

Satellite Mobile Data Service for Canada

Glenn R. Egan and David J. Sward
Telesat Mobile Inc.
333 River Road
Tower A, 14th Floor
Ottawa, Ontario
K1L 8B9
Telephone: (613) 746-5601
Facsimile: (613) 746-2277

ABSTRACT

Telesat Mobile began commercial operations on December 15, 1988 with the signing of a shareholder agreement between Telesat Canada, Canadian Pacific Ltd. and the C. Itoh Group of Japan. TMI's mission is to construct and operate a commercial mobile satellite system in Canada. This will be done in two distinct phases.

First, TMI will introduce mobile data services in June, 1990. A contract has been awarded to Canadian Astronautics Ltd. supported by Gandalf Systems Ltd. and Hughes Network Systems for the supply of hub equipment and 3,000 mobile data terminals. Over-the-satellite tests began in February, 1990. The mobile data service will provide full two-way digital messaging, automatic vehicle location and fleet management services.

The second phase is to construct, launch and make operational the MSAT satellite and associated network control facilities. This paper will focus on Phase I, i.e. the implementation of a mobile data service in Canada. In addition to a technical description, the paper will provide information on markets and applications.

BACKGROUND

The Canadian Mobile Satellite system (MSAT) is approaching completion after almost ten years of planning. The Federal Department of Communications pioneered the technical and commercial development of MSAT from 1983 to 1986. Telesat Canada worked closely with the DOC

during this period. Telesat Mobile Inc. (TMI) was later formed in December, 1988 to fulfill the mandate of implementing mobile satellite services in Canada.

TMI's business plan is based on providing a North American service through joint operations with a licensed American mobile satellite operator. In May, 1989, the Federal Communications Commission authorized the American Mobile Satellite Corporation (AMSC) to provide mobile satellite service in the United States. In April, 1990, TMI and AMSC formally entered into a Joint Operating Agreement which provides a solid foundation for implementing a North American system.

TMI's major shareholders are Telesat Canada, Canadian Pacific Ltd. and the C. Itoh Group of Japan. Bell Canada Enterprises Mobile (BCEM) also has a financial interest in TMI and will distribute MSAT products and services.

TMI plans to introduce mobile satellite services in two phases. Phase I services will be introduced during the construction period of the MSAT satellite i.e. 1990 - 1993. These services include a mobile data service for introduction in June, 1990 and a "Stop and Talk" voice service planned for introduction in June, 1991. Phase II services will commence when MSAT is commissioned in late 1993 and consist of a full range of integrated voice and data services under the portfolio name "mobile ISDN".

The mobile data service provides two-way messaging, automatic vehicle location and fleet management. A contract was awarded to Canadian Astronautics Ltd. in October, 1988 to provide hub messaging equipment and vehicular terminals. Gandalf Systems Ltd. and Hughes Network Systems are major sub-contractors to this program.

Satellite capacity has been leased through Teleglobe Canada through Teleglobe Canada to facilitate this service. An INMARSAT satellite has been repositioned to 106 W to provide coverage of Canada and the U.S. Current plans are to operate the mobile data service on this satellite commencing late June, 1990. The satellite coverage provided from the 106 W position is shown in Fig. 1.

MOBILE DATA SERVICE

The mobile data system provides solutions on an end-to-end basis. It is a combination of two elements: a satellite-based, packet-switched network and network access systems.

The satellite-based, packet-switched network provides data throughput, route diversity, flow control of multiple network access systems, and error detection with error correction and data retransmission algorithms. The network performs functions similar to most packet-switched networks that provide for reliable, error-free transmission. (See Fig. 2.)

Additional value is offered to users of the network through the flexible network management system.

The network management and control system supports the network as a whole as well as individual fleets. Issues such as network access authorization, radio frequency assignments and overall system fault detection, isolation and correction are managed exclusively by Telesat Mobile network operations staff.

Each element of the network is redundant and fault-tolerant design ensures continuous operation. Many aspects of network management and

