The STARSYS Global Positioning and Messaging System

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ABSTRACT

STARSYS is a commercially feasible mobile satellite communications system which employs low-Earth orbit (LEO) satellite technology to provide brief, two-way messaging and position determination services. STARSYS mobile terminals will be able to send and receive short messages and, through ground computer processing, the system will determine the terminals' location almost anywhere on Earth. These data services will have extensive utility in a number of different applications, such as recovery of stolen property, tracking vehicles and cargoes, remote area positioning and messaging, personal communications, multiple data retrieval, and remote control of systems such as utilities. The market niche for STARSYS-type LEO satellite communications will consist of customers who can effectively employ short, inexpensive data messaging. STARSYS does not, therefore, compete directly with those systems which emphasize voice services. Moreover, with its design emphasis on inexpensive satellites and very low cost terminals, STARSYS will foster the creation of a completely different market of data messaging users, a mass market consisting of millions of commercial users around the globe. Additionally, nearly all of the applications envisioned by STARSYS for its commercial customers have corresponding utility in the government and military marketplaces.

The concept of providing satellite messaging and positioning to individual user terminals has been attempted before, but satellite and user terminal costs were too expensive for mass market acceptance, and the services languished. Now, with the continually diminishing cost of sophisticated electronics, and the ability to use low-cost, low-earth orbit satellites, the commercialization of space communications for mass market use is on the threshold of being realized. STARSYS is a leader in the effort to bring two-way space-based data communication and positioning at an affordable cost to people and businesses around the globe. The STARSYS system, our market perspective, and where we stand in implementing our system for low-cost data messaging and positioning by satellite is the subject of this paper.

STARSYS FUNCTIONS

The STARSYS system performs two functions, both of which are based on existing and proven technologies currently in use.

First, employing low Earth orbiting satellites as relays, STARSYS exchanges brief, data-only, encoded radio signals between mobile receiver/transmitter terminals and distant fixed-position ground stations. For its second function, STARSYS determines the geographic location of transmitting mobile units through computer analysis of the terminals' emitted signals using Doppler and ranging techniques. These functions occur when the remote mobile terminal and its ground station are simultaneously within the 3,000-mile footprint of one of the constellation's low-Earth orbit satellites. When the system is operating at full constellation strength, terminal-ground station contact will be virtually constant.

With current and familiar non-voice wireless communications systems, an individual or company wishing to reach a remote unit contacts an intermediary service company, indicates the unit to be reached and leaves a call-back name or number, sometimes with a short message. Generally, these systems are confined in their reach by antenna height and power to a single metropolitan area, or, at additional user cost, to somewhat wider areas. This is the extent of most of these systems' capabilities.

STARSYS, on the other hand, presents a dramatically new and expanded range of capabilities for this type of communications, offering a satellite-based service which technically leaps over existing terrestrial infrastructure requirements. With STARSYS, an initiating organization located anywhere can send a full message or command of up to 32 characters in length to a mobile unit when the terminal and ground station are both within the same satellite footprint of more than three thousand miles diameter. Additionally, with STARSYS, customers receive in return from the mobile unit an acknowledgement of receipt, and a response message or data of up to 32 characters, all at a very low, single message cost.

For customers also needing position information, STARSYS will determine the geographic location of remote units by computer processing the received signals. Position information is especially useful and valuable to commercial and industrial interests for finding, spot monitoring or tracking goods, vehicles or personnel, or for commanding equipment response in a remote location.

These two STARSYS functions – data exchange and position determination – can be configured or combined to create a variety of service applications for commercial, industrial, governmental or personal use.

STARSYS MARKETS AND APPLICATIONS

The principle which drives STARSYS is that of providing an affordable service attractive to large user markets. The company is designing its system to yield high cost-benefit ratios for customers to make STARSYS a preferred communications choice.

Features setting STARSYS apart from existing communications systems are STARSYS's very low costs coupled with its global reach and two-way capabilities. Many systems offer remote data acquisition or two-way communications, but at significantly higher equipment, maintenance and operating costs than those proposed by STARSYS.

By virtue of these low costs, STARSYS will be available and attractive to large numbers of users and become an economically preferable method of data acquisition, transfer and position determination. The system is a response to needs in the marketplace, not a technology in search of a market.

