APPLICATION OF

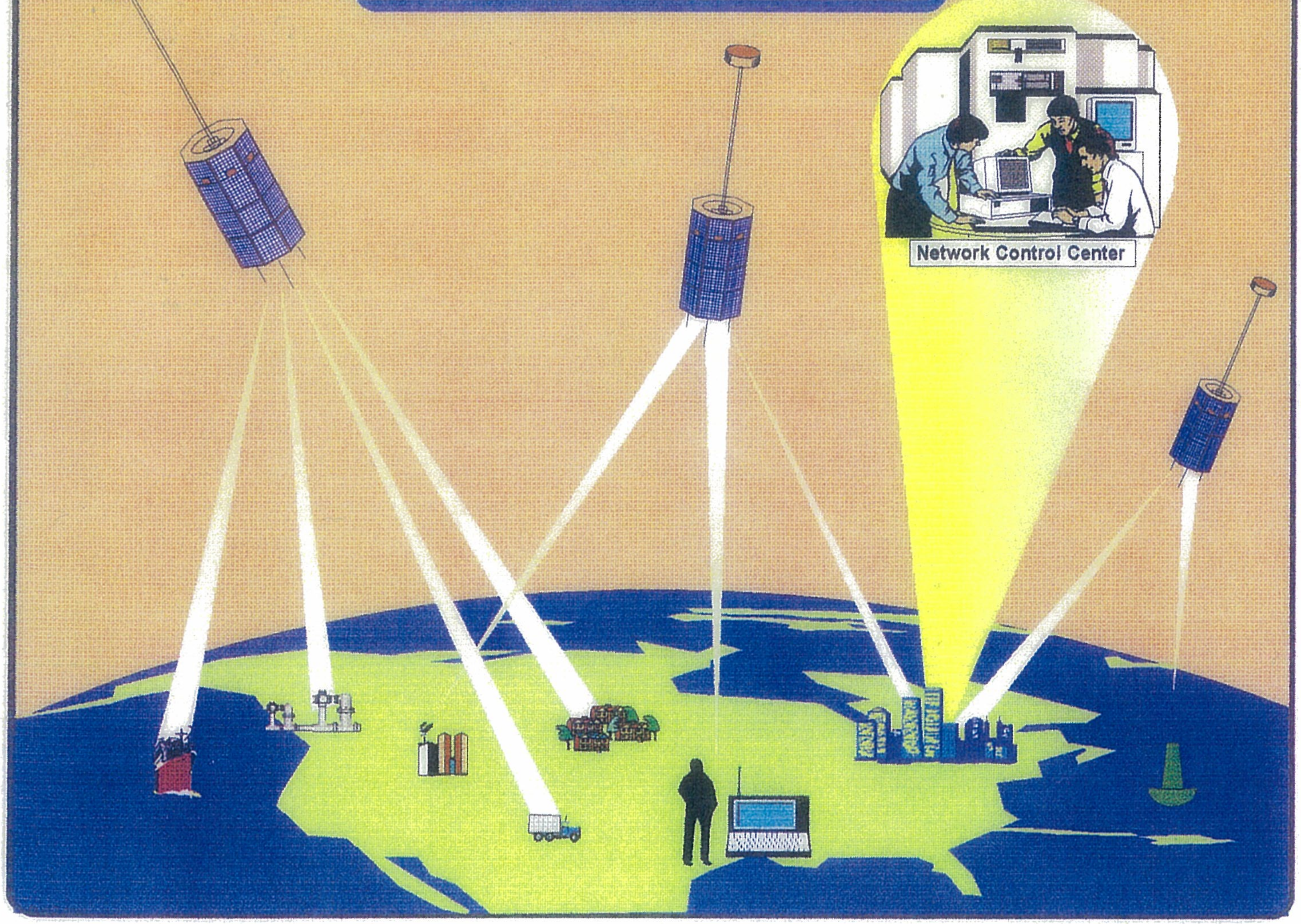
Final Analysis Communication Services, Inc.

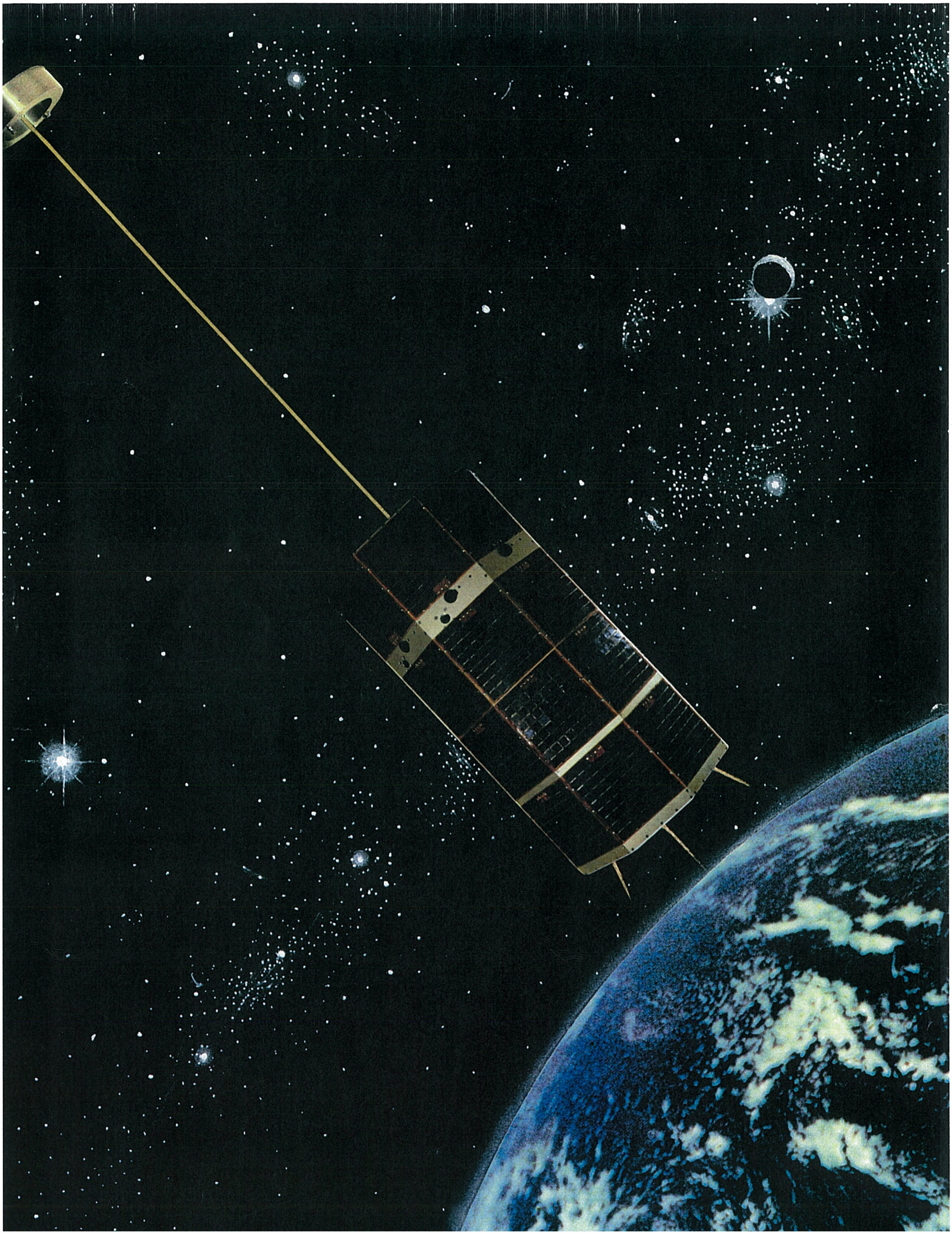
A SUBSIDIARY OF

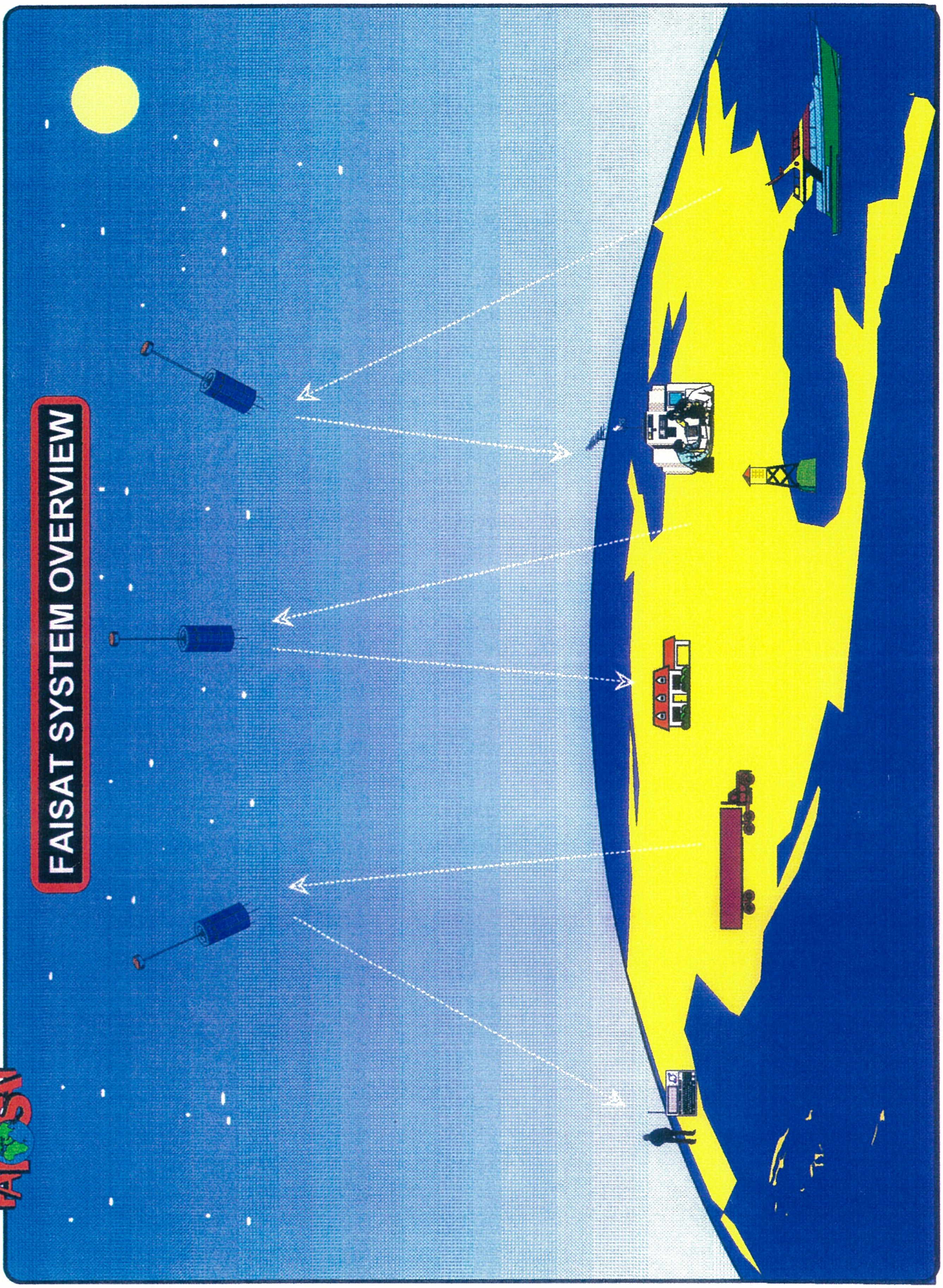
FAI Final Analysis, Inc.

