1 of this document.

Inmarsat therefore concludes that the proposed MSV interference monitoring system is unable to provide any guarantee of interference protection to the Inmarsat spacecraft receivers. Thus, the Inmarsat system would be left totally vulnerable to the harmful uplink interference that would be caused by the proposed MSV ATC transmissions. Furthermore, Inmarsat believes that the proposed monitoring system is unable to accurately measure the self-interference to MSV's own satellite uplink, and this will inevitably lead to MSV having to completely segregate the spectrum used for its ATC and its satellite uplinks. Such a result would be fundamentally inconsistent with MSV's core asserted justification for its ATC system.

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Annex 1

Azimuth Pointing Directions to MSV and Inmarsat Satellites for Various U.S. Cities Compared to City Street Plans

The azimuth pointing directions from several widely spaced U.S. cities towards the MSV and Inmarsat satellite orbital locations are provided in this annex. Also shown are the street plans for those cities, in order to compare the general street alignments with the satellite azimuth pointing directions.

Note that, for the cities shown, there is generally good alignment with one or more of the Inmarsat azimuth directions. This will give rise to situations where very little signal blockage occurs between the proposed MSV ATC users and the Inmarsat satellite, as discussed in previous Inmarsat submissions on this matter.[10]

In these and similar situations the following will occur:

1. Very low signal blockage means that only a small number of co-frequency ATC transmitters will cause harmful interference. Based on Inmarsat's previous analysis each MSV ATC carrier could cause an increase in the Inmarsat satellite receive system noise temperature of greater than 0.2%, and so only a relatively small number of co-channel carriers is required to produce harmful interference.[11]

2. The interfering signal levels measured by the proposed MSV satellite monitoring system would be totally uncorrelated with the interfering signal levels received by the Inmarsat satellite. Therefore the monitoring system would be incapable of detecting whether the Inmarsat satellite was suffering harmful interference levels from the ATC transmissions.