Markets already identified as ready for STARSYS low-cost technology include commercial trucking, public utilities, hazardous materials transport, high-value/special interest goods transport, vehicle security, motoring services, environmental and ecological services, law enforcement, the military, commercial insurance, and private commercial communications organizations.

Within the many potential service markets, there is an even wider number of possible applications of the STARSYS system functions. Preliminary contacts with selected public and private organizations indicates a strong user acceptance of the system's capabilities and potential usefulness to these groups.

Using the STARSYS system, trucking companies can send inexpensive, brief messages from their headquarters to drivers anywhere in the country, and receive acknowledgement messages in return. Likewise, drivers can initiate messages to their companies, alerting them of delays or other operational problems. By processing received message signals, STARSYS can also tell the headquarters where each responding unit is located, information highly useful for efficient scheduling. Similarly, corporations and their travelling personnel can keep in touch by the same process.

For remote, unmanned applications, mobile terminals can transmit data from sensors or meters which measure temperature, humidity, flow rates, pressure, utility usage, etc., or detect motion, actuate switches, and so on. Units can be programmed to transmit specific information or status reports or perform control functions at given intervals or circumstances, or on demand. A perishable goods shipper, for example, can use

the STARSYS system to spot check and track a long-distance shipment, thus receiving assurance that proper climatological conditions are being maintained in transit, and that the shipment will arrive at its destination on schedule. The terminal can also be programmed to transmit information at routine intervals during the day, or, the customer can choose to get data on demand by sending signals to, or "polling," individual remote units, triggering the transmission of current data. In the event of a problem, the shipper, once alerted, can take early remedial action to protect the shipment's value or to keep a customer informed of any possible schedule delays.

Industrial firms can use mobile terminals to transmit data from instruments measuring various effluents or atmospheric emissions at plant locations. Readings taken several times a day can provide documentary evidence of environmental compliance or provide early warnings if levels begin to fall out of tolerance.

STARSYS mobile terminals can be integrated into property security systems for household, warehouse or property yard intrusion alarms or smoke detectors. STARSYS terminals attached to automobiles or boats aid in early detection of unauthorized use, help locate the property if stolen, and enhance early recovery and reduce losses.

Time-sensitive data applications are affected by the number of satellites in operation, ground station processing and non-direct terminal-to-terminal communication. Messaging delays can occur until the satellite constellation is completed on orbit. In the system's beginning stages, when only five or six satellites are in use, terminals will only be able to communicate with a ground station about fifteen minutes each hour. As the constellation grows, the windows of connectivity become larger, where, at a full constellation of 24 satellites, remote terminals will nearly always be in contact with a satellite. Ground computer processing time for message data under all circumstances is virtually instantaneous. Processing time, however, for position information, because several readings are required to achieve the highest accuracy, can take several minutes.

Because the STARSYS concept is relatively unfamiliar to most businesses, the company launched a familiarization project called Early Entry Program (EEP) to acquaint target market groups with the capabilities and potential of low earth orbiting satellite communications. This successful effort has embraced a number of diverse commercial interests through demonstrations with an older satellite system called Argos. Argos, which is owned jointly by the U. S. and French governments, gathers environmental data from mobile transmitters scattered throughout the world. A small portion of the system's capacity has been temporarily allocated to STARSYS use for the Early Entry market capabilities demonstrations and experiments.

Although Argos is a one-way system, sending data from mobile terminals, and has a less accurate position determination capability than that proposed for STARSYS, businesses nonetheless are discovering new and enhanced data communications and position determination applications which can yield increased operating efficiencies, reduced operating costs, as well as improved service offerings.

SYSTEM OPERATION

The STARSYS communications and positioning system is designed to permit mobile radio transmitter/receivers to send and receive via satellite brief digital data messages from virtually any location, and to determine the geographic location of the sending units. The latter capability is accomplished through computer processing on the ground of received signals from mobile terminals.

Messaging or data transfer may be initiated at either end of the system, that is, from remote terminals to a specific, privately operated customer service bureau (User Segment Application Center - USAC), or messages may

be initiated by an individual or organization, through a USAC, to any of its specific terminals. STARSYS satellites will relay messages between remote terminals and ground stations only when the sending and receiving components are both within the relaying satellite's footprint.