BEFORE THE
FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C. 20554

FOR
Construction, Launch and Operation of NVNG MSS System






FAISAT SYSTEM OVERVIEW

BEFORE THE

FEDERAL COMMUNICATIONS COMMISSION

WASHINGTON, D.C. 20554

In the Matter of

FINAL ANALYSIS COMMUNICATIONS SERVICES, INC.	)	
For Authority to Construct, Launch and Operate A Non-Voice, Non-Geostationary Mobile Satellite System in the 137-138 MHz, 148-150 MHz, and 400-401 MHz Bands	)	File No. 25-SAT-P/LA-95

APPLICATION TO CONSTRUCT, LAUNCH AND OPERATE THE FACS LOW-EARTH ORBIT SATELLITE SYSTEM

Final Analysis Communication Services, Inc. ("FACS") hereby requests authority to construct, launch and operate a Non-Voice, Non-Geostationary Mobile Satellite ("Little LEO") System Below 1 GHz, consisting of a constellation of 26 satellites to be placed in orbit at a nominal altitude of 1,000 km and operating on the following frequency bands: 137-138 (Space to Earth); 148-150 (Earth to Space) and 400-401 (Space to Earth). As set forth in the ensuing Application, FACS respectfully submits that it is legally, financially and technically qualified to hold Commission license in the Little LEO service, and that grant of this Application would serve the public interest, necessity and convenience.

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I. OVERVIEW

I. OVERVIEW

A. The Applicant

The Applicant, Final Analysis Communication Services, Inc. ("FACS") was formed in 1993 for the primary purpose of developing a commercial communications business employing a constellation of satellites in the Non-Voice, Non-Geostationary ("NVNG") Low-Earth Orbit Mobile Satellite Service Below 1 GHz. FACS is a wholly-owned subsidiary of, and is collocated with, Final Analysis, Inc. ("FAI"), an aerospace engineering consulting firm with principal offices in Greenbelt, Maryland. FACS and FAI also have a laboratory and field office in Logan, Utah.

FACS presently has a professional staff consisting of six employees and consultants. The staff includes aerospace and operational engineers, market analysts and business development experts currently shared by FACS with its corporate parent. FACS' management and board of directors also interlock with FAI. FAI has a staff of approximately twenty-five employees and fifteen consultants, consisting primarily of scientists and engineers working on aerospace programs.

Initially, FACS will draw extensively on the financial and administrative infrastructure of FAI for business operations efficiency. This arrangement will allow FACS to keep its overhead to a minimum during the critical start-up phase of its operations. The parent company will design, build, and deliver all of FACS spacecraft (known as "FAISATs") into orbit. FACS will develop the communications business opportunities, the marketing organization, and the administrative infrastructure to support its commercial business enterprise and conduct the operation of the constellation system.

FAI was incorporated in 1992 to address spaceborne business opportunities with Federal Government agencies and commercial clients. FAI's owners are Dr. Nader Modanlo, an aerospace engineer who also serves as President and Director, and Michael Ahan, an aerospace engineer who serves as Executive Vice-President and Director. FAI's professional staff has extensive experience with government and commercial space projects as well as numerous NASA programs.

FAI engineers and scientists played important technical and program management roles in designing, developing, and testing the satellite precursor to the FAISAT series of satellites described in this application. FAI fully understands the underlying design of the unique FAISAT space platform, its capabilities, and how to tailor system performance for the needs of specific subscribers. FAI's in-depth experience in aerospace engineering and project management will enable it to realize significant cost savings and efficiencies in the design and implementation of the proposed FAISAT system.

B. <u>The Proposed System</u>

As set forth in greater detail below, FACS proposes to construct, launch and operate a constellation of 26 FAISAT satellites, consisting of 4 planes of 6 satellites with an inclination of 66°, and two additional planes of one satellite each with inclinations of 83°

which will provide enhanced polar coverage. The entire constellation of satellites is to be launched by the year 2000, providing virtually continuous coverage to the entire world.

The satellites will be in low-earth orbit at approximately 1,000 km. Each satellite will be configured to receive data from a variety of ground stations, process the information and retransmit. Consistent with the authorization sought in this application, FACS will provide a variety of NVNG services such as tracking, electronic mail, paging, monitoring, location determination, and distress signalling.

The satellites will be controlled from a Master Ground Station ("MGS") located in Logan, UT. The MGS may also be remotely commanded from a Network Control Center ("NCC") located in Greenbelt, MD. This NCC will be connected to the MGS via the Public Switched Telephone Network ("PSTN"). The NCC will also have the capability of operating in a receive-only mode to obtain data from the satellites. One additional fixed-base Secondary Ground Station ("SGS") will be strategically located in the eastern United States. Both the MGS and the SGS will be designed to upload and download data to and from the satellites.

In addition to the fixed MGS and SGS, there will be two general types of mobile ground terminals (Remote Terminals, or "RTs" and Messaging Terminals, or "MTs"). The RTs will be passive communications devices typically used to monitor, track or send alert signals. The MTs will contain alphanumeric input devices such as keyboards to allow users to enter brief messages and convey them via the satellite system to other MT users, in a manner similar to alphanumeric paging.

Both the RTs and MTs will be relatively small, inexpensive, ruggedly constructed and long-lived. The low-cost data transmissions from NVNG low-earth orbit satellite ("Little LEO") systems will result in a wide range of applications. These will include emergency assistance in remote locations, tracking of cargo shipments, and gas and electric meter monitoring functions. In order to accommodate these different applications, the RTs and the MTs will be designed and made available in various customized versions. Thus, several product lines could evolve to meet the specific types of communications needs to be served. See Figure I-1.

C. Services to Be Offered and Projected Markets

Because the "Little LEO" services have not been offered commercially on a wide scale, all of FACS marketing plans are necessarily based on reasonable estimates drawn from existing communications markets and services. FACS will target unserved or underserved applications that hold great potential for the types of low-cost, ubiquitous services offered by NVNG service. Early research indicates that certain types of communications services are a natural fit for the capabilities of the proposed system and the economics involved. These services include:

- Data Acquisition Services
- Remote Monitoring
- Tracking
- Personal and Business Non-Voice Messaging
- Emergency Communications/Distress Calls

In addition, the foregoing types of commercial communications services are divisible into many different subgroups. The world wide explosion in cellular radiotelephones, digital and alphanumeric pagers, and other technologies makes it likely that the Little LEOs will find their appropriate niches and that they will be profitable.

It is anticipated that several million end users, both businesses and individuals, will ultimately subscribe to FACS' service. It seems likely that a multiplicity of Little LEO devices will touch on our lives in the world of the near future. For example, an individual's car could contain a passive monitoring device which could summon help in the case of an accident, and/or assist in recovery of theft. That same individual could have a passive monitoring device on her electric, gas and water meters at home. She could also have a small emergency medical distress-signal generator. Finally, she could own a personal communicator, either stand-alone or combined with other technologies.

A single large business subscriber, such as a utility or an energy production company, might have tens of thousands or even millions of passive Little LEO communications devices. These devices could be used to read meters, or monitor remote machinery or other assets. This "multiplication effect" will make the ultimate market for Little LEO services enormous.

D. <u>Present Status of FACS' Efforts</u>

FACS, in coordination with the engineers and scientists of its corporate parent, FAI, has carefully analyzed the technical aspects of the Little LEO system concept. FAI has acquired an already-constructed government satellite, which it will retrofit in accordance with an Experimental Authorization obtained from the FCC. FAI has benefited from the cooperation of the Air Force's Phillips Laboratory and two separate parts of NASA: the Center for Space Power and the Space Communications Technology Center. FAI's research and development partnerships with NASA and the Air Force have enabled it to have access to advanced research, testing and production facilities that have greatly enhanced FAI's ability, through its subsidiary, FACS, to enter the Little LEO commercial services arena.

In connection with this developmental research project, FAI is in the process of assembling the component parts of an experimental system, including the FAISAT-1 satellite, a MGS facility in Logan, Utah, and a prototype RT to be employed in communications experiments with FAISAT-1. FAI has been working closely with the Air Force on an experiment intended to gather data on a capillary pumped loop thermal management system incorporated as a secondary payload on FAISAT-1. In addition, NASA has agreed to work closely with FAI to refine the techniques and equipment related to the RTs and MTs.

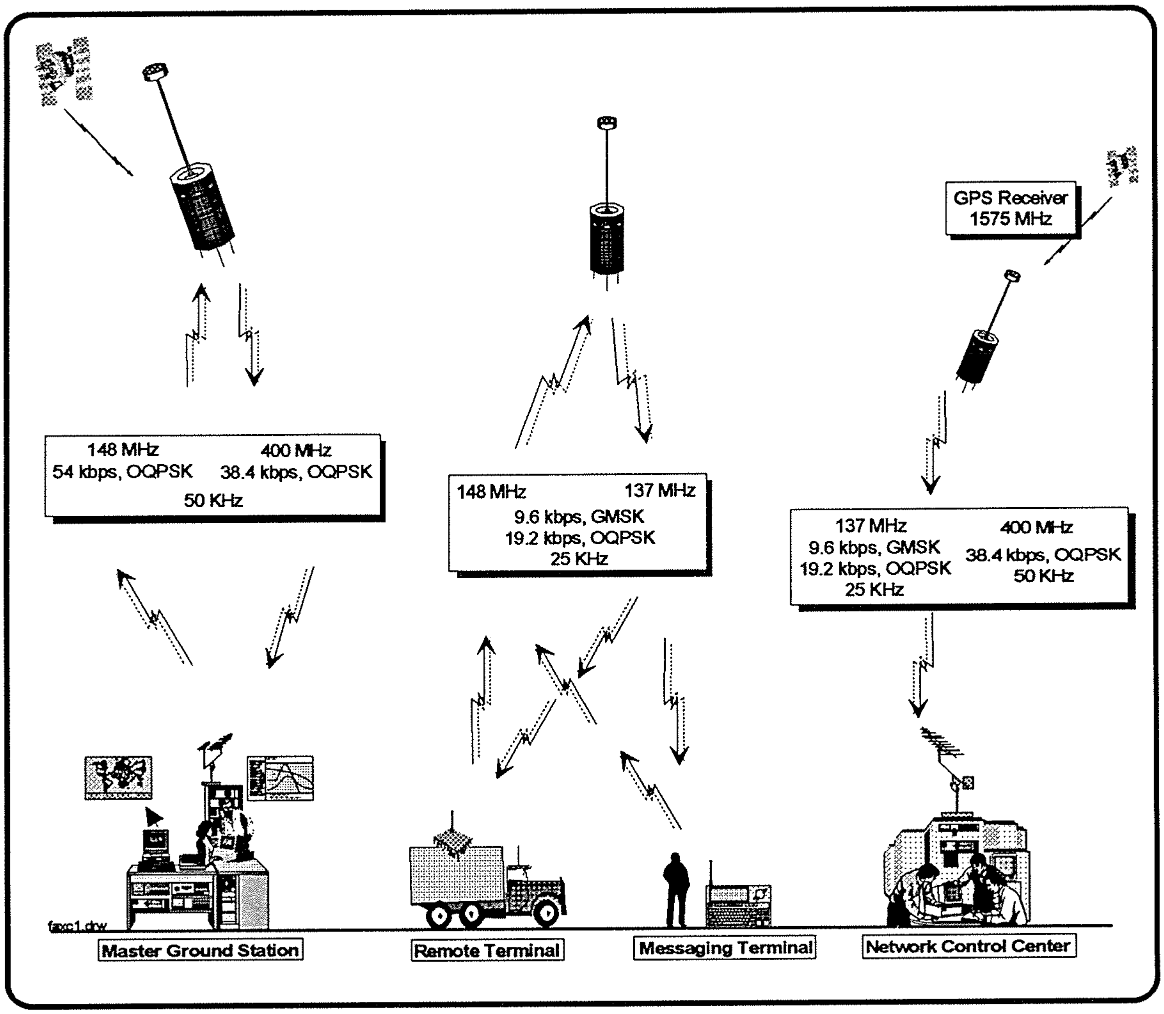
It is anticipated that this working partnership with the leading proponents of space technology and research in the United States Government will carry over into FACS' commercial operations as well. FACS intends to make space available to Government users on its satellites for secondary payloads, in order to conduct experiments and for other necessary services. This could well become a significant national resource for inexpensive access to space for scientific research.