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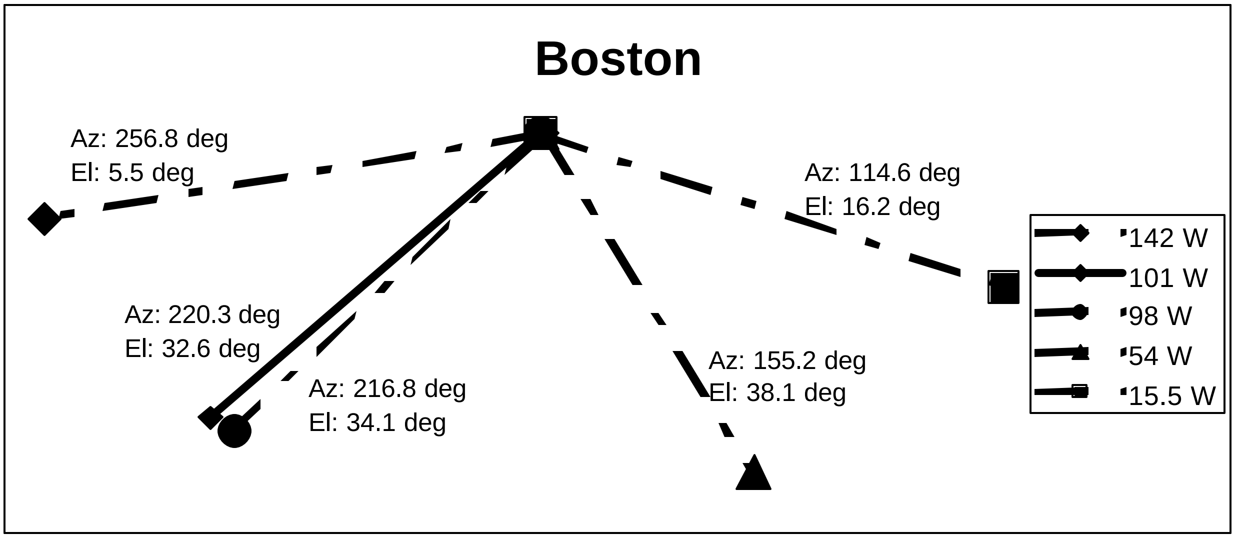
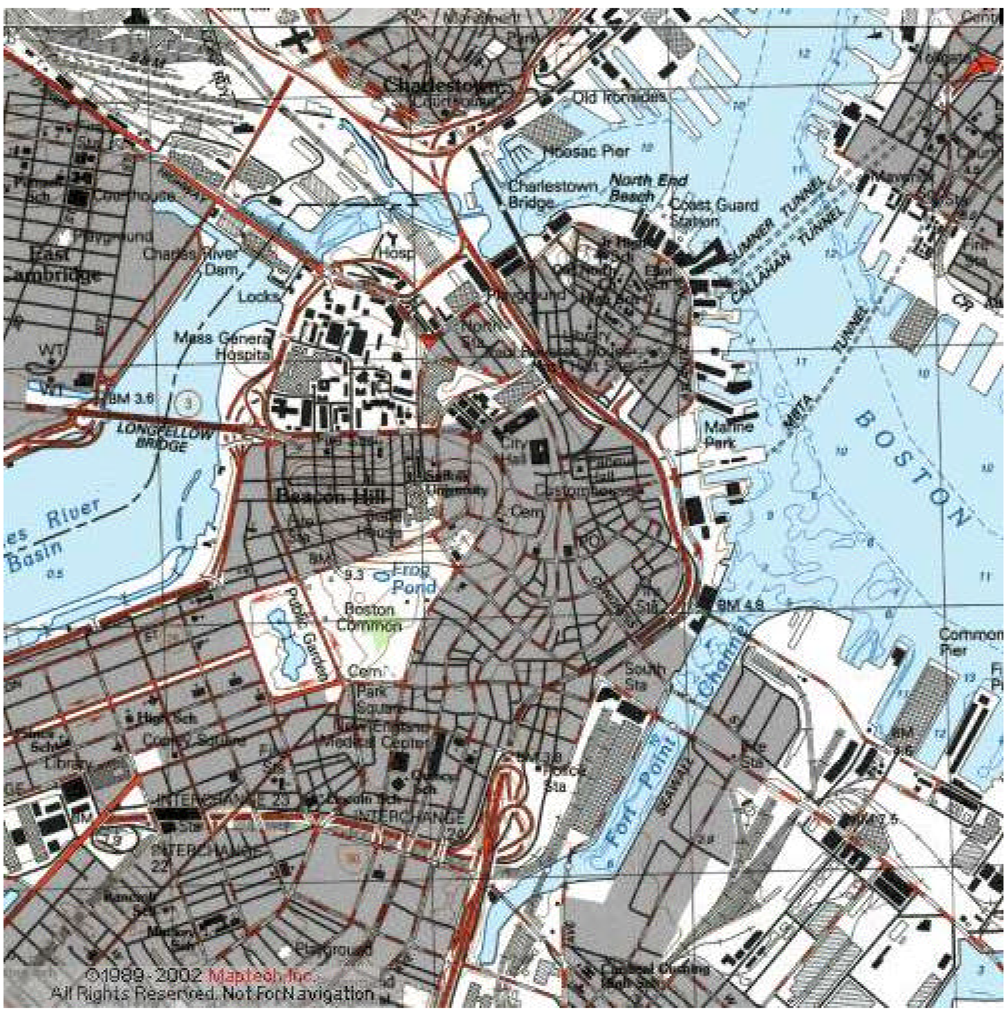
[10] See Section 3.4 of Supplemental Technical Annex to the Reply Comments of Inmarsat Ventures PLC, November 13, 2001.

