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INTERNATIONAL AND DOMESTIC REGULATORY ISSUES FACING THE CANADIAN MSAT SYSTEM

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ABSTRACT

This paper addresses international and domestic regulatory issues which affect the implementation of a mobile satellite system (MSAT) over North America. It deals with WARC-MOB-87, MSAT frequency co-ordination, frequency sharing and key Canadian domestic issues.

INTRODUCTION

Introduction of MSAT service is the next logical progression in satellite communications in Canada and the U.S. The first part of this paper deals specifically with issues related to frequency/orbit co-ordination of MSAT within the context of the prevailing international Radio Regulations. It reviews briefly the results of the 1987 World Administrative Radio Conference on Mobile Service and its foreseen effects on the MSAT frequency co-ordination environment. Possible approaches to frequency sharing between the existing and planned systems will also be examined. The second part addresses the domestic regulatory issues surrounding the development of a commercial MSAT service in Canada.

WARC-MOB-87

The 1987 World Administrative Radio Conference on Mobile Services (WARC-MOB-87), as part of its agenda dealing with the contentious issue of spectrum re-allocation, finally recognized the need and made specific provision for land mobile satellite service (LMSS) in the 1.5 - 1.6 GHz range. Under the new provisions, the full complement of satellite based mobile services now can be provided in this part of the spectrum, subject to successful co-ordination under the international Radio Regulations. The conference, however, chose to preserve the distinction between various types of services. For a multi-beam mobile satellite system such as MSAT, this means that the provision of a full complement of services within each beam now requires multiplexing distinct segments of the corresponding spectrum allocated to each class of service. Furthermore, the allocations to LMSS now come in three categories - Exclusive (LMSSE), Co-primary (LMSSC) with, and Secondary (lmss) to maritime mobile satellite service (MMSS), depending on location in the band in question.

While the decision of the conference obviously entails changes to the technical design of the MSAT associated hardware, it is the international co-ordination aspect of the new provisions which will be dealt with in the following sections.

MSAT CO-ORDINATION ENVIRONMENT

In order to gauge broadly the co-ordination environment for the Canadian MSAT system, Figure 1 was prepared to represent graphically the population and distribution of existing and planned mobile systems in this band, as identified through the ITU publications. The systems within the arc 23°E - 150°E are not depicted, as they are not likely to affect the Canadian MSAT. The service classification under which these systems have been filed with the ITU as well as the dates of Advance Publication Information (API) and start of the co-ordination phase are identified in Table 1.

A more detailed consideration of the entries in Table 1 in terms of their relative orbital positions, the expected in-service dates, operational life and the intended service area reveals that the systems subject to detailed co-ordination with the Canadian MSAT are likely to be reducible to a shorter list as presented in Figure 2. In this figure, the exact downlink frequencies as identified in the ITU publications are also shown to indicate the extent of spectrum overlap which may require detailed frequency co-ordination. It is to be noted, however that some of these systems are expected to change in the process of realignment with the outcome of WARC-MOB-87. These changes, along with new entries which may emerge in the coming years, will no doubt impact the co-ordination picture just described.

A POSSIBLE APPROACH TO FREQUENCY SHARING

In this section, by way of a simple example, some technical principles and guidelines which have the potential to facilitate the co-ordination process are discussed in a qualitative fashion. To better understand the concept, the following notes are in order. The MSAT related co-ordination activities can be divided into two broad categories: 1) co-ordination with existing systems or their replacements, and 2) co-ordination with planned systems. These two groups could conceivably each be divided into global systems and national or regional systems. National or regional systems are quite likely to utilize spot-beams to conserve satellite power over the intended service area, a fact that greatly enhances their frequency re-use capability and facilitates the frequency co-ordination process. The global systems on the other hand, have been traditionally characterized by large beams with little or no re-use capability. Frequency co-ordination of the spot-beam based systems amongst themselves is expected to be relatively simple to achieve. Indeed the models developed for the North American MSAT systems to date are indicative of the feasibility and efficiency with which such beam topologies could be implemented. The basic concept has been shown to be easily extendable to South America and other ITU regions [Ref. 1]. Co-ordination with the global systems, however will require special measures.