E. <u>Proposed Use Of Spectrum</u>

As detailed in Sections II and III, below, FACS proposes to use several different "slices" of spectrum to support the operation of its proposed system. These frequencies have been designated by the Commission for use by NVNG MSS systems operating below 1 GHZ. These frequencies are located in three general areas of the spectrum: (i) 137-138 MHz for space to earth communications; (ii) 148-150 MHz for earth to space communications; and

(iii) 400-401 MHz for space to earth communications.[1] See Figure I-2.

Figure I-2 Frequency Use By FACS System Components



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[1]These are not intended to be precise indications of frequency, but rather a general identification of the range of frequencies for purposes of discussion in this "Overview" Section. For example, some of the frequencies implicated in this discussion will not be available until after January 1, 1997. The manner of utilization of frequencies by the FACS proposed system, the precise identification of the frequencies and the frequency sharing issues and are discussed in Sections II and III, respectively.

FACS has carefully reviewed the Commission's rules and orders applicable to this service, including the joint frequency sharing plan submitted by ORBCOMM, VITA and STARSYS in the "first round" Little LEO proceeding. Based on its extensive analysis, FACS has devised a multifaceted technical strategy for coexistence with authorized users (including Government users) of the frequencies. One innovative feature of the coexistence strategy employed by FACS is its Scanning Telemetry Activity Receiver System, or "STARS." This state-of-the-art technique dedicates one of the multiple onboard satellite VHF receivers to scan the uplink band for available channels to be used by the RTs and MTs. This process enables the FACS satellite system to coexist unobtrusively with other users in the NVNG spectrum, and maximizes efficient frequency utilization.

F. <u>Public Interest Considerations</u>

FACS submits that the NVNG MSS system it proposes will serve the public interest in a variety of ways. As noted above, there is a tremendous potential market for non-voice communications services. Little LEO technology will help to automate repetitive and time-consuming tasks, such as meter reading and monitoring of remote assets. Eliminating the need for human intervention in many of these applications will free a labor force for other work that makes better use of human capabilities. Economies realized by the utilization of Little LEO services will also result in tremendous long-term cost savings for businesses, and ultimately the consuming public.

In addition, many of the potential applications for FACS RTs and MTs could save life and limb. These include distress signals from victims of automobile accidents or hikers stranded in remote areas where conventional means of communication are not available. FACS RTs will also play a significant role in the deterrence of theft for automobiles, business machinery, freight items, and other portable assets. Little LEO tracking technology will help to locate these items after they are moved or even while they are being transported. Although this type of service could be made available by means of other technologies, the Little LEO tracking services will be more economical and dependable, allowing wider use and greater innovation.

The availability of low-cost, reliable, world-wide messaging services will help to shrink the world, enabling United States citizens and businesses to communicate more freely with their counterparts around the world. Although only relatively brief messages will be carried on this service (and voice carriage is not presently an option) the Little LEO service will contribute to the mounting process of spreading information and communications services throughout the world, promoting closer ties and better understanding between its peoples.

In summary, the Little LEO system proposed by FACS has a multiplicity of applications that are virtually guaranteed to serve the public's interest, necessity and convenience in the near future, and for many years to come. Accordingly, FACS respectfully requests that the Commission grant its application in the public interest.

II. DESCRIPTION OF PROPOSED SYSTEM

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A. Space Component

The FACS system will consist of a constellation of 26 low-earth orbit satellites known as FAISAT-1A[1] through FAISAT-26 launched over a period of five years. The satellites will all be placed in circular orbits at an altitude of 1000 km with orbital eccentricity of ~0°. The primary portion of the constellation will consist of 24 satellites in four evenly-spaced orbital planes with six satellites per plane, each plane being inclined with respect to the equator at an angle of 66°. A supplemental portion of the constellation consisting of two satellites in two quadrature orbits inclined 83° will provide enhanced polar coverage.

1. Constellation Design

The FACS constellation trade studies considered a number of factors : (i) the number of satellites; (ii) the altitude of the satellites; (iii) the RF power on the satellites; (iv) the coverage outage experienced by the constellation over the continental United States; (v) the availability of launch services by the service providers; and (vi) the overall cost of the system. The resulting constellation design described above provides coverage of the continental United States about 93% of the time and service outages of nominally one to 2.5 minutes every twenty minutes. A satellites orbiting at 1,000 km altitude provides a 5,600 km diameter footprint with a 5° elevation mask.

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[1]The first satellite in the constellation is known as FAISAT-1A due to the fact the FAI's experimental satellite is named "FAISAT-1." The designation of the satellite following FAISAT-1A is FAISAT-2, and so on, through FAISAT-26.

The achieved continental United States coverage provides the ability to acquire over 2 million RT transmissions per day from RT users in the United States.

The orbit planes for the 24 satellite portion of the constellation are evenly spaced at Right Ascensions of 0°, 45°, 90° and 135°. The satellites in each of the orbits will be spaced 60° apart in each plane with the Mean Anomaly for the first satellite in each plane increased from 0 to 15° to 30° to 45° in order to improve the footprint coverage. The satellites in the two satellite supplemental portion of the constellation will be placed in orbits with Right Ascensions of 0° and 90° and Mean Anomalies of 0° to provide equally spaced coverage of 5 to 6 hours during the first year of operation.

The constellation orbital details are shown in Figure II-1 and a depiction of the constellation in orbit is shown in Figure II-2. The footprint coverage for the 26 satellite constellation is shown in Fig. II-3.

Figure II-1 - Constellation Orbital Parameters

Sat No.	Alt (km)	Inc (Deg)	Ecc (Deg)	ArgP (Deg)	Ra (Deg)	M (Deg)	S (Deg)
1A	1000.	83	0	0	0	0	360
2	1000.	83	0	0	90	0	360
3	1000.	66	0	0	0	0	360
4	1000.	66	0	0	90	30	360
5	1000.	66	0	0	45	15	360
6	1000.	66	0	0	135	45	360
7	1000.	66	0	0	0	60	360
8	1000.	66	0	0	90	90	360
9	1000.	66	0	0	45	75	360
10	1000.	66	0	0	135	105	360
11	1000.	66	0	0	0	120	360
12	1000.	66	0	0	90	150	360
13	1000.	66	0	0	45	135	360
14	1000.	66	0	0	135	165	360
15	1000.	66	0	0	0	180	360
16	1000.	66	0	0	90	210	360
17	1000.	66	0	0	45	195	360
18	1000.	66	0	0	135	225	360
19	1000.	66	0	0	0	240	360
20	1000.	66	0	0	90	270	360
21	1000.	66	0	0	45	255	360
22	1000.	66	0	0	135	285	360
23	1000.	66	0	0	0	300	360
24	1000.	66	0	0	90	330	360
25	1000.	66	0	0	45	315	360
26	1000.	66	0	0	135	345	360

Abbreviations: Alt=Altitude Ecc=Eccentricity M=Mean Anomaly
Inc=Inclination ArgP=Argument of Perigee S=Service Arc
Ra=Right Ascension of the Ascending Node

Figure II-2 FACS Constellation in Orbit

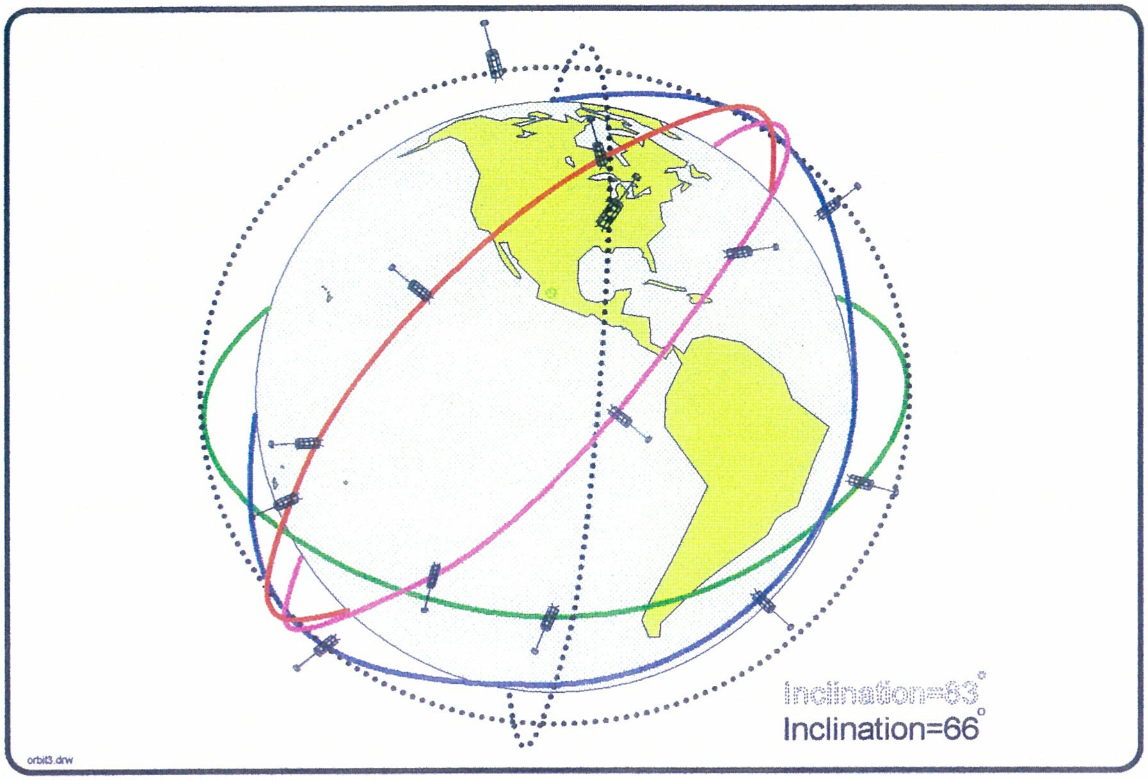
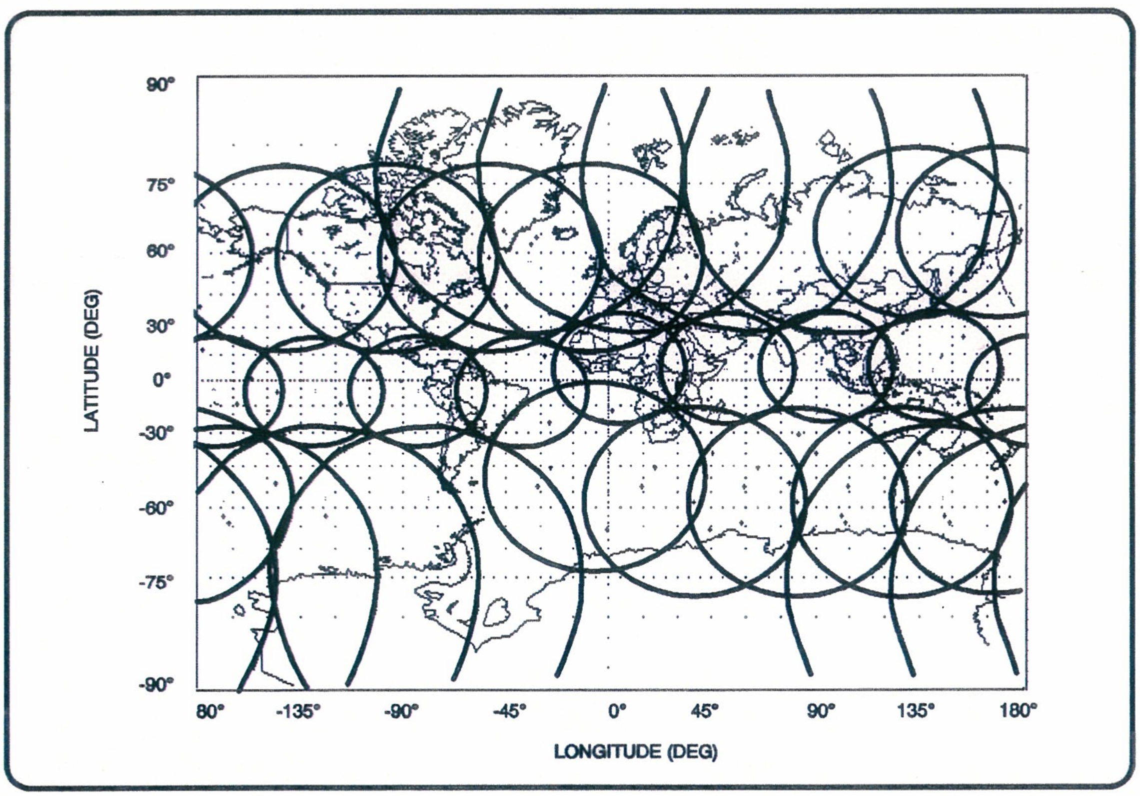


