

MOBILESAT, Australia's Own

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ABSTRACT/INTRODUCTION

Australia will be introducing a dedicated Mobile Satellite Communications System following the launch of the AUSSAT-B satellites in late 1991. The Mobile Satellite System, MOBILESAT, will provide circuit switched voice/data services and packet-switched data services for land, aeronautical and maritime users. This paper overviews the development program being undertaken within Australia to enable a fully commercial service to be introduced in 1992.

SYSTEM

The two AUSSAT-B satellites are HS-601 spacecraft being built by Hughes and due for launch on the Chinese Long March rockets. The primary purpose of the AUSSAT-B satellites is to provide replacement Ku-Band capacity for the current AUSSAT-A satellites with the major secondary function of providing L-Band capacity for mobile services. Each satellite will have a single 14 MHz L-Band transponder with associated Ku-Band back-haul providing 48 dBW of usable EIRP into a single beam covering the whole of Australia and its surrounding waters.

The ground infrastructure will consist of a network management system, to be provided in a redundant configuration from two locations, gateway stations to provide access to the public switched network and base stations for connection to private networks as well as the customer mobile terminals. Figure 1 schematically represents the system.

MARKET

The market for MOBILESAT services within Australia is targetted primarily at servicing the rural and remote areas of the country in a complementary nature to urban services such as cellular telephony and UHF/VHF private mobile radio systems. Australia is a vast country (~ 7.6 million square kilometres) with a small population (16 million) which is concentrated in less than ten major urban areas centres. Despite the population concentration in the urban areas the Australian export economy revolves around industries such as agriculture (sheep/wool, cattle/beef, wheat, etc), mining (coal, iron ore, etc) and tourism which, in general, are located in the remote regions of the country where the telecommunications infrastructure (both fixed and mobile) is quite often rudimentary or in some cases non-existent.

The urban population has rapidly adopted the mobile services provided by the cellular mobile telephone system with currently an 8% growth rate per month. The services was introduced in 1987 with, as of March 1990, over 10 users per thousand population, representing one of the most rapid take-ups of the technology throughout the world. The system is targetted at covering around 80% of the population during the next few years (currently 70% coverage) but this only represents around 1% coverage of the area of the country.

Market surveys have found that users in the rural and remote regions of the country also desire and have a need (it could be argued that the

need is greater than that of their urban cousins) for a quality mobile communications service with features equivalent to that available to urban dwellers. As well as showing a definite requirement for a satellite based mobile communications system, the market surveys identified a variation with the potential markets in the US and Europe where the long distance transport market dominated the user population. The trucking user does not dominate the Australian market but rather a range of service industries requiring a mix of public access and private network telephony applications dominated the usage requirements. Figure 2 shows the predicted mobile voice terminal market whilst table 1 summarises the usage breakdown.

Sector	Percentage
Sales	19.7%
Trades	18.1%
Agriculture	13.0%
Construction	9.8%
Pastoral	8.2%
Road Transport	7.2%
Mining	6.2%
Others	17.8%

Table 1
MOBILESAT Telephony Market
Segmentation

The market within Australia has indicated a need for data only services but significantly at a terminal price around 50 - 60% of a voice terminal. As well a strong desire for a combined voice and packet-data capability led to the development of packet-data services using the voice signalling channels.

MARKET EXPECTATIONS

The market expectations for equipment pricing and service charges have generally been of pricing which is a little greater than that available from the urban cellular telephone system. This is due, in the main, to the perceived high technology nature of the service and, more

importantly, to the added functionality, in particular the ubiquitous coverage capability of a satellite system. The expectations for a service to be introduced in 1992 are as follows:

Mobile Telephony Terminal
A\$5000 (US\$3750)

Mobile Radio Terminal
A\$5000 (US\$3750)

Mobile Data Terminal
A\$2500 (US\$1875)

Voice, Per minute air-time charge
+ Monthly Access Fee
A\$1.20 (US\$0.90) + A\$0.0 to A\$0.80 (US\$0.60)
+ A\$50 (US\$37.50)

Data, Monthly Fee
A\$30 - A\$50 (US\$22.50 - US\$37.50)

These figures compare to ~A\$1000 for a car mounted cellular telephone, ~A\$3000 for a hand-held cellular telephone, ~A\$3000 for a HF radio and A\$35 per month plus A\$0.70 per minute for long distance cellular charges in Australia.