In a manner similar to non-voice paging systems, a customer who needs to reach a particular remote terminal contacts the appropriate servicing USAC to initiate a message. The USAC enters the message into the system by transmitting it to the STARSYS processing center where computer processing digitally encodes and forwards the data to a ground station. The ground station immediately transmits the data via satellite for relay to the proper remote terminal. The entire process takes a second or so to complete.

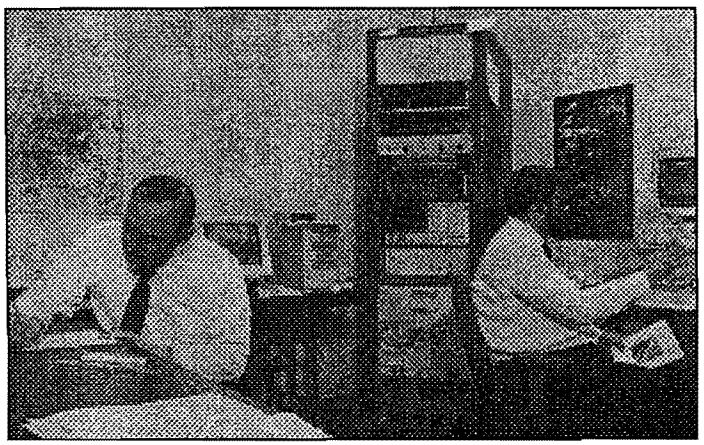
Return messages from terminals held by individuals are entered by the sender who initiates the terminal transmission. As the information is received by the satellite it is automatically re-transmitted to the ground station and processing center. The digital message is decoded and automatically sent to the appropriate USAC to be made available to the addressee/customer. The transmission/processing sequence is nearly instantaneous.

If a remote terminal is attached to a sensor, vehicle or other item of equipment, as opposed to communicating from an individual, different procedures are used. Terminal units can be programmed, for instance, to transmit data at pre-set intervals or when sensors detect readings outside pre-programmed limits. Customers will also have the option with STARSYS's two-way capability, of "polling" terminals on demand – sending signals to designated remote units to initiate a data response. For those terminals on mobile equipment, additional ground processing of the signals will determine the geographic position of the terminal at the time of each transmission, thus providing a record both of terminal movement as well as conditions sensed during movement.

Geographic position determination is accomplished through ground computer analysis of signal emissions. From the initial transmission, the terminal position can be determined to about 1,000 meters accuracy. The process integrates Doppler effect readings with radio ranging to determine the latitude-longitude position of the transmitting terminal. For precise positioning, the computer compares signal data separated by several minute intervals to achieve position accuracy within 100 meters. As this information is processed and available, it is forwarded to the USAC for distribution to the customer.

Customer access to a USAC can be accommodated in several ways. As with other non-voice, wireless systems, an individual can telephone his service center to give and receive messages verbally. With STARSYS, customers can also use dedicated linkages to the USAC such as computer modem, E-Mail, digital mail box, or teletype to connect with STARSYS directly and conveniently.

Several key operational features of the STARSYS system design have been under evaluation by STARSYS for several months under an experimental program. Using a leased transponder on the French-owned S80/T low-Earth orbit satellite, STARSYS has surveyed activity in the designated operating frequencies



Test Station

to determine how well the system will function in its assigned environment. The tests have yielded valuable results and have validated the

STARSYS concept for operating in the spectrum assigned, to include sharing that spectrum with existing users.

Additional engineering experiments have focussed on testing antenna design, power requirements and transmit and receive protocols using spread spectrum signal propagation techniques. STARSYS will use spread spectrum multiple access (SSMA) for remote terminal-originating data signals. This technique spreads the transmitted message across a number of frequencies at very low power, allowing virtually non-interfering frequency sharing with existing users of the frequency band.