Figure II-3 FACS Constellation Footprint Coverage



2. Technical Description of Spacecraft

The principal role of any spacecraft is to support the payload which in this case is the communications subsystem. The spacecraft for this application has been designed to meet the technical standards contained in the FCC regulations for NVNG operations, and also to minimize complexity and thereby enhance reliability. The spacecraft design is a follow-on to the FAISAT experimental satellite system authorized by the FCC[2], which is being launched in December, 1994.

Figure II-4 is the FAISAT spacecraft block diagram. The major spacecraft characteristics are shown in Figure II-5. The following subsections describe in greater detail all pertinent aspects of the FAISAT satellite system.

3. Communications Subsystem - The Payload

The FACS system will operate simultaneously in the VHF and UHF frequency bands between space and earth. To achieve maximum operational efficiency, traffic from the ground segment to the satellite will operate in the 148-150 MHz VHF band. Traffic from the satellite to the ground segment will operate in the 137-138 MHz VHF band and the 400 to 401 MHz UHF band. This UHF band will be used to transmit satellite data and collected user data to the Network Control Center and multiuser collection terminals. The VHF band will be used for messaging services and data collection requests to the user terminals.

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[2]FCC Call Letters: KE2XGU, KE2XGV, KE2XGW, KE2XGX, KE2XGY

Figure II-4 FAISAT Spacecraft Block Diagram

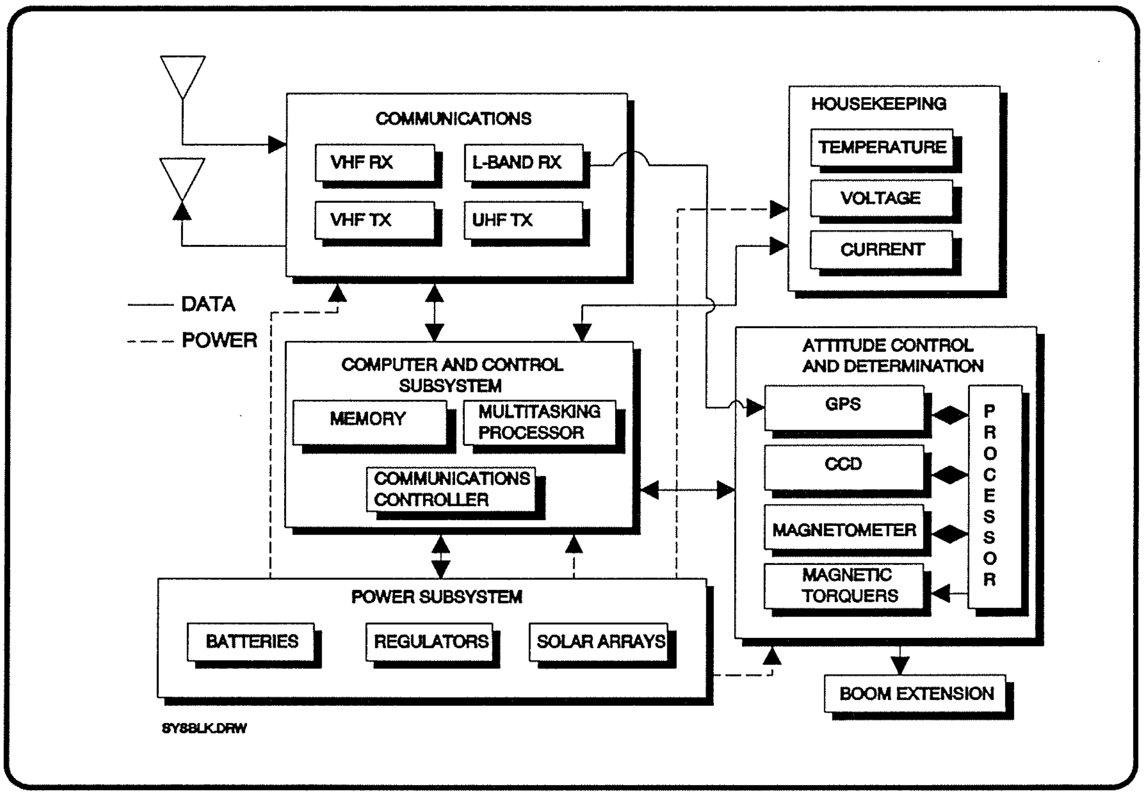

Figure II-5 FAISAT Spacecraft Summary

Constellations:	
Primary (66°)	24 Satellites
Supplementary (83°)	2 Satellites
Total	26 Satellites
Altitude	1,000 km Circular
Footprint Coverage	5,600 km Diameter
Weight	100 kg
Size	
Stowed	90 cm x 60 cm
Deployed without Boom	180 cm x 60 cm
Deployed with Boom	690 cm x 60 cm
Power	
BOL	59 Watts
EOL	47 Watts
Transmitters	3 VHF, 1 UHF
Receivers	14 VHF, 1 L Band
Mass Memory	32 Megabytes
Attitude Control	3 Axis Controlled Gravity Gradient and Magnetic Torquers
Launch Vehicle Candidates	Pegasus, LLV-1, Cosmos
S/C Lifetime	7 Years

Each operational satellite will have fourteen uplink messaging channels operating in the 148-150.05 MHz frequency range;[3] three downlink messaging channels operating in the 137-138 MHz frequency range; one downlink channel operating in the UHF band at 400.1 to 401 MHz; and a GPS receiver operating in the L-Band at 1575.42 MHz to receive GPS time and position information.

The precise channels being requested for UHF and VHF are set forth in Figure II-6 .[4]

a. <u>Subsystem Description</u>

The FAISAT on-board communications system consists of receiver and transmitter modules as shown in Figure II-7. Both the VHF (137 MHz/148 MHz) and UHF (400 MHz) antennae receive and transmit right hand circularly polarized electromagnetic waves. This will avoid the loss of signal due to Faraday rotation and also provide interference immunity to/from systems using the opposite (left- handed) polarization. In addition, the antenna gain patterns have an isoflux response to compensate for the difference in path loss between 5° and 90° elevation angles.[5] For a 1000 km orbit the path loss difference is about 12.5 dB. A typical gain pattern is shown in Figure II-8. The gain at 5° elevation (about 60° off nadir) is

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[3]Frequencies in the 149.9 to 150.05 MHz range will be available for the first time after January 1, 1997, and FACS intends to utilize them when they become available.

[4] As noted below, "RSU" means "Remote Terminal Satellite Uplink;" "MSU" means "Messaging Terminal Satellite Uplink;" "GSU" means "Ground Station Satellite Uplink," "RSD" means "Remote Terminal Satellite Downlink; "MSD" means "Messaging Terminal Satellite Downlink;" and "GSD" means "Ground Station Satellite Downlink."

[5]5° elevation angle corresponds to the edge of coverage for the FACS system.

Figure II-6. Requested Frequencies

Link	Frequency Band	Requested Frequencies	Total BW
RSU/MSU	148-150.05 MHZ	148.905-150.05 MHz*	1,145 KHz
RSD/MSD	137-138 MHz	137.3375-137.3625 MHz** 137.4875-137.5125 MHz** 137.6075-137.6325 MHz** 137.6325-137.6575 MHz 137.6575-137.6825 MHz 137.6825-137.7075 MHz 137.7075-137.7325 MHz 137.7325-137.7575 MHz 137.7575-137.7825 MHz**	225 KHz
GSU	148-150.05 MHz	149.25-149.30 MHz	50 KHz
GSD	400.15-401 MHz	400.380-400.430 MHz*** 400.520-400.570 MHz*** 400.595-400.645 MHz*** 400.720-400.770 MHz***	200 KHz

* FACS will not use 149.9-150.05 MHz until after January 1,1997.
** FACS will not use these band segments until after January 1, 2000.
*** Each satellite uses only one of these 50 KHz sub-bands.

3 dBi, while the gain at 90° elevation (zero degrees off nadir) is about -9.5 dBi. This results in near constant power flux density at a fixed point on the surface of the earth while the satellite travels across the sky (for minimum elevation of 5°). Separate antennae are included for the both the VHF transmit and receive functions. Additional antennae are included for the ground station UHF downlink and the L-Band GPS receiver.