The current knowledge of the system costs and perceived terminal prices suggests that the terminal prices should be achievable if not a little bit high at the commencement of service. As well, the usage charges, owing to the efficiencies of the digital voice implementation, are readily achievable and offer scope to be competitive with long distance cellular services.

TECHNICAL FEATURES

The MOBILESAT system developed for Australia shares many of the features of the systems being developed elsewhere as well as those of terrestrial mobile communication systems. However a number of key technical features have been adopted to address the market requirements and to utilise the full potential of the available technology.

A common signalling channel architecture has been adopted to accommodate developments in modulation and processing technologies and allow for a variety of communication standards.

Indeed the first release of the system specification has adopted both analog ACSSB and digital voice modulation as schemes being permitted to operate over MOBILESAT. Further, the features and the reserve capacity of the signalling system have been used to implement a packet-data communications service operating in conjunction with the circuit-switched voice service. This feature will provide for services such as position location in association with a voice service and will allow for a range of enhanced capabilities to be added to the voice services. This capability will also allow low cost stand alone packet-data terminals to provide for messaging and telemetry style applications.

The channel plan is based on 2.5 kHz channel spacing in a non-paired channel format, and will initially support up to 1,500 circuits using digital voice modulation with 5 kHz channels, at a threshold C/No of less than 45 dBHz. An additional 3 dB fade margin will be used to provide a high quality, robust voice service that will operate under severely shadowed satellite links.

The MOBILESAT system has adopted a three try (two repeat) strategy in the call initialisation procedure to accommodate for potential shadowing in the communications link. The three try strategy has been demonstrated to be the optimum scheme to provide a highly reliable signalling channel in the propagation environment of the mobile satellite service.

The voice modulation will be based on a nominal 4800 bps encoding algorithm. At the time of writing (March 1990), Australia's TELECOM Research Laboratories were undertaking an evaluation program, for Australia's MOBILESAT system and for INMARSAT's-M system, to determine the most appropriate digital encoding algorithm. The joint MOBILESAT/INMARSAT evaluation is aimed at achieving a common standard.

The MOBILESAT system will support a digital facsimile service based on the INMARSAT-M specifications, but operating at up to 4.8 kbps and incorporating an ARQ protocol to ensure error free transmission. The

system design allows for an easy transition to a Store and Forward facsimile service in the future.

The public access gateway stations will directly interconnect with the ISDN network and provide an advanced, high capacity link into the PSTN, whilst low capacity minor base stations will support customised private networks.

IMPLEMENTATION

The MOBILESAT program is focussed on providing services using the AUSSAT-B satellites from mid 1992. However, the user community has an immediate need for the services that a mobile satellite system can offer so a parallel program is underway to provide an early entry MOBILESAT service. The close parallels with the Canadians with their MDS and the US with AMSC, Qualcomm and GEOSTAR where services are being implemented prior to a dedicated mobile satellite system, has been recognised. The early entry MOBILESAT service uses an unmodified INMARSAT-C product and will operate via the hub station provided in Perth, Australia by OTC Ltd, Australia's international common carrier and INMARSAT signatory.

The target market sectors for the early entry product are the remote monitoring and control industry, long distance transport and the remote services sector. The following applications are being implemented:

- interface of the INMARSAT-C system into a water resource management system through development of an interface box between the INMARSAT-C terminal and remote monitoring and control devices and modification of head office control software.
- monitoring of valuable cargos using INMARSAT-C interfaced to a position location device (TRANSIT or GPS) in the long distance transport and security industries.
- use of INMARSAT-C to provide the communications link from a lap-top PC to a head-office computer for applications such

as records access for remote area medical clinics provided by Australia's Royal Flying Doctor Service.