Representative Link Budget

		FORWARD		RETURN		INTERFERENCE
		Up	Down	Up	Down	Up
Pt	dBW	-1	11.2	4	-14	
Elevation	•	5	10	10	5	
G	dBi	16	1.9	1	3	
EIRP	dBW	15	13.1	5	-11	
Space Loss	dB	147.46	154.9	146.3	146.74	
Pol Loss	dB	2	3	3	2	
Rec Loss	dB	0.5	0.5	0.5	0.5	
G	dBi	3	1	1.9	16	
Received Level	dBW	-131.96	-144.3	-142.9	-144.24	-124*
T	dBK	33.47	28.61	33.47	33.6	
C/N_0	dBHz	63.17	55.69	52.23	50.76	
C/N_{users}	dBHz			50.46		
C/N_{interf}	dBHz					41.1
rb	b/s	14,000	14,000	1,200	1,200	
Eb/N_0		21.7	14.23	21.4	19.97	
$(Eb/N_0)_t$ W/Interf.			13.51		9.17	
Margin W/Interf.	dB		9.11		4.77	

An important feature of the spread spectrum technique is its inherent capacity for accommodating large numbers of simultaneous users of this propagation method. Employing SSMA allows the system to be shared by literally millions of STARSYS customers in the U. S. and other countries around the world, while simultaneously allowing the frequency band to be used by other SSMA systems and single frequency operators in the band.

Separating individual STARSYS messages from among others will be done through code interpretation. Each STARSYS transmission, whether originating from a remote terminal or a ground station, will have a unique, imbedded digital identifier designating the specific remote terminal sending the information or receiving it. Computer processing recognizes incoming STARSYS data messages from remote terminals, decodes them and routes them to the proper USAC. For outgoing data, the USAC encodes and directs the messages to the Control and Data Acquisition Station, where the messages are relayed through the satellite to the specifically identified remote user terminal. The spread-spectrum transmission system provides a high degree of message privacy and allows efficient message separation and identification.

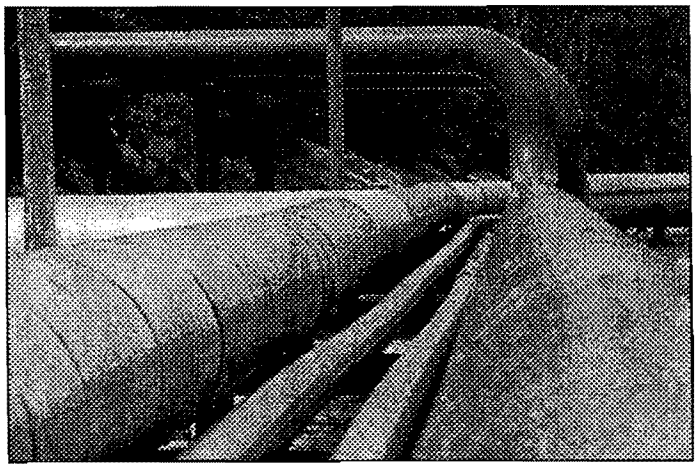
System technical "housekeeping" will be a function of the Operations and Control Center. This center will monitor all technical operational functions, providing alarms, status reports and coordination between ground stations as needed, and making satellite orbit control adjustments as required to maintain system accuracy and reliability.

STARSYS SYSTEM COMPONENTS

The STARSYS messaging and global positioning system functions with three general components: mobile transmitter/receiver terminals, a constellation of low-Earth orbiting satellites, and inter-linked ground segment elements.

Mobile User Terminals

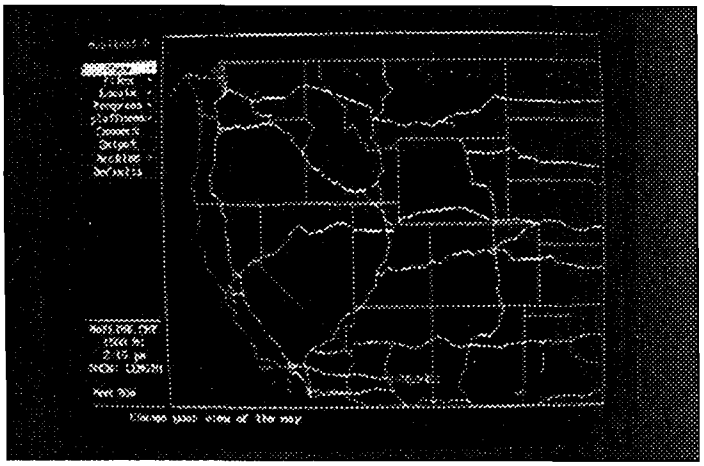
All elements in the STARSYS system are designed to make the mobile user terminal operate efficiently, to ensure that messaging



between customers and their terminals is completely reliable. The mobile terminal functions both as a radio signal receiver as well as a radio signal transmitter. Depending on intended use, terminals can be configured for different operational requirements.

