N92-24076

The American Mobile Satellite System

W. B. Garner
American Mobile Satellite Corporation
1233 20th Street NW
Suite 301
Washington, DC 20036
Phone: 202-331-5858
FAX: 202-331-5861

During 1989, American Mobile Satellite Corporation, (AMSC), was authorized to construct, launch and operate satellites to provide Mobile Satellite Services to the US and Puerto Rico. AMSC has undertaken three major development programs to bring a full range of MSS services to the US. The first program is the space segment program. It will result in the construction and launch of the satellites, and the construction and installation of the supporting ground telemetry and command system. The second program is the ground segment program. It will result in the specification, design, development, construction and installation of the Network Control System necessary for managing communications access to the satellites, and the specification and development of ground equipment for standard circuit switched and packet switched communications services. The third program is the Phase I program. This program will provide low-speed data services within the US prior to availability of the AMSC satellites and ground segment. This article describes the present status and plans for these three programs, and also provides an update on related business arrangements and regulatory matters.

SATELLITE PROGRAM

AMSC has been authorized by the Federal Communications Commission to construct, launch and operate three satellites for the purpose of providing general mobile satellite services to all fifty States, Puerto Rico and the Virgin Islands. The technical characteristics of these satellites are described in AMSC's application to the FCC of February, 1988 and the Modifications to the application submitted in December, 1989 at the FCC's request. The significant submittals in the Modification were a detailed transponder plan which included details on channelization by means of sub-band filtering, a complete set of antenna patterns for all three orbit positions, detailed link budgets for a wide range of services, and a description of how priority and preemption would be provided for aviation safety and regularity of flight services through the Network Control System. Authority was requested to construct the satellite to be able to operate in the bands 1530-1545 MHz and 1631.5-1646.5 MHz in addition to the bands 1545-1559 MHz and 1646.5-1660.5 MHz authorized by the FCC. This request was made in order to be able to provide backup services to Canada. Authority was also requested to operate single polarization in 200 MHz of feeder-link

spectrum rather than dual polarization in 100 MHz of spectrum as authorized. This request was made to eliminate a serious uncontrollable cross polarized interference situation caused by foreign systems illuminating the spacecraft at L-band.

It is expected that a satellite contract will be let by mid 1990, with first delivery in time for a late 1993 launch. Operations are planned to begin the first quarter of 1994. Options for additional spacecraft will cover failures and growth needs. The Canadians will launch a similar satellite in the same time frame so that backup capability will be in place.

NASA will provide the first AMSC launch under a barter agreement. In return for the launch, AMSC will provide an equivalent value in services to US government agencies during the first two years of operation. NASA has already put in place a program to involve government agencies as users of the services.

GROUND SEGMENT PROGRAM

The first objective of the ground segment program is to specify, design, develop and bring to operational readiness a ground system capable of providing standardized circuit switched and packet switched services by the time the satellites are ready for operation. A second major objective is to have available a supply of Mobile Earth Terminals (METs) and Feeder-link Earth Stations (FESs) and service providers by the time operations commence. A third major objective is to have in place the Network Control System that will manage all communications access to the AMSC satellites. In order to achieve these objectives, AMSC, in cooperation with TMI, has established a two stage development program for circuit switched services and the Network Control System. In addition, a program is being established for the development of standard packet switched services.

Network Control System and Circuit Switched Services.

The Network Control System and Demand Period circuit switched services are being developed under the same program since they are closely related. The Network Control System provides management of all communications access to the AMSC satellites. Physically it consists of a Network Operations Center (NOC) and two Network Control Centers (NCC). The NOC provides top level operations, administrative and network management services while the NCCs provide real-time management of Demand Period circuit switched services. The NCCs interact with the METs and FESs using Demand Period circuit switched services by means of satellite signalling channels designed for that purpose.

The NCS and circuit switched service standards are being developed under a two stage contracting program. The first Design contract is for the system definition and technical specification for the NCS, METs and FESs supporting circuit switched services. The RFP for this contract was released in April 1990, with the goal of being under contract by the end of June, 1990. The contract is planned to be completed by the 2nd quarter of 1991. Based upon the specifications developed under the Design Contract, a Construction Contract will be let by mid 1991. This contract will result in the design, construction, installation and operational readiness of the NCS. It will also result in the availability of METs and FESs capable of providing circuit switched services to the standards developed under the first contract.

As part of these programs, the specifications for METs and FESs will be available for review and comment as they are being developed. Two Industry Participation reviews will be held during the Design Contract period to familiarize manufacturers and service providers with the specifications and to obtain comment. The resulting specifications will be issued as AMSC Technical Standards at the end of the first stage, and updated as the second stage development program proceeds.