Figure II-7 FAISAT Communications Subsystem

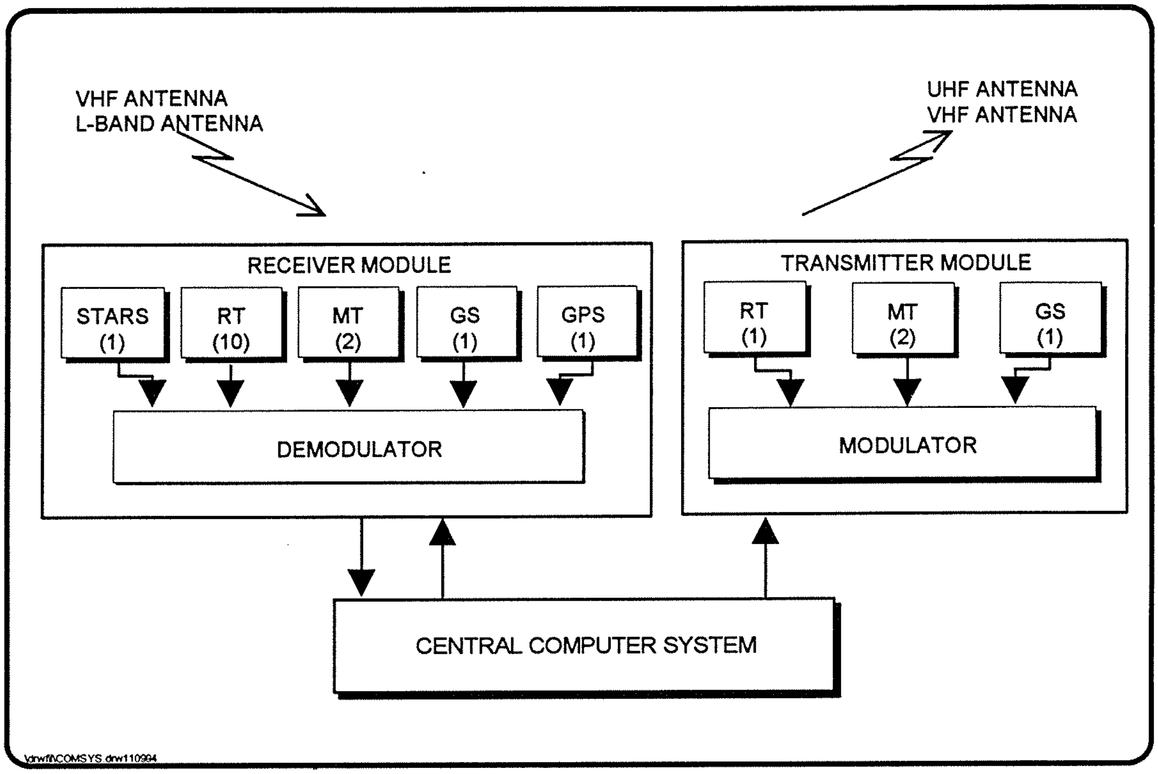
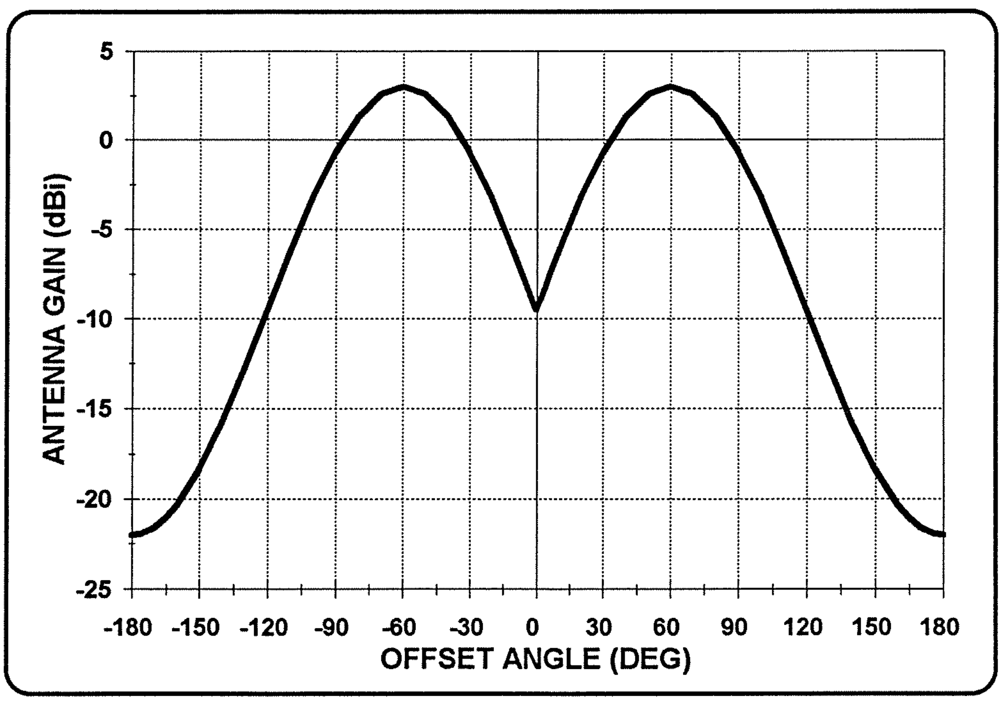


Figure II-8 Typical Satellite Antenna Gain Pattern



The satellite receivers include various integrated filter structures to limit the effective noise bandwidth. Likewise, the satellite transmitters include similar filters to minimize out-of-band spurious emissions. In addition, the Gaussian Minimum Shift Keying ("GMSK") modulation scheme (detailed below) is highly efficient in reducing energy outside the main spectral lobe. Emission responses for the various transmitters are presented in Figure II-9.

Figure II-9 Transmitter Emission Characteristics

Percent Bandwidth from Center Freq.	Spurious Emission Below Peak
50 to 100%	-25 dBc[6]
100 to 250%	-35 dBc
>250%	-60 dBc

The receiver module contains fourteen VHF receivers, dedicated to the following uses: (i) ten of the receivers will be dedicated to the reception of data from RTs; (ii) two of the receivers will be dedicated for use with the active MTs; (iii) one of the receivers will be dedicated to receive transmissions from the MGS; and (iv) the final receiver (the "STARS" receiver, see below) is dedicated to scanning the frequency spectrum for available channels for transmissions from the ground. All of the VHF receivers are identical and downconvert to an intermediate frequency using a synthesized local oscillator. The receivers are capable of being tuned from 131-151 MHz; however, in its application, FACS is requesting usage of

[6] "dBc" refers to "dB relative to the peak carrier level."

a portion of the authorized band, from 148.905-150.05 MHz (subject to the availability of 149.9 to 150.05 MHz after January 1, 1997).

The heart of the interference avoidance system for the uplink band is the Scanning Telemetry Activity Receiver System ("STARS"). The STARS receiver will scan the 1145 KHz sub-band in 2.5 KHz steps in approximately one second and measure the spectral power density in each channel. This information will be processed on board the satellite to determine the best uplink channels, based on minimum power density, to be utilized for the next uplink series. With a user uplink channel width of 25 KHz, spaced on 2.5 KHz channels, the 148.905 to 150.05 MHz band contains 453 usable channels.

The input to the fourteen VHF receiver suite contains a filter to minimize noise effects from outside the assigned band and a low noise, high gain amplifier. These two components establish the receiver noise figure. Following the low noise amplifier is a hybrid power splitter which distributes the signals to the various receivers. The receiver downconverts the incoming signal, demodulates the signal (*i.e.*, recovers the data) and routes it to the system computer. The system computer separates the data into appropriate segments and stores them in memory for future transmission.

The satellite transmitter module contains one VHF transmitter for RTs, two VHF transmitters for MTs and one UHF transmitter for satellite- to-MGS communications. The one RT transmitter and the two MT transmitters each operate in one of the requested nine channels in the 137-138 MHz band, as depicted in Figure II-6. The satellite transmitter module contains the modulators, synthesized oscillators, power amplifiers, and filters necessary to generate and shape the transmitted signals.

The RT transmitter is used to alert (wake-up) the RTs in the satellite's footprint, define the timing sequence for the polling scheme and assign the uplink frequencies. The two MT transmitters are dedicated to send/relay messages to the active MTs.

The MGS communications section on the satellite contains a dedicated VHF receiver which operates on 149.275 MHz and a UHF transmitter tunable over the 400.15-401 MHz band. The MGS will scan this UHF band to determine which of the four 50 KHz channels shown in Figure II-6 is available for transmissions. Once a UHF channel is selected by the MGS, the MGS will command the satellite to transmit its data on that channel.

b. <u>Frequency and Polarization Plan</u>

Early in the design of the FACS communications system, the issues of frequency sharing and non-interference with the other NVNG applicants was a primary concern. ORBCOMM, STARSYS, and VITA submitted a joint frequency sharing plan to the FCC on August 7, 1992. This joint plan allows the first round applicants to operate compatibly in the 137-138 MHz, 148-149.9 MHz, and 400.15-401 MHz bands and purposefully leaves open spectrum available for other NVNG systems. FACS has used that plan as the basis for its frequency selection process/non-interference analysis. The proposal developed by FACS results in the sharing of these bands effectively and efficiently with the existing and other proposed users, without causing harmful interference.

The FACS system will consist of six simplex communications links. These will be used for RT-satellite interconnection, MT-satellite interconnection and MGS-satellite interconnection. The links are:

RT-Satellite Uplink (RSU)

RT-Satellite Downlink (RSD)

MT-Satellite Uplink (MSU)

MT-Satellite Downlink (MSD)

MGS-Satellite Uplink (GSU)

MGS-Satellite Downlink (GSD)

The RSU, MSU and GSU will operate in the 148-150.05 MHz band, the RSD and MSD will operate in the 137-138 MHz band, and the GSD will operate in the 400.15-401 MHz band.

Each satellite communications payload will include ten RSU receivers and two MSU receivers. Each of these receivers has a synthesized local oscillator and is capable of being tuned over the 148-150.05 MHz band. The STARS receiver will scan the requested uplink band in about one second and select twelve channels every eight seconds (the "polling period") with the least activity to be used for uplink transmissions. The RSU and MSU receivers will each be tuned to one of the twelve selected clear frequency channels. The clear channel assignments will also be downlinked to the RTs and MTs.

The RSU/MSU receivers will include demodulators for 1.2, 2.4, 4.8 or 9.6 Kbps GMSK signals and 19.2 Kbps offset-Quadrature Phase Shift Keying (OQPSK) signals. The RSD/MSD transmitters will include modulators for 1.2, 2.4, 4.8 or 9.6 Kbps GMSK and 19.2 Kbps OQPSK. The GSU receiver will include a OQPSK demodulator operating at a bit rate of 54 Kbps and the GSD transmitter will include a OQPSK modulator operating at a bit rate of 38.4 Kbps. The RTs and MTs will transmit and receive up to 9.6 Kbps GMSK modulated signals and 19.2 Kbps OQPSK modulated signals. The GSs will transmit OQPSK modulated signals at a rate of 54 Kbps and receive OQPSK modulated signals at a rate of 38.4 Kbps. The modulation plan is summarized in Figure II-10.

The OQPSK scheme was chosen because of its high modulation efficiency (1.5 bits/sec/Hz). In order to conserve usage of the scarce frequency spectrum, OQPSK is used on the links handling high data rates (greater than 9.6 Kbps). The GMSK scheme, which has a moderate modulation efficiency of 0.667 bits/sec/Hz, was chosen because of its low

Figure II-10 Modulation Plan

Link	Frequency Band	Max. Bit Rate	Modulation
RSU	148-150.05 MHz	9.6 Kbps	GMSK
		19.2 Kbps	OQPSK
RSD	137-138 MHz	9.6 Kbps	GMSK
		19.2 Kbps	OQPSK
MSU	148-150.05 MHz	9.6 Kbps	GMSK
		19.2 Kbps	OQPSK
MSD	137-138 MHz	9.6 Kbps	GMSK
		19.2 Kbps	OQPSK
GSU	148.0-150.05 MHz	54 Kbps	OQPSK
GSD	400.15-401 MHz	38.4 Kbps	OQPSK

secondary spectral lobes (at least 10 dB lower peak secondary lobes compared to other digital modulation techniques). GMSK is used in all the moderate to low data rate links (rates less than and equal to 9.6 Kbps) to minimize interference to users in adjacent channels.