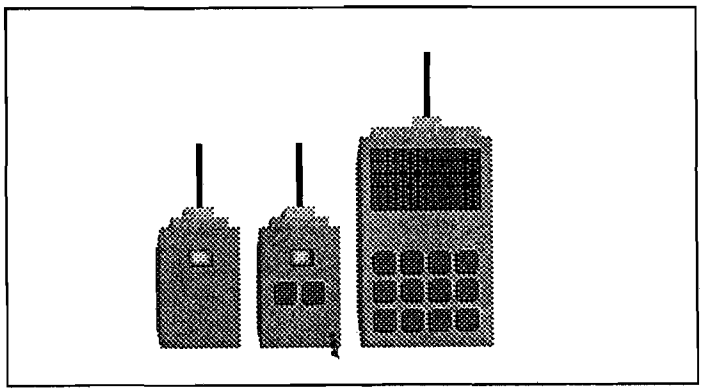
The simplest terminal could be a transmitter only, programmed to send data messages automatically at pre-set intervals or under certain prescribed circumstances or conditions. These units would be the least expensive, on the order of $100/unit or less, and could be employed in a number of ways, such as for providing status information from remote storage locations, utility meters and equipment, or environmental sensors.

The next and most versatile level of terminal would be the transmitter/receiver designed for remote (non-personal) applications. This unit enables customers, among other things, to initiate transmissions from remote terminals upon command from the fixed ground station. Typical applications for this type of unit would be vehicle security, mobile inventory control,



vehicle and cargo tracking, or other remote acquisition of data on demand. If a vehicle equipped with a STARSYS terminal is lost or stolen, for instance, the unit's position can be determined quickly by remotely activating the terminal and processing its "polled" radio signal to establish the geographic location. These remote terminals can be mated with data sensor inputs to transmit virtually any type of information desired, using brief data messages. For example, such terminals could be mated with laptop computers to transmit field data to a central customer location.

More sophisticated terminals add features, such as a key pad for manual entry of personal messages and an LCD-like screen for viewing received messages. It is anticipated that these personal communication models would retail for



up to $250. Personal communication applications could include maintaining contact with home or office while on personal or business travel, boating, hiking, camping or participating in other recreational activities, in the event of a vehicle breakdown or mishap, or in case of a personal distress.

User terminal design is focussed on weight and size as well as price, with capability and convenience major design influences. Most user terminals will be on the order of the size of a light weight pocket calculator, be battery operated, and capable of transmitting a brief, coded digital message at approximately two to five watts power in the VHF frequency band.

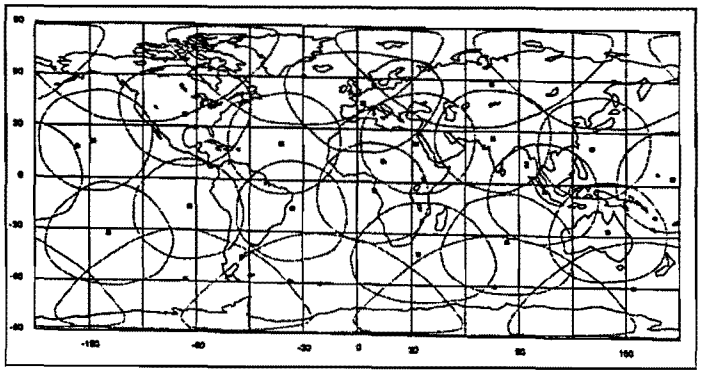
Satellites

STARSYS will deploy a constellation of small, light weight, low-power "bent pipe" transponder-equipped satellites to provide the connecting link between mobile terminals and ground processing locations. The system will begin initial services with five or six satellites about two years after license approval from the U. S. Federal Communications Commission (FCC). STARSYS expects to start operations in late 1995.

Satellites will be added periodically until the full constellation of twenty-four is in place for maximum service capability.

STARSYS satellites can be placed in orbit by a variety of single and multiple payload launch systems, giving STARSYS choice and flexibility for economies in launch costs, payloads, and scheduling.

