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# Developments in Land Mobile Satellite Service in Europe

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## ABSTRACT

The evolution of land mobile radio has reached a stage to benefit from satellite communications. The provision of a service on a pan-European basis makes the use of satellites a viable proposition. The paper describes the European position on both system and space segment aspects of the land mobile satellite service. Also, some of the functions of the European institutions, such as ETSI, CEPT and CEC, in establishing these services are identified in the paper.

## INTRODUCTION

The need to develop land mobile satellite service (LMSS) in Europe has long been recognised by many European organisations. The studies and discussions have been continuing in various fora, notably within the European Space Agency (ESA). These studies have included market aspects, technical matters (including standards and frequency availability) and regulatory aspects concerning the operation of LMSS terminals on a pan-European basis.

The pan-European digital cellular radio system, GSM, is expected to begin operation in

1992. The other land mobile systems which operate in many countries on a national basis will continue to provide services. In addition to these the market needs identified for pan-European satellite services, for both data and voice, will be fulfilled by systems proposed by ESA, Inmarsat and Eutelsat. The low speed data systems include: ESA PRODAT, Inmarsat Standard-C and Eutelsat EUTELTRACS. The former two are L band systems whilst the latter operates at Ku band. Further plans are also afoot to provide voice services. To this end, in addition to Inmarsat Standard-M, Eutelsat has been examining the possibility of providing a pan-European (regional) service with the embarkation of an L band payload, currently being developed by ESA, on one of its Eutelsat II satellites.

In all cases mentioned above the utilisation of the frequency spectrum necessitates detailed study. The studies concerning the L band systems indicate the difficulties associated with frequency coordination. This with future traffic/market projections have shown the need for additional frequency spectrum for mobile satellite services and discussions are underway within CEPT on future frequency requirements for mobile

satellite services (MSS) in preparation for WARC 92.

The provision of a mobile service on a pan-European basis necessitates the establishment of a harmonised regulatory regime to enable the operation of mobile terminals throughout Europe. These issues are being considered by various European organisations, such as European Telecommunications Standards Institute (ETSI), Conference of European Postal and Telecommunications Administrations (CEPT) and the Commission of the European Communities (CEC).

### EUROPEAN MARKET

Market studies conducted by various organisations suggest that in spite of the developments taking place to establish GSM system in Europe there is a sufficient demand to justify the establishment of mobile services, for both voice and data, by satellite. These studies also recognise the need for the proposed low speed data systems to take advantage of the "window of opportunity" that exists prior to the implementation of the GSM system. Nevertheless some level of system integration between European LMSS and GSM will provide a further advantage to the LMSS market by establishing it as a supplementary service to GSM especially in the areas where GSM service is patchy.

### LOW SPEED DATA SYSTEMS

Low speed data systems have been identified as a key LMSS market for pan-European applications in various market studies. Over the last few years ESA and Inmarsat have carried out trials of their systems known as PRODAT and Standard-C respectively. Recently Eutelsat has entered

the market with a system called EUTELTRACS which operates through Eutelsat's Ku band regional beams in Europe. It is also understood that the LOCSTAR radiodetermination satellite system is expected to offer a messaging service using its low speed data transmission capability.

### Prodats

ESA, after carrying out a comprehensive study of system aspects, has successfully demonstrated the PRODAT bi-directional data transmission system to the European mobile market. The PRODAT system, designed to operate at L band, with omnidirectional antennas, at present utilises the Inmarsat space segment. The design of this system has been preceded by investigations into the problems associated with the propagation of signals to all three mobile environments, namely land, maritime and aeronautical. The system has benefited from ESA studies considerably, in that, it has demonstrated its ability to operate reliably in a highly variable land mobile radio channel where shadowing is a frequent event.

### Inmarsat Standard-C

This system was initially designed for applications in the maritime service. Since then it has adapted for land mobile applications and successful demonstrations have been performed throughout Europe and beyond using Inmarsat global satellite network. This system also employs omnidirectional mobile antennas.

### Eutelsat EUTELTRACS

This system has recently been

introduced into Europe and operates via Eutelsat space segment at Ku band primarily assigned to the Fixed Satellite Service (FSS). Following initial trials of the system carried out by European PTTs to ascertain the system performance, Eutelsat has now entered into the pre-operational demonstration phase for a six month period from the beginning of January 1990. Initial indications are that the system performs satisfactorily in a LMSS environment. This system employs a relatively narrow beamwidth mobile antenna coupled with spread spectrum transmissions to enable it to co-exist with other Ku band FSSs without causing harmful interference. The latter issue, the question of frequency compatibility, is currently under study in some European administrations.

#### Locstar

The LOCSTAR organisation in Europe has proposed the implementation of an RDSS system to offer, in addition to the radiodetermination service, a messaging service which utilises the system's low speed data transmission capability. The proposed system is to operate at L band where primary allocations exist in some of the European countries. It is clear, therefore, that successful frequency coordination on a pan-European basis is required for the implementation of the service.

#### VOICE SYSTEMS

Inmarsat has already initiated discussion throughout the world on voice systems in order to facilitate the development of the Standard-M system. The proposed system is at L band and uses directional antennas. Further discussions on European

requirements for voice systems are expected to take place in the recently formed Mobile Satellite Group of ETSI, known as SES5.

#### SPACE SEGMENT

The space segment has an essential role to play in determining the type of service to be provided and the type of market to be addressed. The current discussions in Europe concern three types of space segment, namely Inmarsat, ESA/Eutelsat EMS and Eutelsat Ku band. The LOCSTAR system employs a dedicated satellite system hence it is not subject to further discussion in this section.