The required FACS channel bandwidths are determined by the data rate, the spectral efficiency of the modulation, the transmitter frequency stability, and the uncompensated Doppler shift. The calculated Doppler shift for a 1000 km orbit at the 149 MHz uplink frequency is shown in Fig. II-11. This curve corresponds to an orbit directly over the observer and thus represents the worst case value of the Doppler shift. Time equal zero corresponds to the instant the satellite crosses the horizon (zero elevation angle). The total Doppler shift is 6.3 KHz (2 x 3.15). The value of the worst case Doppler shift at the other link frequencies scales linearly with the frequency ratio (*i.e.*, link frequency/149). The required channel bandwidths are given in Figure II-12.

Figure II-11 Doppler Shift at 149 Mhz

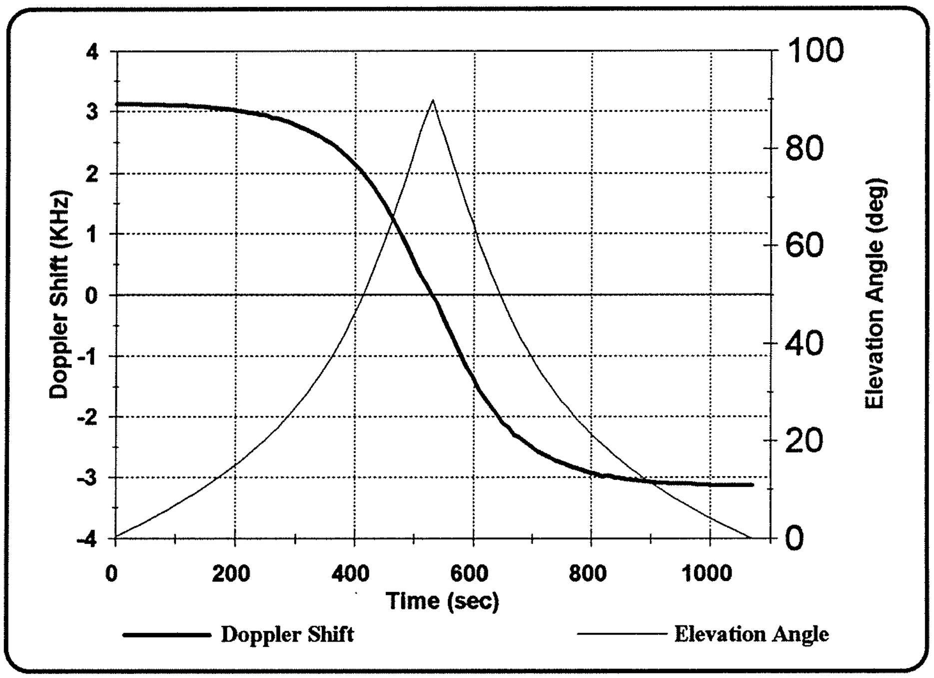


Figure II-12 Link Bandwidth Requirements

	RSU/MSU	RSD/MSD	GSU	GSD
Bit Rate	9.6 Kbps	9.6 Kpbs	54.0 Kpbs	38.4 Kpbs
Modulation	GMSK	GMSK	OQPSK	OQPSK
Signal Bandwidth	14.4 KHz	14.4 KHz	36.0 KHz	25.6 KHz
Total Stability*	0.6 KHz	0.5 KHz	0.5 KHz	1.0 KHz
Total Doppler Shift	6.3 KHz	6.0 KHz	6.3 KHz	16.8 KHz
Sum	21.3 KHz	20.9 KHz	42.8 KHz	43.4 KHz
Channel Bandwidth	**25 KHz**	**25 KHz**	**50 KHz**	**50 kHz**

*Oscillator stability is approximately ±2 ppm.

Based on the above discussions and the frequency sharing and non-interference analysis performed by FACS, the specific requested frequencies and total bandwidths have been determined. The charts set forth in Figures II-13, II-14 and II-15 display the existing or planned users in the frequency bands proposed for NVNG MSS operation. The primary NVNG MSS downlink segments are 137-137.025 MHz, 137.175-137.875 MHz and 400.15-401 MHz. The secondary downlinks are 137.025-137.175 MHz and 137.825-138 MHz. Primary uplinks are 148-150.05 MHz and 399.9-400.05 MHz[7]. The frequencies requested by FACS for the various communications links are presented in Figure II-6. In addition, the frequencies requested by FACS were indicated in Figures II-13, II-14 and II-15. The proposed center frequencies are presented in Figure II-16. For each link, the transmitted

[7]FACS does not incorporate the 399.9-400.05 MHz band in its satellite system at this time. However, it reserves the right to do so dependent on conditions warranting the inclusion of a UHF receiver on the satellite.

signal polarization is shown in Figure II-17 and the channel emission designators are presented in Figure II-18.

Figure II-13 Frequency Usage in the 400.1 - 401.0 MHz Downlink Band

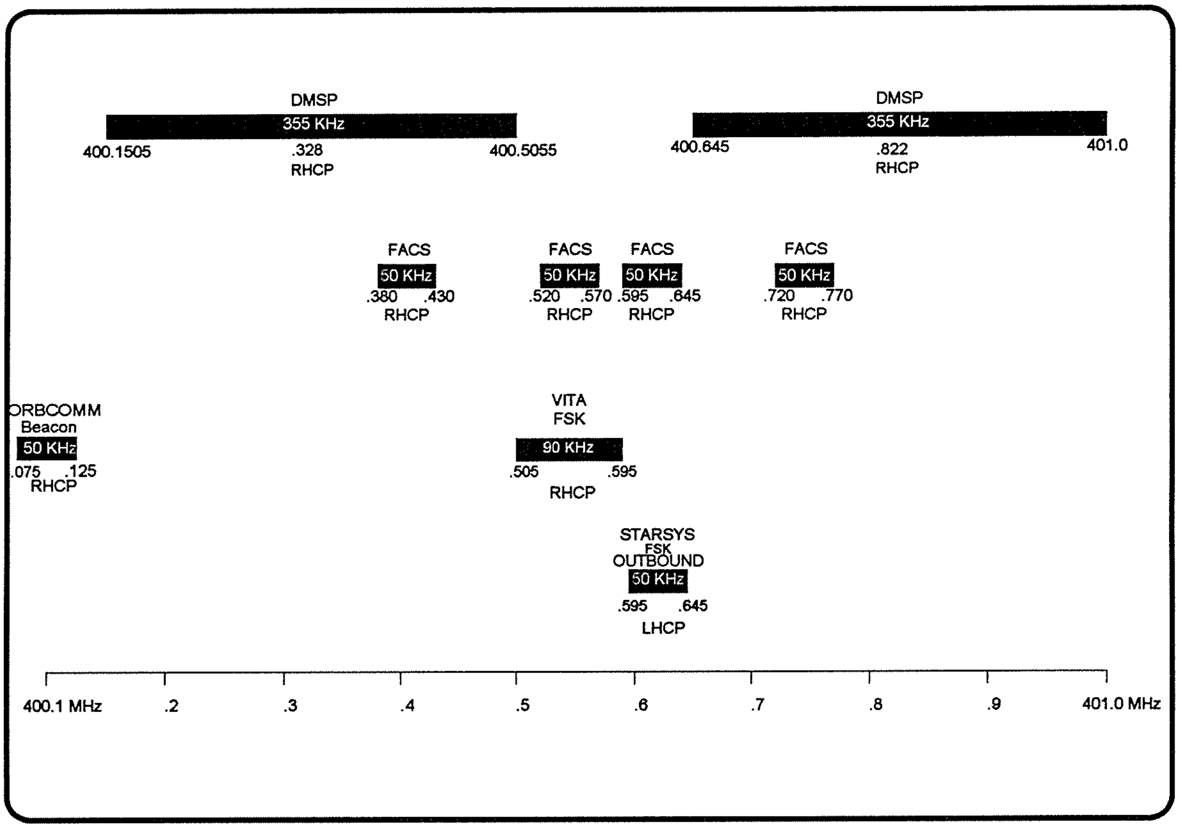


Figure II-14 Frequency Usage in the 148.00 - 150.05 MHz Uplink Band

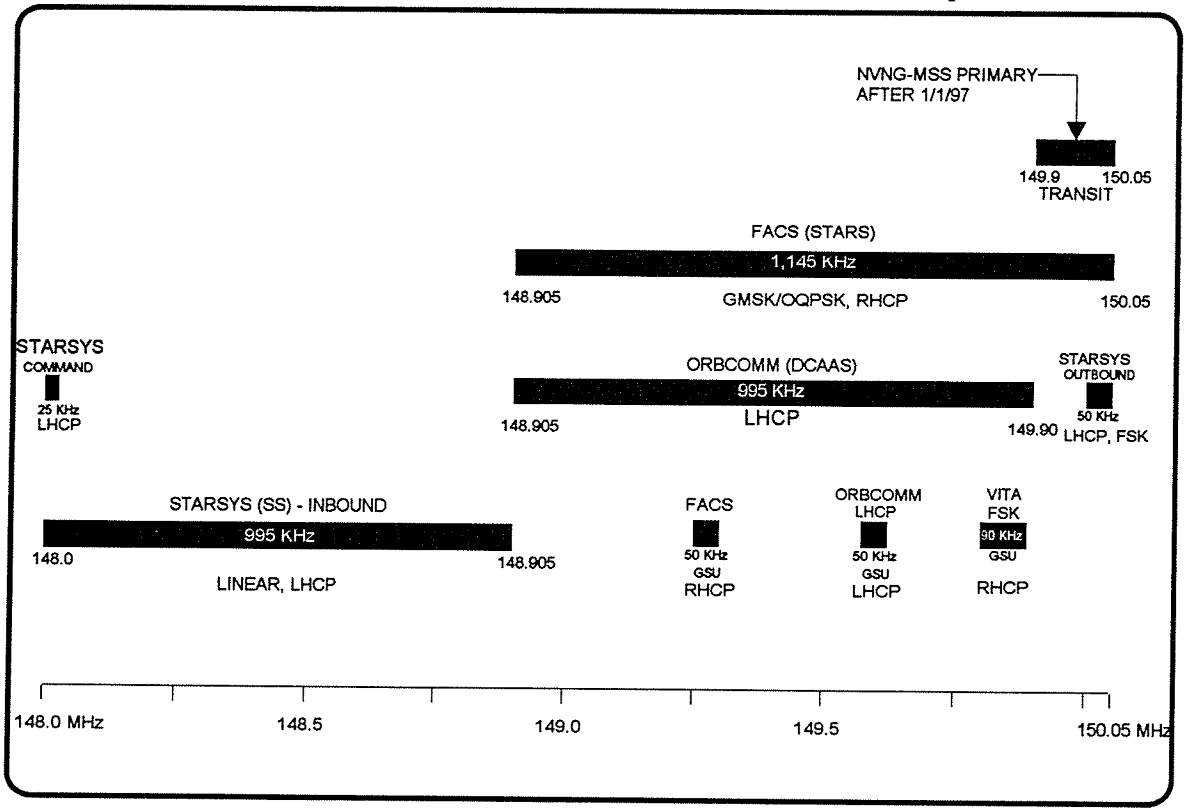
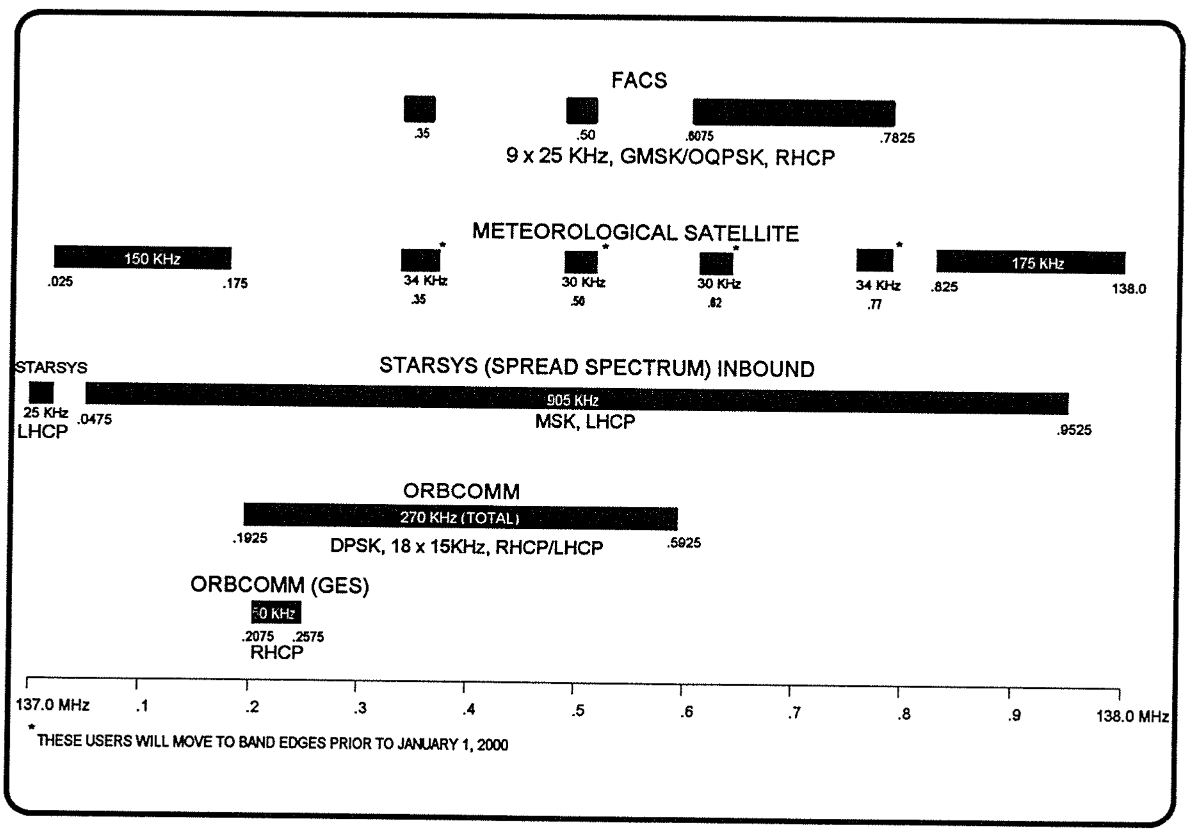