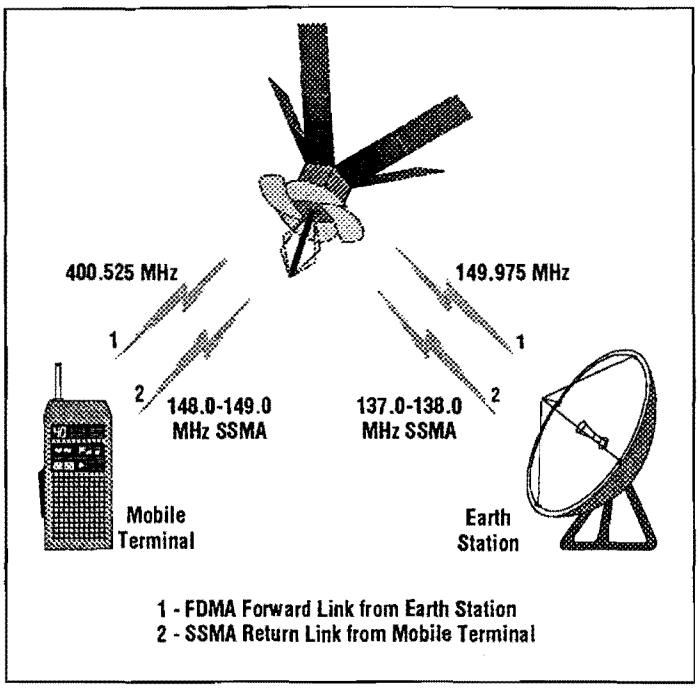
The system design calls for the satellites to fly in circular, 60° inclination orbits at approximately 800 miles altitude in planes varying from 0° to 360°. Each satellite will provide an average footprint of more than 3,000 miles in diameter. The full constellation, with overlapping footprints, will provide near



constant total coverage, assuring that the mobile terminals are almost always within immediate contact of a ground station.

With a "bent pipe" transponder, no on-board processing of radio signals is anticipated. The satellites will function primarily as transponder platforms, allowing two-way communication between mobile terminals and ground stations. The satellites will have no on-board data storage capability. Therefore, in order for data to transfer between a terminal and ground station, a satellite must be within range of both communicating elements.

The new generation of STARSYS satellites will weigh about 330 pounds and be placed in their proper orbit, inclination and spacing by launch insertion. Satellite design will be kept as simple as possible, with all signal processing done at the ground station. Solar panels will charge on-



board batteries, which in turn will power on-board systems and the radio transponder. An on-board control system will maintain attitude and orbit control. The satellites are expected to have about a five-year life expectancy.

STARSYS FREQUENCY PLANNING

Non-Voice, Non-Geosynchronous Low Earth Orbit (NVNG LEO) Mobile Satellite Services (MSS) – the so-called "Little LEO" group, which includes STARSYS – are authorized to operate in the following frequency bands: 137-138, 148-149.9, 149.9-150.05, and 400.15-401 MHz. The little LEO group, at the urging of the FCC, negotiated its own operating rules for sharing the allocated spectrum, and presented its proposal to the FCC. In January 1993, the FCC issued a "Report and Order" confirming the frequency allocation for Little LEO services. With some amendments, the FCC is expected to publish the NVNG MSS rules in the Fall of 1993. As a result of the frequency sharing process, STARSYS plans to use a hybrid data transmission scheme consisting of two types of frequency sharing techniques to complete its transmission links: SSMA (Spread Spectrum Multiple Access) and FDMA (Frequency Division Multiple Access). FDMA will be used on the forward links, with messages from the

mobile terminals returning to the ground station using SSMA format.

STARSYS will use the narrow-band FDMA technique in the 149.9-150.05 MHz frequency band for the uplink to the satellite, and the 400.15-401 MHz frequency band from the satellite to the mobile user terminal.

Typical System Parameters

Satellite				
Orbital Altitude	h	1,300	km	
Range at 5°	d	3,753	km	
Orbital Period	T	111.6	mn	
Overhead Pass	Tp	21	mn	
Foward Link				
Uplink Frequency		149.9-150.05	MHz	
Number of Forward Channels		Nc	1	
EIRB of Ground Station		15	dBW	
Channel Bit Rate		rb	14,000	b/s
Coded Symbol Rate		rs	28,000	b/s
Modulation		OQPSK		
Downlink Frequency		400.15-401.13	MHz	
EIRP of Satellite		13	dBW	
Return Link				
Uplink Frequency		148-149.9	MHz	
Number of Simultaneous Users		Nu	7	
EIRB of User		5	dBW	
Message Bit Rate		Rb	1,200	b/s
Coded Symbol Rate		Rs	2,400	b/s
Chip Rate		Rc	1,000,000	b/s
Modulation		QPSK		
Downlink Frequency		137-138	MHz	
EIRP of Satellite		8	dBW	