Before searching for a solution, we should first understand the nature of the problem. The primary mode of interference between a spot-beam system and a global one is uplink interference into the former case and downlink interference into the latter one simply caused by the large inhomogeneity in the associate coverage gains. This observation suggests that if the intended service areas are to a large extent mutually exclusive, then sharp roll-off characteristics of the spot-beams will quickly localize and limit the interference to the overlap boundaries of the two systems. Once the potential incompatibilities become localized, then detailed frequency co-ordination becomes a feasible task. This can be achieved in two principal ways. Either the mobiles belonging to the global system and roaming in the areas close to the overlap region will not be assigned common frequencies with those utilized in the boundary spot-beams, or alternatively, these spot-beams will use a set of frequencies not used by the global beam.

A PLAUSIBLE SCENARIO

A simplistic example of the application of such a sharing concept is depicted in Figure 3. Sub-bands from LMSSE allocation are used to construct the coastal beams for a hypothetical North American system and the frequency is reused wherever feasible within the intended coverage area. Noting the fact that WARC-87 resolutions require that the LMSSE allocation only be used for national or regional coverage, it is necessary to utilize spot-beam technology for controlling emissions over adjacent service areas. The entire frequency band used in this fashion could therefore be reused several times within the remainder of the Region II outside of North America. The spectrum for central beams could come from the LMSSC allocation to complete the coverage of the land mass in North America. The separation of the central spot-beams from coastal areas would make it feasible for the global maritime systems, which share this band on a co-primary basis with LMSS, to fully utilize it over their primary service areas. Similarly, AMSS(R) and lmss allocations could be used over North America. However in this case, the coastal beams need to be subjected to detailed frequency co-ordination with global systems over the interface areas. The fact that AMSS(R) is not currently utilized could facilitate significantly the process of frequency planning between the emerging systems.

REGULATORY DEVELOPMENTS IN CANADA

Satellite services and associated tariffs charged by Telesat are regulated by the Canadian Radio-television and Telecommunications Commission (CTRC). Rapid changes in the field of telecommunications technology and service development have prompted the CRTC to re-examine its approach to regulation. Spurred by increased competition created by the introduction of new products and services, the CRTC has strived to find ways and means to ensure a "level playing field" for facilities-based service providers and non-facilities-based service providers where competition exists. In order to satisfy the pressures of the marketplace and its statutory responsibilities, the CRTC has used a process called "forebearance" which exempts certain companies or their respective services from the requirement to file tariffs.