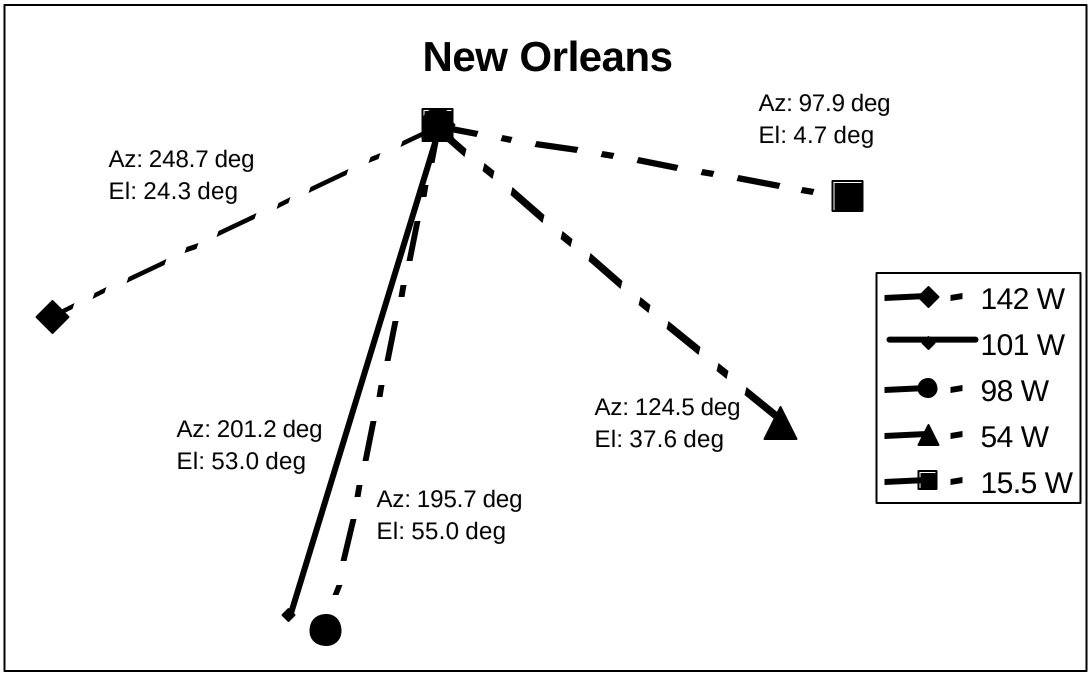
[11] It should be noted that the MSV ATC uplink interference is in addition to the uplink interference arising from MSV's satellite uplinks.

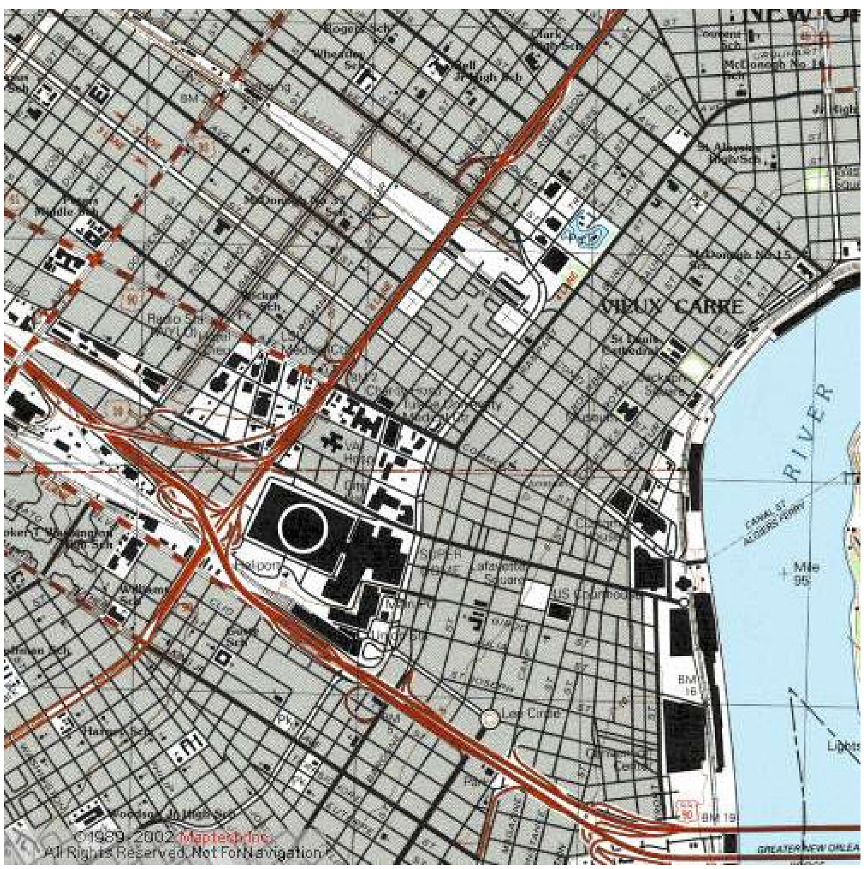
Solid line = MSV satellite direction
Dashed line = Inmarsat satellite directions





Solid line = MSV satellite direction
Dashed line = Inmarsat satellite directions





Solid line = MSV satellite direction
Dashed line = Inmarsat satellite directions