The return links will use SSMA, in the 148-149.9 MHz frequency band from the mobile terminal to the satellite, and in the 137-138 MHz band from the satellite to the ground station. The SSMA transmission technique spreads the transmitted radio signal across nearly one megahertz of band width at relatively low power rather than using a single, narrow-band frequency. This technique offers a high degree of privacy and allows multiple users to share a frequency band with minimal interference to each other.

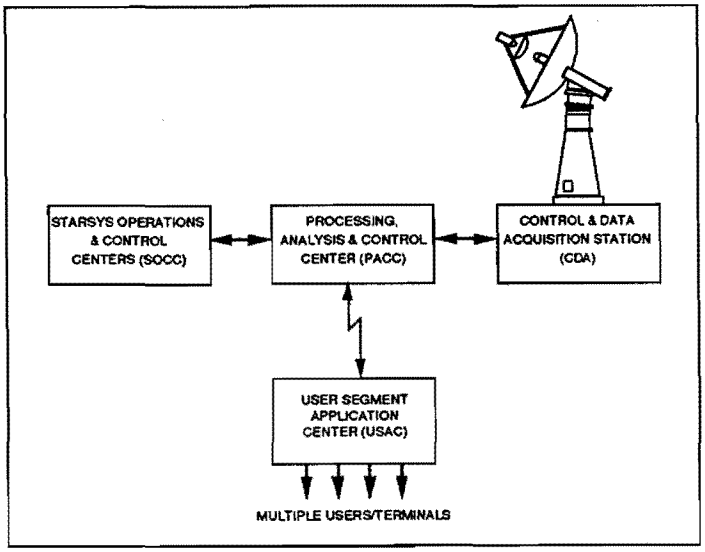
To avoid interference with existing users of the 137-138 MHz band, STARSYS will employ a series of notch filters to protect frequencies used by meteorological and space research systems. This procedure will ensure that STARSYS does not interrupt other operations.

THE GROUND SYSTEM

Control and Data Acquisition Station (CDA)

The Control and Data Acquisition station's function is to receive messages from and send messages to mobile user terminals through the satellite. The CDA will also receive status information from the satellites and send command messages back for satellite management. Individual CDA ground stations will be linked in a communications network to provide coordinated messaging and positioning services on a global scale.

Two computer-driven steerable antennas at each station will track and maintain contact with two satellites simultaneously. A third antenna will serve as back-up.



A reference/calibration sub-system platform, precisely surveyed, will be used to assist in calculating the exact position of satellites. A time reference sub-system synchronized to world standard Universal Coordinated Time, time stamps data. These two sub-systems support computer processing of signals to determine the geographic position of transmitting terminals using Doppler and ranging techniques. For applications and customers requiring extremely accurate positioning information, a GPS capability can be employed at added cost.

Processing, Analysis and Control Center (PACC)

Processing, Analysis and Control Centers (PACC), strategically located to service selected CDAs, are used principally to process data for customers in the PACC's respective region but can also serve as back-ups to each other in the event of a problem with another center.

The main functions of the PACC are message handling, position processing and linking the system to the USACs, its primary users. Each function will be managed by an inter-connected set of computerized sub-systems which will transfer, process and route data using a variety of communications interfaces with the User Segment Application Centers (USACs) it serves. Communications interfaces will employ or be compatible with U. S. and international data standards and protocols.

STARSYS Operations and Control Center (SOCC)

The STARSYS Operations and Control Center will manage the technical portions of the STARSYS system, monitoring traffic flows and systems operations, provide alarm monitoring for system operations, supervise satellite tracking and housekeeping, and maintain overall system quality control.

User Segment Application Center (USAC)

The User Segment Application Center is the primary user of STARSYS and is that portion of the system which manages customer services and functions as the retail service provider.

Each Center will provide specific STARSYS services for its particular market application group. Large volume STARSYS users, such as fleet operators, may operate their own Application Centers.