Figure II-15 Frequency Usage in the 137 - 138 MHz Downlink Band



Each satellite communications payload contains three user transmitters (one RT transmitter and two MT transmitters). In order to avoid inter-satellite interference between a satellite and its two nearest neighbors in the orbital constellation, a minimum of nine (3x3) RT/MT downlink channels is required. The rationale for the choices was set forth in Figure II-16 and is further discussed in Section III.

Figure II-16 Requested Center Frequencies

Link	Center Frequencies
RSU/MSU	148.9175 MHz, 148.9200 MHz, 148.9225 MHz, 148.9250 MHz, 148.9275 MHz,....., 149.1775 MHz, 149.1800, 149.1825 MHz, 149.1850 MHz, ..., 150.0400 MHz*, 150.0425 MHz*, 150.0450* MHz, 150.0475 MHz*
RSD/MSD	137.350 MHz**, 137.500 MHz**, 137.620 MHz**, 137.645 MHZ, 137.670 MHz, 137.695 MHz, 137.720 MHz, 137.745 MHz, 137.770 MHz**
GSU	149.275 MHz
GSD	400.405 MHz, 400.545, 400.620 MHz, 400.745 MHz

* FACS will not use these channels until after January 1, 1997.
** FACS will not use these channels until after January 1, 2000.

Figure II-17. Transmit Polarization

Link	Polarization
RSU/MSU	Vertical
RSD/MSD	RHCP
GSU	RHCP
GSD	RHCP

Figure II-18. Emission Designator

Link	Designator
RSU	25K0F1D, 25K0G1D
RSD	25K0F1D, 25K0G1D
MSU	25K0F1D
MSD	25K0F1D
GSU	50K0G1D
GSD	50K0G1D

c. <u>Link Budget Analysis</u>

The satellite transmitter output power at the antenna input and the maximum effective isotropic radiated power (EIRP) for the various downlinks are shown in Figure II-19. The EIRP includes a transmitter line loss of -0.2 dB and an antenna gain of 3 dBi, corresponding to a 5° elevation angle.

Figure II-19. Output Power and Maximum EIRP

Link	Power	EIRP
RSD/MSD	10 W	12.8 dBW
GSD	10 W	12.8 dBW

The receiver noise temperature, antenna gain and gain-to-temperature ratio for the various uplinks are shown in Figure II-20. The receiver noise temperature is based on an amplifier noise figure of 3.0 dB, a loss between the amplifier and antenna input terminal of -1.0 dB, and an effective antenna temperature of 500° K.[8]

Figure II-20. Satellite Receiver Noise Temperature, Antenna Gain and Gain to Temperature Ratio (G/T)

Link	Noise Temp.	Antenna Gain	G/T
RSU/MSU			
90° elevation	940° K	-9.5 dBi	-39.2 dB/K
5° elevation	940° K	3 dBi	-26.7 dB/K
GSU			
90° elevation	940° K	-9.5 dBi	-39.2 dB/K
5° elevation	940° K	3 dBi	-26.7 dB/K

Link budgets were evaluated for the FACS communications system and are presented in Figures II-21, II-22, II-23 and II-24. These correspond to the minimum system elevation angle of 5°. Each of the satellite antennae exhibits an isoflux response, which was shown in Figure II-8. This results in equal link margins at elevation angles of 5° and 90°, other factors being equal. FACS has designed the RTs and MTs (i.e., with similar antenna, transmitted power, receivers, and modulation rates) so that they result in same link budget.

The RT/MT-satellite link budgets presented in Figures II-21 and II-22 correspond to GMSK modulation at 9600 bps and a bit error rate (BER) of 1E-05. For OQPSK modulation at 19.2 Kbps and the same BER, the link margin decreases by 3 dB. The satellite receives and

[8]This includes the effect of sky noise.

transmits right hand circularly polarized waves, while the RTs and MTs receive and transmit linearly polarized waves. This introduces a 3 dB polarization loss into the link budgets. In addition, an implementation loss of 2 dB is included to account for non-ideal modulation/demodulation hardware.

The ground station-satellite link budgets presented in Figures II-23 and II-24 correspond to OQPSK modulation at 54 Kbps for the VHF uplink and 38.4 Kbps for the UHF downlink. The link margins calculated are for a BER of 1E-06. Right hand circularly polarized antennae are used in both the ground station and the satellite. A polarization loss of 0.5 dB is included to account for any deviation in axial ratio from the ideal.

In all the link budgets presented above, the margins are 9 dB or greater. This assures that the links would operate reliably, even under worst case conditions of blockage and adverse weather conditions.

Figure II-21
Satellite to RT/MT Downlink

Frequency (Typical)	137.67 MHz
Transmitter Power	10.0 W
Transmitter Power	10.0 dBW
Transmitter Line Loss	-0.2 dB
Transmitter Antenna Gain	3.0 dBi
EIRP	12.8 dBW
Slant Range	3194.5 km
Space Loss	-145.3 dB
Polarization Loss	-3.0 dB
Atmospheric Loss	-1.0 dB
Receive Antenna Gain	0.0 dBi
System Noise Temperature	940.0 K
Data Rate	9600 bps
Eb/No	23.6 dB
Bit Error Rate (BER)	1E-05
Required Eb/No	10.0 dB
Implementation Loss	-2.0 dB
Margin	10.6 dB

Figure II-22
RT/MT To Satellite Uplink

Frequency (Typical)	149.18 MHz
Transmitter Power	10.0 W
Transmitter Power	10.0 dBW
Transmitter Line Loss	-0.2 dB
Transmitter Antenna Gain	0.0 dBi
EIRP	9.8 dBW
Slant Range	3194.5 km
Space Loss	-146.0 dB
Polarization Loss	-3.0 dB
Atmospheric Loss	-1.0 dB
Receive Antenna Gain	3.0 dBi
System Noise Temperature	940.0 K
Data Rate	9600 bps
Eb/No	22.9 dB
Bit Error Rate (BER)	1E-05
Required Eb/No	10.0 dB
Implementation Loss	-2.0 dB
Margin	9.9 dB

Figure II-23
Ground Station to Satellite Uplink

Frequency	149.275 MHz
Transmitter Power	20.0 W
Transmitter Power	13.0 dBW
Transmitter Line Loss	-1.0 dB
Transmitter Antenna Gain	10.0 dBi
EIRP	22.0 dBW
Slant Range	3194.5 km
Space Loss	-146.0 dB
Polarization Loss	-0.5 dB
Atmospheric Loss	-1.0 dB
Receive Antenna Gain	3.0 dBi
System Noise Temperature	940.0 K
Data Rate	54,000 bps
Eb/No	29.0 dB
Bit Error Rate (BER)	1E-06
Required Eb/No	11.0 dB
Implementation Loss	-2.0 dB
Margin	16.0 dB

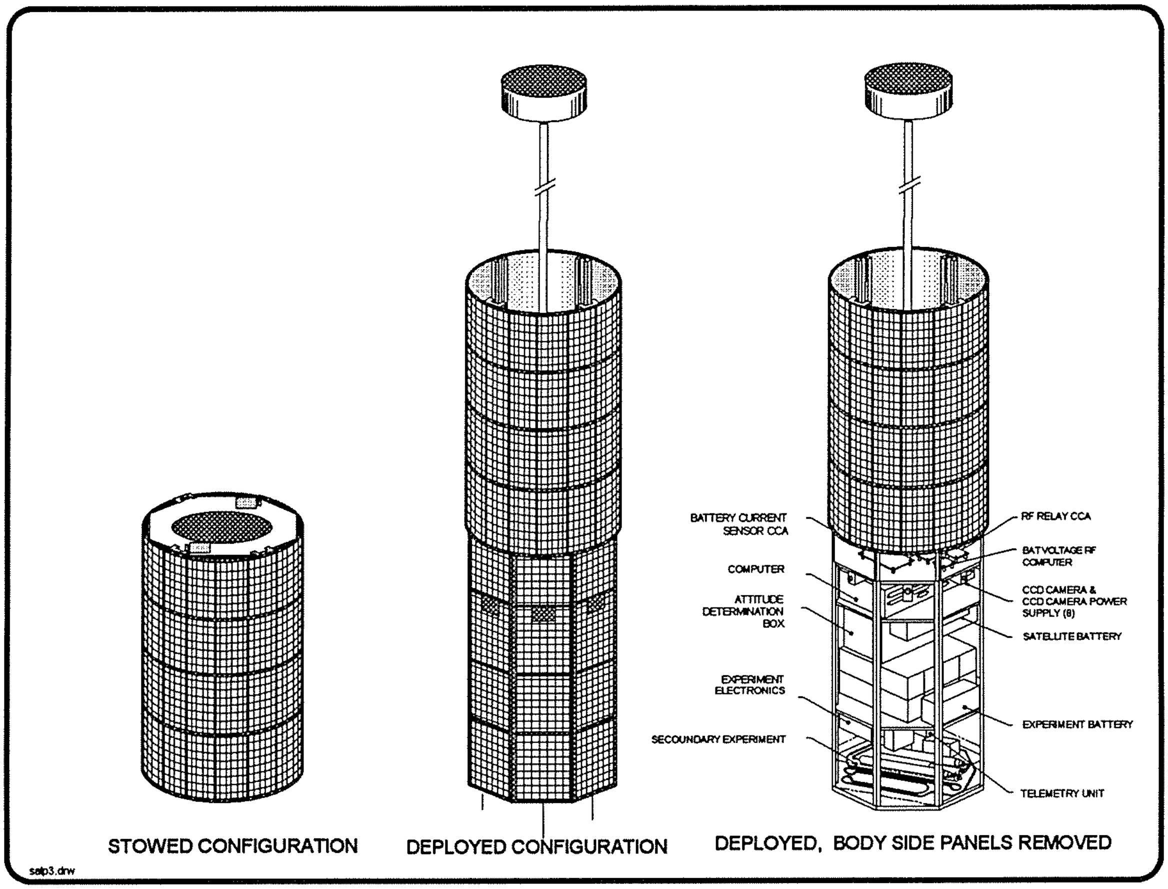
Figure II-24
Satellite-to-Ground Station Downlink