Fig. 1 Coverage from 106° W Longitude

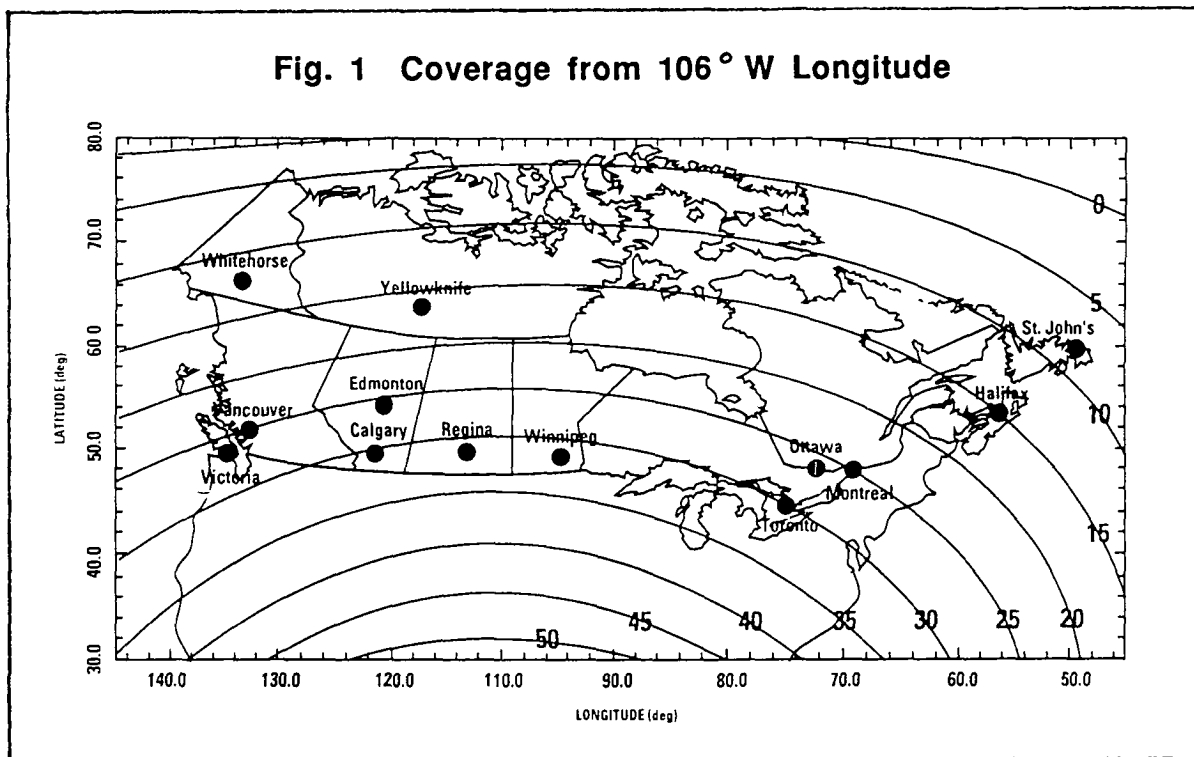
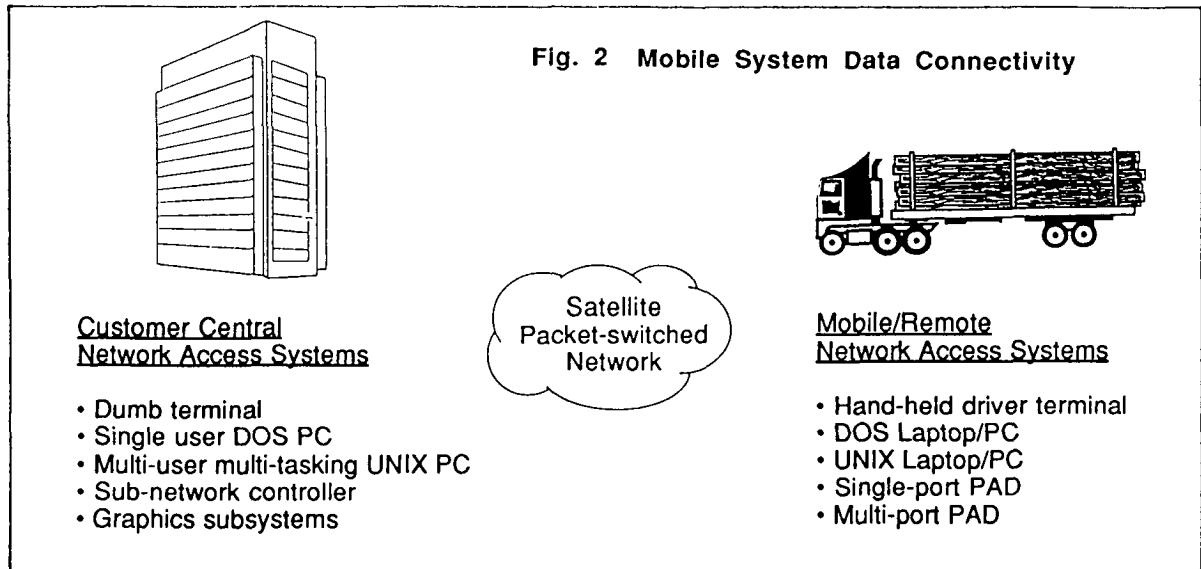


Fig. 2 Mobile System Data Connectivity



control relate to the operation of a particular customer fleet, and the network through partitioning and secure network access procedures allow individual customers to directly manage their own fleet.