Packet Switched Services

Packet Switched service standard specifications will also be developed. These services will include end to end two-way Virtual Circuit packet services of general application, including both switched virtual circuits and permanent virtual circuits. Message store and forward service will be included, building on the low speed data capabilities of Phase I. Currently the functional requirements for packet switched services are being defined. From these functional requirements the detailed system design and technical specifications will be developed. These specifications will be available as AMSC Technical Standards. A contract will be let for the development, construction and implementation of a set of equipment to support these Standards in time for service when the satellites are operational.

PHASE I SERVICE

The AMSC satellites will be available for service in early 1994. Recognizing the long time gap between the present and that date, AMSC has inaugurated a program to supply a low speed, two way, store and forward message service in the interim. The purposes of this program are several fold. First, the program will permit the Corporation to develop a customer base prior to full service. Second, it will provide a means for understanding customer needs and aid in development of products to meet those needs once the full service is available. Third, it will provide a means for AMSC to gain hands-on operational experience of an operating system prior to going operational with the much larger, more complex AMSC satellite system.

Phase I Service is a two-way, low speed store and forward messaging service between omni-directional mobile terminals and an AMSC owned and operated Network Operations Center located in Washington, DC. Users fixed site data equipment will access the NOC via dial-up lines or via public data network services. Messages to mobiles are delivered at once, either to individual mobiles or to groups of mobiles. Messages from mobiles may be generated at random, in response to polls from the NOC, or on a scheduled basis. Mobiles may also transmit emergency messages that are given delivery priority by the NOC. Mobiles will have a Data Terminal Unit for entering and receiving messages in a variety of ways. An auxiliary data port is available for connecting other asynchronous devices. A Loran-C position location receiver is offered as an option.

Service will be provided via space segment leased on the MARISAT spacecraft located at 106.5 degrees West longitude. The COMSAT Southbury, Connecticut INMARSAT earth station will be used to access the satellite. The coast earth station and the AMSC NOC will be interconnected via leased lines. Forward direction transmissions will be via one or more packet multiplexed, continuous, 1200 sps BPSK channels.

Return transmissions will be via several Slotted Aloha or Reservation TDMA 600 sps BPSK channels. The Service will be transferable to the AMSC satellites without modification of the mobile terminals or changes in user operations. The service will continue to be supported after full service commences. The mobiles and the NOC will have an INMARSAT-C interoperable mode for backup purposes. This mode will be such that transfer can take place automatically and transparently to users of the system.

A contract has been placed for construction of the NOC, coast earth station equipment and an initial quantity of mobile terminals. The system will begin initial operation in November, 1990 and be in full service by the second quarter, 1991. Mobile terminal specifications will be available for use by other manufacturers in that time frame.

BUSINESS AND REGULATORY MATTERS

AMSC now has eight shareholders, each of which has contributed 5 million dollars in equity to the Corporation. The firm of Donaldson, Lufkin and Jenrette has been retained to help obtain additional financing needed to construct the system. AMSC and TMI have entered into a Joint Operating Agreement that provides for mutual satellite backup services, cross-leasing of satellite capacity and joint development of core communications ground equipment standards and specifications to promote commonality and interoperability. AMSC and NASA are working on an agreement for the barter exchange of services for a launch.

On the regulatory side, the MARISAT lease for Phase I Service has been approved under a Special Temporary Authority. Several items were pending at the time this article was submitted in April. Among these items is final approval of the satellite license and approval of the Phase I Service earth stations applications. AMSC has also applied for authority to operate in the lower portion of the mobile satellite bands. This application has been deferred pending an FCC Notice of Proposed Rule Making that would allocate these lower bands to generic MSS services domestically, similar to the allocation in the upper portion of the bands.

Access to additional spectrum is viewed as a must to meet long term, world-wide projections of service demands. The totality of projected needs is well in excess of that currently available. Because of the low discrimination of mobile terminals, frequency reuse by orbit separation is severely limited. Further limiting the available spectrum is the fragmentation caused by international allocations based on type of service (Land, Maritime, Aeronautical). This fragmentation results in inefficiency by leaving unused spectrum in one band while other bands saturate. The result of all these limitations makes sharing of spectrum difficult and an equitable distribution of the spectrum between systems a major issue.

The 1992 World Administrative Conference (WARC 92) offers an opportunity to improve the situation. The adoption of generic allocations would remove the fragmentation by service type limitation. Additional allocations for generic MSS should be vigorously pursued, with MSS system operators, service providers, manufacturers and users working together to make those responsible for spectrum allocations aware of, and supportive of, MSS needs.