Whatever the application, each USAC will market its own services and capabilities, collect its own fees and charges, purchase, resell/lease and maintain its own transceiver units, provide resources for originating and receiving user data and messages, and generally perform all direct contact business functions with subscribers.

Each USAC will have direct contact with the customer to process and distribute messages and information from the STARSYS system. Customers in turn will have access to messages and location information through a variety of means, depending on the type of service subscribed to, such as voice mail or digital mail box, using a phone,computer, or a dedicated system such as a teletype. USACs serving specific application segments are anticipated to provide sophisticated value added services tailored to the USACs unique business customer requirements.

USACs are expected to purchase STARSYS satellite capacity in bulk, charging users directly, based on type of service provided. User costs will be determined on the basis of message length, type of service, and frequency of message transmissions. A typical user cost structure is anticipated to be about 1¢ per byte, and subscription costs similar to current telephone rates. The USACs are expected to derive additional revenues from the sale and lease of user terminals and from annual subscriber fees based on the type of service provided.

The Application Centers can operate on a city/state/region basis, nationwide, or on a worldwide basis, depending on the specifics of its application and its agreement with STARSYS.

STARSYS BUSINESS FEATURES

The cost to design, build, launch and begin STARSYS operations is estimated to be on the order of $50US Million. This amount will vary according to final satellite design and launch options selected. The company anticipates it will launch its first satellites to begin commercial operations within two years of final license approval by the U. S. Federal Communications Commission (FCC). The current expectation is for STARSYS to begin service in 1995 with its first two satellites.

STARSYS ground segment complexes, excluding privately owned User Segment Application Centers, are expected to cost about two to three million dollars US for a CDA and USAC. A single Systems Operation and Control Center (SOCC) will be built and maintained near the company's headquarters in the United States to manage and control the STARSYS system worldwide.

User Segment Application Centers will vary in operators' investment cost according to the size of the market served and the services provided. Start-up costs conceivably could run from as low as a few thousand dollars US for a small center, to a few hundred thousand dollars for a large, full-service center. STARSYS could also be an additional service offered by existing communications services providers.

STARSYS income will be derived from the sale of satellite capacity to the USAC's, initial sign-up fees and annual subscription fees for each terminal. STARSYS will contract for specific rates with each USAC on the basis of anticipated message volume and services provided.

USAC operators will generate income from the sale or lease of user terminals, annual subscriber or service fees, and from the re-sale of satellite capacity. Depending on the application, volume, and type of service provided to an individual user, the USAC can charge per message, or on the basis of defined, blanket service, or on a mixed basis. In general, costs to the user for messages will be less than one cent per byte of data, depending on the frequency of use. Monthly fees will approximate normal telephone subscription rates.

A designed-in low cost structure for equipment and operations makes STARSYS messaging extremely affordable and therefore very attractive for mass market use. STARSYS system capacity can accommodate millions of customers in the United States, and still reuse the frequencies around the world.

Customer advantages include affordable pricing for terminals and low-cost system access, the ability to send to and receive information from mobile terminals remotely located virtually anywhere on Earth, and the ability to determine the geographic position of the terminals. Independently or in combination, the messaging and position determination capabilities hold enormous economic potential for users, whether in commercial, governmental, personal or military applications. The conclusion is that no other communications system offers the combined geographic coverage, capabilities and affordability of STARSYS. The unique aspects of STARSYS – its mass market appeal for business, government and individuals, its low cost, and multiple capabilities – give the company potential for becoming one of the most successful new satellite service providers.

SUMMARY

STARSYS will offer a unique, low-cost combination of two-way messaging and position determination services using low-Earth orbiting satellites. Applications of this technology will be advantageous for a variety of commercial/ industrial, governmental, military and personal uses.

The system is designed to be simple, low-cost, have broad commercial application, and be affordable for mass market appeal. System capacity will accommodate millions of customers worldwide.

The system functions by using satellites as relays to connect small, low-powered remote radio transmitter/receiver units with distant ground stations. The digital radio signals used in the system are processed at computer centers on the ground. Customers access the system through commercial service centers dedicated to serving select market segments.

STARSYS is an applicant to the United States Federal Communications Commission to operate the system and expects license approval by the end of 1993 or early 1994. The company expects to begin commercial operations in 1995 with an initial constellation of five to six satellites.