The program for implementation of the AUSSAT-B MOBILESAT service, at the time of writing, is at the stage of evaluation of the ground infrastructure components of the MOBILESAT system. Formal responses have been received for all components of the ground system, (Network Management System, Gateway/Base Access Stations and Mobile Terminals). The schedule for the implementation program is; contracts for infrastructure in mid 1990 with a service introduction by June 1992.

As a large proportion of the MOBILESAT market will be using a public-switched service, a close technical relationship has developed between AUSSAT, Australia's national satellite service provider and TELECOM Australia, Australia's monopoly PSTN and cellular service provider (as of April 1990). The interface issues between the terrestrial system and the mobile satellite system have been resolved and a mechanism for providing the ground infrastructure has been developed which allows for co-operation between the organisations in the technical areas and competition in the provision of services.

AUSTRALIAN INDUSTRY

The Australian decision to provide a Mobile Satellite Service was relatively late when compared to the deliberations and research and development undertaken in various parts of the world. However various sectors of industry throughout Australia have learnt from the international developments and will be in a position to provide the ground infrastructure for the MOBILESAT system (largely software control) as well as compete in the provision of MOBILESAT terminals, both within Australia and worldwide. Indeed, the timing of the MOBILESAT system being some twelve to eighteen months in advance of the dedicated North American systems has been recognised as an opportunity by both the Australian and international industry to utilise Australia as a test bed for a range of technical and service

developments.

CONCLUSIONS

Mobile communications represents one of the fastest growing areas of the telecommunications industry within Australia. The MOBILESAT system is a vital component within the mobile telecommunications product range providing services to the economically important rural and remote areas of Australia. The activities within the MOBILESAT program are at the forefront of service developments throughout the world, tailored to the Australian market, but also with an eye to developments and opportunities throughout the world.

The MOBILESAT development team recognises that satellites will play an important role in the development and provision of ubiquitous mobile and personal communications services and that the MOBILESAT program is but one step in the evolution towards the now 'not-so-futuristic' "Dick Tracy" or "Star Trek" communicators.