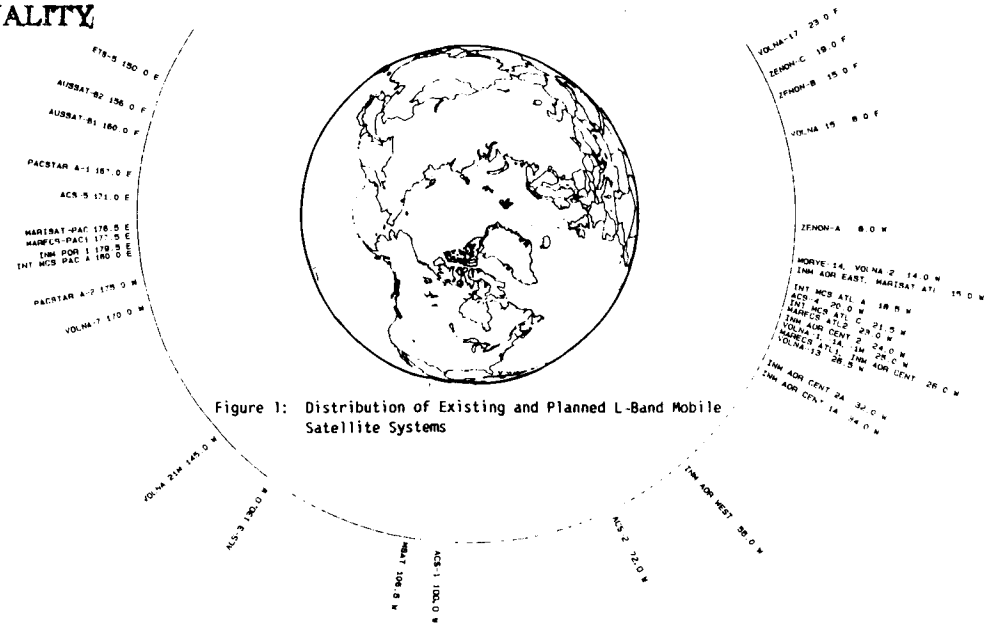

Figure 1: Distribution of Existing and Planned L-Band Mobile Satellite Systems

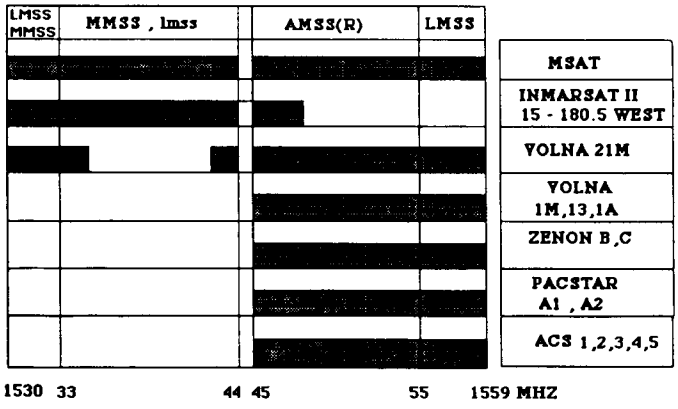

Figure 2: Systems Most Affecting Coordination of a North American MSAT System

ORBIT POSITION	SATELLITE	SERVICE CLASS		DATE API	DATE COORD
150.0E	JAP ETS-5	A	M	85	86
156.0E	AUSAT B2	A		87	
160.0E	AUSAT B1	A		87	
167.0E	PNG PACSTAR A-1	A		86	
171.0E	USA ACS-5	A		87	
176.5E	INMARSAT MARISAT		M	73	76
177.5E	INMARSAT MARECS	A		79	80
180.5W	INMARSAT POR-1	A	M	86	
180.0W	INTELSAT MCS PAC A		M	81	82
175.0W	PNG PACSTAR A-2	A		86	
170.0W	USSR VOLNA-7	A		77	78
145.0W	USSR VOLNA-21M	A	M	85	
130.0W	USA ACS-3	A		86	87
106.5W	MSAT	A		86	87
100.0W	USA ACS-1	A		86	87
72.0 W	USA ACS-2,	A		86	87
55.0 W	INMARSAT WEST	A	M	86	
34.0 W	INMARSAT CENT 1A	A	M	87	
32.0 W	INMARSAT CENT 2A	A	M	87	
26.5 W	USSR VOLNA-13	A		85	87
26.0 W	INMARSAT CENT	A	M	84	86
26.0 W	INMARSAT MARECS ATL1		M	79	80
25.0 W	USSR VOLNA-1	A		77	78
25.0 W	USSR VOLNA-1M		M	85	
W	USSR VOLNA-1A	A		86	
24.0 W	INMARSAT CENT 2	A	M	86	
23.0 W	INMARSAT MARECS ATL2		M	79	80
21.5 W	INTELSAT MCS ATL C		M	80	81
20.0 W	USA ACS-4	A		87	
18.5 W	INTELSAT MCS ATL A		M	79	79
15.0 W	INMARSAT EAST	A	M	84	86
W	INMARSAT MARISAT ATL		M	73	77
14.0 W	USSR MORE-14		M	85	
14.0 W	USSR VOLNA-2	A		77	78
8.0 W	FRA ZENON-A	A		87	
8.0 E	USSR VOLNA-15	A		85	87
15.0 E	FRA ZENON-B	A		87	
19.0 E	FRA ZENON-C	A		87	
23.0 E	USSR VOLNA-17	A		85	87

Table 1: Coordination Status of Existing and Planned L-Band Mobile Satellite Systems