Prior to the launch of MSAT, L-band space segment is at a premium. Telesat Mobile has secured long term leases through Teleglobe to support our program. Efficient allocation of the space segment is critical to providing uniform quality service to several thousand mobiles. This is achieved through segmenting data according to its traffic profile and utilizing multiple satellite channels, each optimized to suit a particular type of traffic. The network architecture supports regularly scheduled reporting, demand access short messaging and demand access file transfer.

Inbound traffic is routed via three distinct channel types. Regularly scheduled information such as vehicle locations or remotely sensed data can be transmitted on one of the position reporting channels. Since all transmissions are pre-assigned, extremely high efficiencies are attainable on these channels.

Randomly scheduled short messages are transmitted on one of the general messaging channels. The satellite link protocol utilizes a combination of random access slotted aloha and pre-assigned

TDMA to transmit messages. Each frame on the inbound channel is portioned into a random access and pre-assigned segment. This moveable "fence" separating the two access schemes allows for system tuning based on actual traffic patterns.

According to the total message length, the message is divided by the mobile unit into a number of packets. The first packet is transmitted in the random access portion of the frame and the remainder of the packets is transmitted in the pre-assigned portion. Information embedded in the outbound channel informs all mobiles of the upcoming slot reservations and assignments. Demand access file transfer is provided on dedicated circuit-switched channels that allow for continuous packet transmission.

Outbound messages are carried on a TDM carrier. The carrier utilizes variable packet lengths in each 639 information byte frame. This assures maximum utilization of the high power forward carrier. The outbound carrier transmission rate is 1200 sps. The mobile units employ two speed modems to support both 600 sps and 1200 sps transmission rates. (See Fig. 3.)

Network access systems are provided at the mobile and organization's central facility. These systems define the real functionality of the service and provide

the user with transparent access to the packet-switched network. Since the interface specifications to the network are open, a broad array of network access systems are evolving.

The interface to the mobile portion of the packet switched network consists of the two RS-232 ports. Devices are currently available to support simple message creation, editing, storage, transmission and receipt in a hand-held terminal. Laptop computers and single user PC's are also available. High end multi-user platforms with extensive networking capability are also provided to support more sophisticated applications. The access devices utilize DOS and UNIX operating systems to allow the migration of existing software applications to the remote or mobile domain. This allows users to continue to use familiar programs when they move from the office to the mobile environment.

Additional access devices are available to support unmanned sites such as data collection platforms or monitor and control stations. Ranging from single port to multi-port programmable, these devices offer the flexibility required to support a broad array of applications.

At the customer's central office, network access is also supported by a variety of systems. The most elementary of these consists of a dumb terminal driven by the network that provides full text messaging and printing capability. Single user DOS-based PC's and multi-user UNIX-based micro-systems are also available that support full text and data messaging and powerful graphics displays.

Graphics systems may be modified by customers to suit their own applications and can be displayed on standard monitors, high resolution monitors or full screen projection systems. For customers with existing unique applications, interface specifications for message and file transfer are provided, and integration support is available.

DISTRIBUTION

TMI is in the process of establishing a sales and support network for MDS through agreements with value-added resellers (VARs). VARs will provide a local presence for sales and maintenance functions. VARs' responsibilities may be segmented by service type i.e. Road KIT, Field KIT, or by geographic territory. VARs also contribute significantly as the name suggests to the "value" of the service