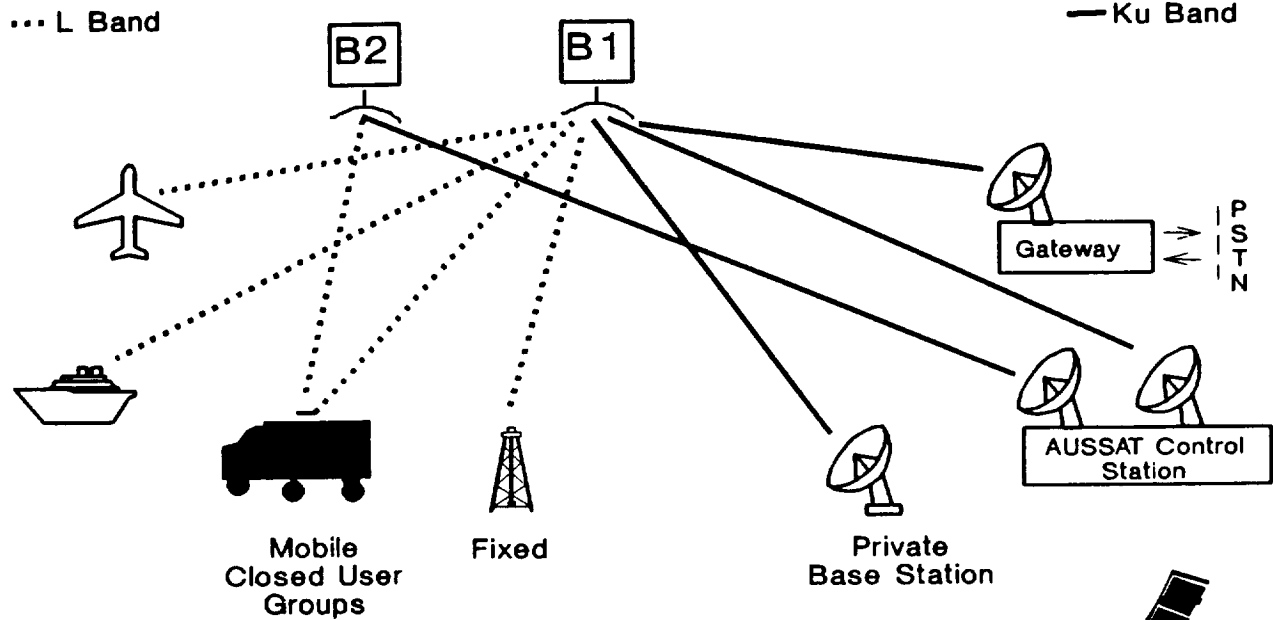


Figure 1
MOBILESAT Configuration

MOBILESAT - MARKET PROJECTIONS

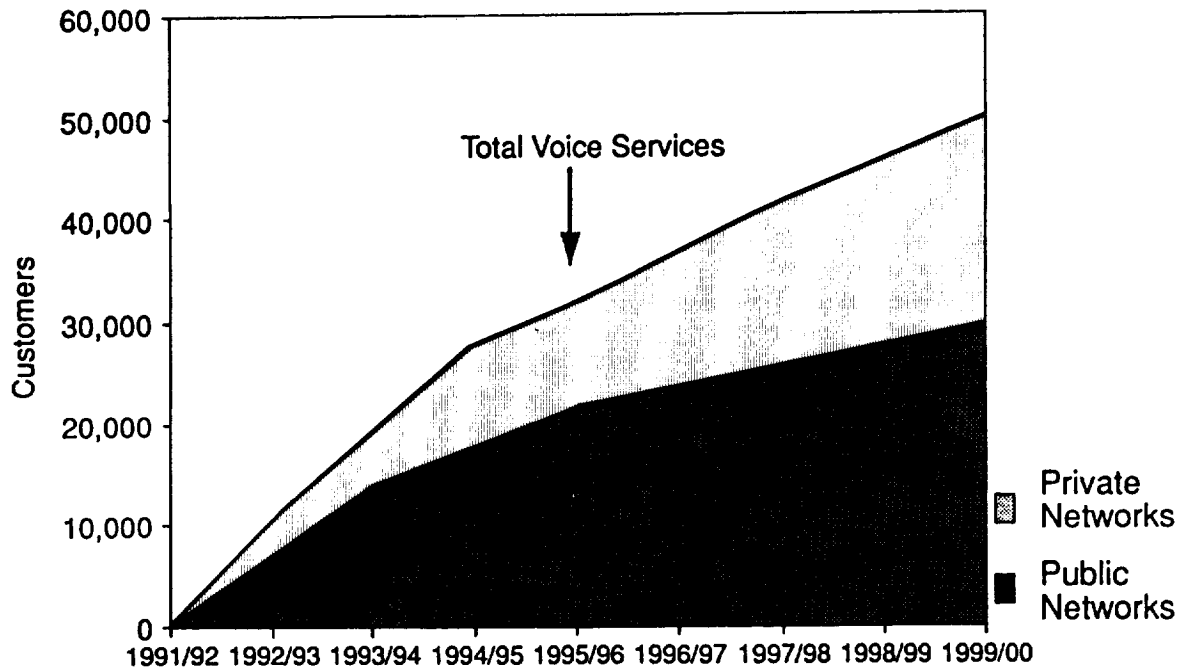


Figure 2
MOBILESAT Voice Terminal Market