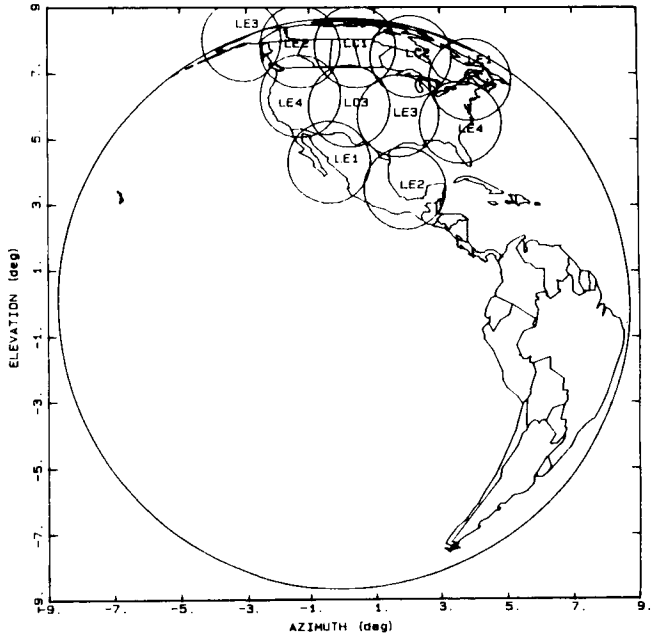

Figure 3: AMERICA AS SEEN FROM 106.5 DEGREES WEST

REGULATORY APPROACH TO MSAT

New mobile services, such as cellular telephone, have been foreborne from regulation because of effective competition and public interest arguments. It seems appropriate that a similar regulatory approach be applied to an analogous service such as MSAT.

There are four main arguments in support of this approach:

(a) Effective Competition from Other Mobile Satellite Services

Other satellite services are being offered as an alternative to MSAT. Several U.S. companies are currently in business or are expected to launch mobile satellite services in the near future. These include two-way messaging, voice and radio determination service. One U.S.-based company is attempting to offer mobile and radio-determination satellite services to Canadian users through a subsidiary established in Canada. Plans are also under way to develop a public switched aeronautical voice and data service for major airlines. INMARSAT wants to expand its business to include land mobile services. From the aforementioned, it is evident that effective competition will exist in the mobile satellite market.

(b) Terrestrial mobile Radio Competition

MSAT will compete with cellular telephone and other terrestrial-based service providers. Mobile voice and paging services are provided in most urban areas. In areas where mobile services are firmly established, satellite-based mobile services will need to be priced competitively in order to capture a share of the maturing mobile market. In more remote areas, appropriate pricing will be required to attract users to the satellite-based service.

(c) Attraction of Investment Capital for A High Risk Venture

The construction and deployment of mobile satellites is capital-intensive involving considerable financial and technical risk. The possibility of either launch or in-orbit failure is a serious consideration in any satellite venture. In addition, MSAT is a new service that has no established customer base.

(d) The Public Interest

It generally is recognized that there is a basic social and economic need to extend cost-effective voice and data communications to remote and thinly populated areas of Canada. MSAT will play an important commercial role increasing the demand for fast and reliable communications for users operating on land, sea or air. This will stimulate growth in the telecommunications equipment business, increase the productivity of Canadian manufacturing and business and create new employment opportunities. The Federal Government has strongly endorsed the implementation of a domestic MSAT service and has committed substantial funds to this end.

CANADA-U.S. MSS TREATY

The question of a formal bilateral arrangement between Canada and the U.S. to govern MSAT service is under discussion by the two respective governments. There is ample precedent for such an agreement beginning with the 1952 convention re: radio operation by pilot's license holders to the 1982 Exchange of Letters, re: FSS transborder satellite usage.

It is likely that an agreement, if one transpires, will address such issues as transborder satellite usage, provision of coverage in the other country (for service to that country's subscribers), base and gateway ownership and the question of licensing (will MSAT equipment operators require license, especially in the context of operation in the other country?).

The two governments, in conjunction with MSAT operators on both sides of the border, will have to determine if such an agreement is warranted. It may be possible, for instance, to develop a business agreement that could handle the key financial, technical and reciprocity issues. Whether or not the political process would be satisfied by such a business driven agreement is another question. What is clear is that such negotiations should not impede progress towards the co-operative development of MSAT in Canada and the U.S.

CONCLUSIONS

A certain amount of pragmatism was necessary on both sides of the 49th parallel in order to achieve a suitable bilateral arrangement which is conducive to the development and implementation of a North American MSAT system. It is important that such an attitude be adopted during international frequency sharing negotiations and by domestic regulators. The concept of regulatory forebearance is important to ensure sufficient regulatory flexibility so that MSAT enters the next decade on a sound technical and financial footing.

REFERENCES

"Information Paper - Frequency Re-use Considerations in Sharing Common Frequency Allocations by Various Mobile Satellite Services", WARC-MOB-87, International Telecommunications Union, Geneva; September-October 1987, Document No. 56, Canada.