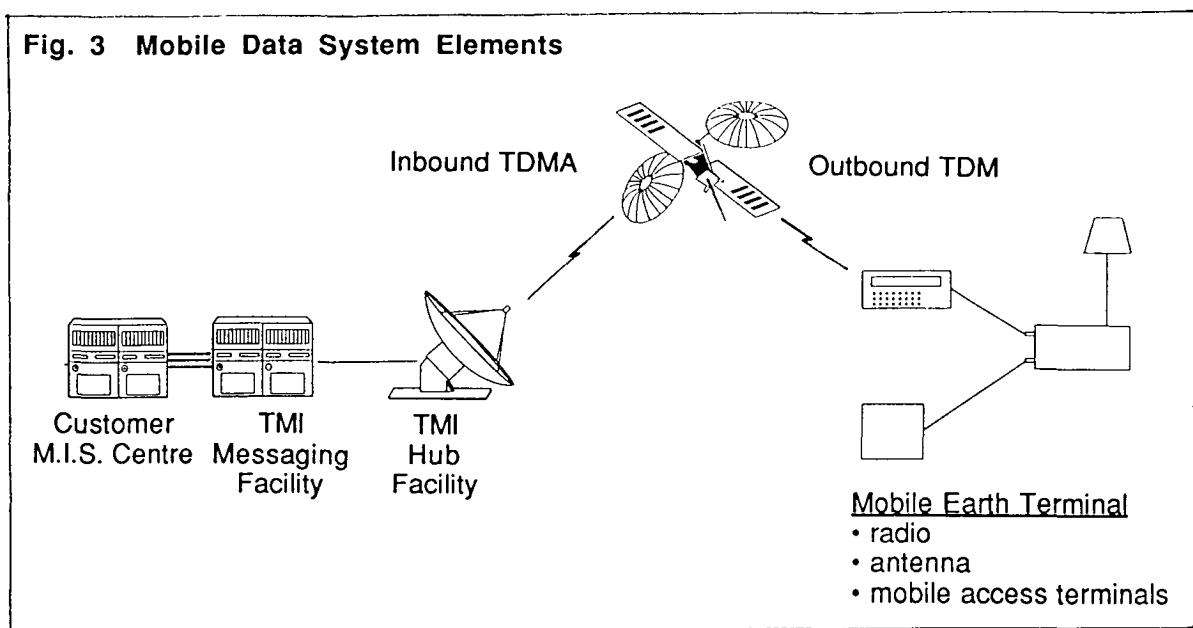
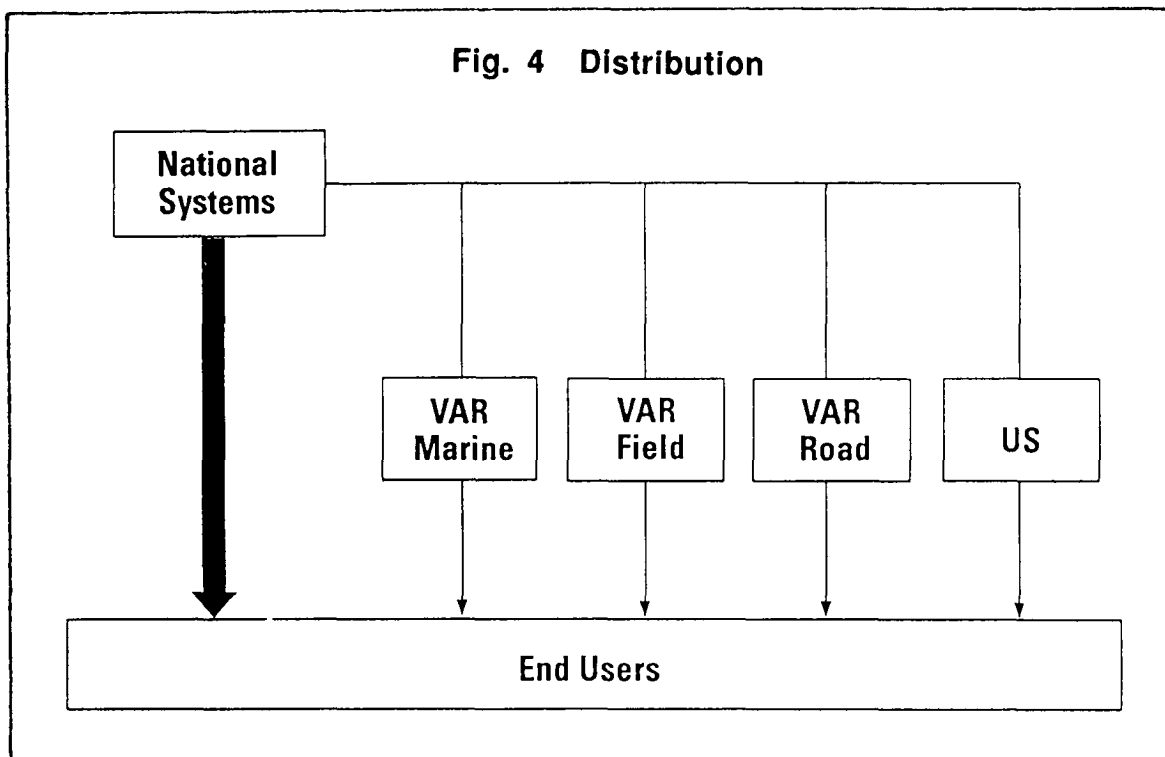


Fig. 4 Distribution



by providing specified access software or custom MET interface devices. TMI has entered into VAR agreements with Sea Link Ltd. of St. John's, Nfld. and Munro Engineering Ltd. of Calgary, Alta. (See Fig. 4.)

CONCLUSION

The Phase I Mobile Data Service is an important first step for Telesat Mobile. MDS meets the needs of the transportation,

marine and SCADA markets by providing wide area, reliable communications and fleet management services. MDS will allow TMI to establish a market presence prior to the launch of MSAT and provide an initial base of users for transfer to MSAT when commissioned in 1993. MDS is the first mobile satellite service in TMI's eventual full service portfolio of Mobile ISDN.