The type of LMSS services required for various markets can succinctly be described as "public" or "private" services. The public service entails the provision of communications with a connection to various public networks, such as PSTN or PSDN. On the other hand some markets rely on private services where a small earth station situated at customers' premises could address directly a closed user community.

#### Inmarsat

At present the only L band space segment available within Europe is that provided by Inmarsat. The frequencies of this space segment lie within the primary maritime mobile satellite service (MMSS) where low speed data transmissions can be provided for LMSS applications on a secondary basis. Once Inmarsat II generation satellites are in orbit the availability of frequencies will improve by nearly three fold and frequencies within primary LMSS bands become available. The proposed Inmarsat III satellites with spot

beam capability will allow the provision of enhanced services in the long term.

European PTTs have elected to provide their initial LMSS public low speed data service (Standard-C) using the Inmarsat space segment. The current generation of satellites and also the II generation satellites are ideally suited to enable European PTTs to offer Standard-C as a public service since existing or planned Coast Earth Stations (CES) infrastructure for MMSS Standard-C, which by definition have connections to public networks, need only minor modifications to adapt for land Standard-C. Inmarsat system can also be configured to provide broadcasts to a closed user group, as exemplified by Enhanced Group Call (EGC) service, transmitted via a CES.

#### ESA/Eutelsat EMS

The ESA, under its mobile satellite programme, is developing a specialised L band payload, called EMS, for European mobile satellite applications. EMS is expected to provide services to a wider European region initially concentrating on LMSS. These services will be able to take advantage of higher eirp provided by EMS payload to offer enhanced services. Discussions are currently underway between Eutelsat and ESA on the embarkation of this payload on one of Eutelsat's II series satellites.

The feeder links to the EMS payload are expected to be at Ku band. Therefore, EMS would be an ideal vehicle to offer private closed user services based on VSAT up link facilities, which can be located at customers' premises. In addition, of course, public services can be provided by establishing necessary interfaces with the

public networks.

#### Eutelsat Ku band

Subject to the satisfactory outcome of the pre-operational trials and frequency compatibility studies, this service is expected to be available on a pan-European basis using Eutelsat's "Eurobeam" coverage and with connections to the public data networks provided at the Central Hub Station.

#### FREQUENCY SPECTRUM

With the development of many global and regional satellite services operating at L band the frequency coordination has become almost an insurmountable task. This coupled with certain traffic forecasts for MSS for the next decade has led to the suggestion that more spectrum is needed to cater for the predicted demand.

The inputs to the studies underway in CEPT, in preparation for the WARC 1992 conference, have identified this need for some additional spectrum allocations to MSS in the L band. This immediately raises the problem of identifying the part of the spectrum which could be allocated to these services. In addition, it is necessary to examine whether the MSS requirements, in particular those for LMSS, can be satisfied with regional allocations in contrast to the global allocations generally made for satellite services. Frequency sharing also plays a crucial role. If studies show that MSS systems require a near exclusive allocation then ways to see how this can be achieved need to be investigated. This in turn leads to the suggestion for a "staged allocation" where the nominated spectrum becomes available at a specified time in

the future, but in time to meet the demand, once the existing services have been relocated.

### **TRANSBORDER OPERATION**

The provision of a land mobile service on a pan-European basis necessitates the establishment of a harmonised regulatory regime to enable the carriage and operation of mobile terminals throughout Europe. The authorisations for the operation of the mobile terminals are generally granted by the administrations who consider, amongst other things, the general type approval requirements of the terminals. These issues are currently under discussion in CEPT, ETSI and CEC.

### **CEPT and Circulation Card**

CEPT has adopted the necessary provisions, in the form of a Recommendation, to facilitate the transborder operation of LMSS systems. This method, initially developed for Inmarsat Standard-C trials, consists of the issue of a "circulation card" which authorises the users to carry and operate the mobile terminals within the countries identified in it. However, the issue of the circulation card is conditional upon the administrations authorising/licensing the specific satellite service and the use of the associated mobile terminals. The latter issue, of course, is related to the type approval of equipment.

Recently Inmarsat, having noted the rapid development of portable mobile terminals, has initiated discussions among its member states for the accommodation of transborder use of Inmarsat terminals in member and non-member countries.

### **ETSI and Type Approval**

As a part of the preparations for the Single Market in 1992 the European Community is developing a policy of testing, certification and inspection which aims to eliminate barriers to trade by encouraging mutual recognition of test results and certificates. The issues relating to telecommunications have been taken up by ETSI which plans to achieve this objective by setting European Telecommunications Standards (ETSS). The afore mentioned SES5 Committee of ETSI has the function of developing such harmonised standards for the mobile satellite equipment. The adoption of ETSS and the mutual recognition which results from that, would enable service operators to satisfy a condition of the circulation card.

### **European Commission**

It is the policy of the CEC to assist the harmonisation effort in Europe to provide pan-European services to the benefit of manufacturers, operators and users. In this regard the CEC has been examining the question of MSS as a part of its studies into the role of communications satellites in Europe. The relevant issues are to be raised in a discussion document (Green Paper) which the CEC intends to publish later this year. It is expected that amongst the issues to be raised there will be policy initiatives on encouraging the development of European standards and achieving some level of system integration between the GSM and LMSS services.

### **CONCLUSIONS**

LMSS has been identified as a viable market in Europe.

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Several initiatives are under way to provide a number of systems operating both at L and Ku bands. These will fulfill a vital segment of the pan-European communication market.

Initial studies have indicated the need to allocate additional spectrum to all MSS to meet the expected demand. This coupled with the establishment of a harmonised regulatory regime should facilitate the operation of LMSS voice and data services on a pan-European basis. The work underway in ETSI, CEPT and CEC would enact procedures to achieve these goals.

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