Frequency (Typical)	400.62 MHz
Transmitter Power	10.0 W
Transmitter Power	10.0 dBW
Transmitter Line Loss	-0.2 dB
Transmitter Antenna Gain	3.0 dBi
EIRP	12.8 dBW
Slant Range	3194.5 km
Space Loss	-154.6 dB
Polarization Loss	-0.5 dB
Atmospheric Loss	-1.0 dB
Receive Antenna Gain	12.0 dBi
System Noise Temperature	940.0 K
Data Rate	38,400 bps
Eb/No	22.7 dB
Bit Error Rate (BER)	1E-06
Required Eb/No	11.0 dB
Implementation Loss	-2.0 dB
Margin	9.7 dB

4. Mechanical Subsystem

The configuration of the spacecraft is similar to the configuration of the FAISAT-1 and is depicted in the stowed and deployed modes in Figure II-25. The satellite structure

Figure II-25 FAISAT Structural Configuration



approximates a right octagonal cylinder and is dimensionally 90 cm long, 60 cm across the extreme vertices, and 23 cm across the flat.

The structure is built of isogrid plates with solar cells mounted to the longitudinal surfaces. An outer cylindrical shell surrounds the inner shell in the stowed launch condition. Solar cells are mounted to the cylindrical surface. This cylindrical structure will be deployed upward after orbital insertion and provides a doubling of the solar array surfaces.

Components are mounted on shelves at various heights within the octagonal cylinder and, as can be seen in Figure II-25, a volume is available to carry supplemental payloads such as the U.S. Air Force Capillary Pumped Loop experiment being carried aboard FAISAT-1, FAI's experimental satellite.

The weight of the spacecraft will be about 100 kg. The Mass Properties Breakdown for the spacecraft is shown in Figure II-26.

Figure II-26 Mass Properties Breakdown	
Component	Weight kg (lbs)
Structure	
Side Panels (8)	12.7 (28)
Decks (6)	13.6 (30)
Telemetry	14.5 (32)
Computer	4.5 (10)
Power	
Battery Box	11.3 (25)
Solar Panels	12.3 (27)
Attitude Control and Determination	
ADS Box	4.5 (10)
G.G. Boom and Tip Mass	3.2 (7)
GPS	2.7 (6)
Magnetic Coils and Magnetometers	3.2 (7)
Thermal Epoxy and Other Compounds	9.0 (20)
Cabling	3.6 (8)
Misc. Hardware	3.2 (7)
Total Weight	**98.5 (217)**

5. Thermal Subsystem

The major requirements levied on the thermal subsystem are (1) to keep all components within temperature limits, (2) to keep the spacecraft side of the spacecraft/component (electronic boxes) thermal interface within limits, and (3) to limit the heat flow across this interface toless than a nominal 5 watts. The FAISAT thermal control subsystem uses passive thermal control surfaces employing conductivity and radiation to maintain the spacecraft components and interface temperatures. The expected range of internal operational temperatures is 20° C ± 10°C. The system will be verified by test to -10°C to 40°C (operational) and -20° C to 50° C (survival). The passive nature of the thermal control system reduces the need for redundancy and increases reliability.

6. Electrical Power Subsystem

The electrical power subsystem consists of solar panels, batteries, and a charge regulator. Utilizing high efficiency solar cells, the solar arrays will be mounted on each octagonal side of the spacecraft and on the cylindrical shell which will be deployed after orbit insertion. The average power for the payload is 29.5 watts and the housekeeping average power is 12.5 watts, giving a total average power requirement of 42 watts. The breakdown for the power requirements for the spacecraft are shown in Figure II-27. Based on these requirements the assumptions for the solar array design are shown in Figure II-28. The output power of the solar array will be approximately 59 watts on orbit average at the beginning of life and 47 watts after 7 years of lifetime.

Two 10 Amp Hour nickel cadmium batteries will provide a source of an excess of 40% eclipse power. The power bus will operate at 12 volts and the two batteries will have a total storage of 240 watt hours. This provides an excellent depth of discharge situation for extended life of the power system.

The charge regulator will be of a shunt regulator strategy and employ solid state power switches for control of power to subsystem elements. The switches will also serve as resettable fuses for power overload conditions.

Figure II-27 FAISAT Satellite Power Budget

Subsystem	Orbit Avg. Cont. Pwr	
Telemetry		
Scanning Receiver (1)	1.5 W	
RT & MT Receivers (12)	12 W	
GS Receiver (1)	2 W	
MT Transmitters (2)	8 W	
RT Transmitter (1)	4 W	
GS Transmitter (1)	4 W	
		29.5 W
Computer		2.5 W
Power Subsystem		5 W
Attitude Control and Determination		1 W
GPS Receiver		3 W
Misc.		1 W
Total		**42 W**

Figure II-28 Solar Array Breakdown

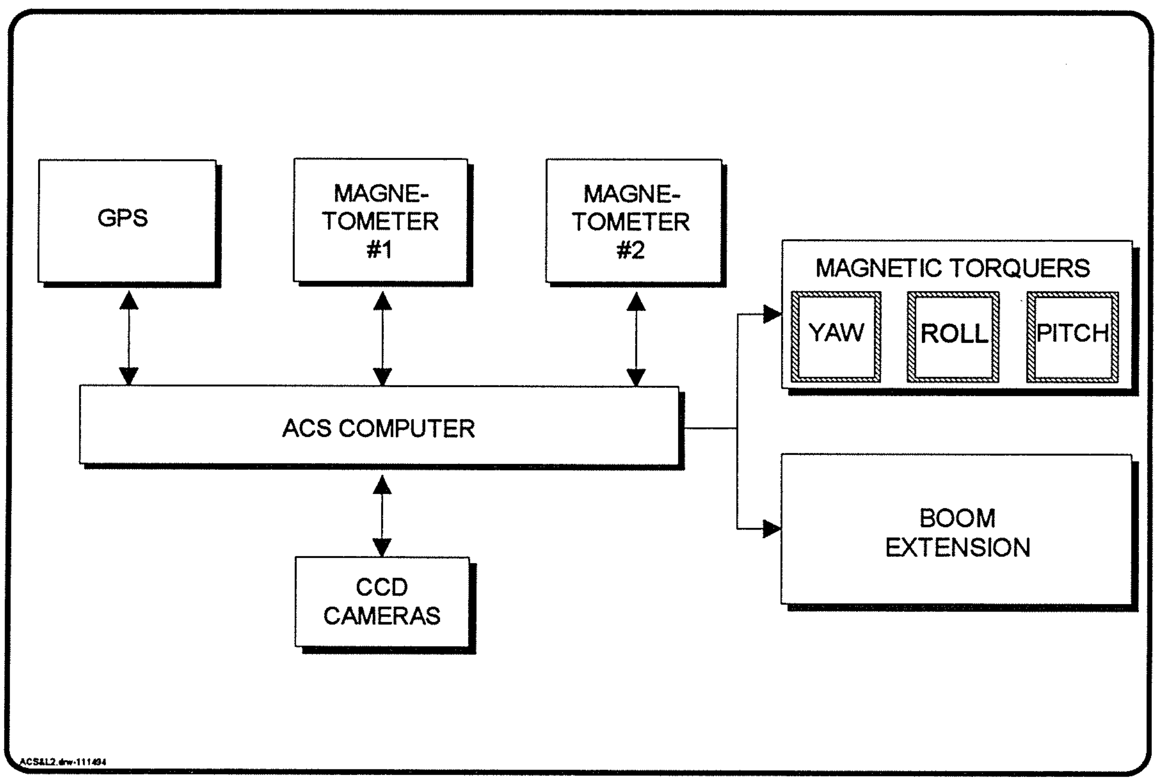
Component	Power (W)
Solar Array Power (Full Sun)	110
Shadow (40%)	-44
10% inefficiencies at BOL	-7
BOL	59
Degradation over 7 Years @ 20%	12
EOL	47
Required Power	42
Margin	**10%**

The implementation of the power system design provides a 10% margin for the satellite at the end of life (7 years).

7. Attitude Control System

The satellite is designed to be gravity gradient stabilized. This technique results in a satellite with no moving parts after initial extensions, and thus the satellite life is limited only by electronic parts and orbit decay. Because of this conservative design approach, one can expect 7-10 years of life from the satellite. The system is shown in the block diagram in Figure II-29.

Figure II-29 FAISAT Attitude Control and Determination System



Primary stabilization will be supplied by using gravity gradient effects. A six meter boom of STACER™ material with a tip mass 1 kg will be extended after the satellite is on orbit. The value of the tip mass will be optimized as the moment of inertia of the satellite is refined.

Torques which effect gravity gradient system are very small perturbations such as photon pressures, bending of the gravity gradient boom due to solar heating, and stray current loops acting against the magnetic field, all of which can cause the satellite to librate in the frame of reference of the satellite. To counteract the resulting angular momentum induced in the satellite, magnetic torques to act against the Earth's magnetic field are generated either with magnetic torque rods, or with large area coils through which currents are passed. The later method is the one we have chosen to use. Small magnetometers aboard the satellite will be used to control the on-time of the coils.

In order to know the librational state of the satellite, it is necessary to measure the satellite attitude. We are using the same system which is being used on FAI's experimental satellite, FAISAT-1. The system consists of eight very small CCD cameras which image the Sun and the Earth's limb. The information in these images is adequate to determine the orientation of the satellite to about 0.2°. Since the period of libration of the satellite is of the order of 3/2 times the orbital period in yaw and about 2/3 times the orbital period in pitch and roll, the duty cycle required of these detectors is small. Once the satellite is established in the gravity gradient mode, the satellite attitude will be monitored periodically (every 5-30 minutes) and an ephemeris of the motion established. When necessary, this can be modified by using the magnetic torquers.

The orbit ephemeris is determined using the data acquired from the GPS receiver on board the spacecraft and transmitted to the MGS. The ephemeris will be calculated for the satellite at the NCC and be made available for orbital operations and also provided to the active MT users for access to all of the various FACS satellites around the world.

8. Computer and Control Subsystem

The Computer and Control Subsystem implementation for the commercial FAISAT builds on the experience gained in developing the FAISAT-1 spacecraft. The advent of low power compact Reduced Instruction Set Computer (RISC) chips provide an opportunity to increase the capability of the current subsystem without a substantial increase in power requirement. The GS-100 software package developed for FAISAT-1 uses a proven, commercial, real-time, multitasking Kernel, the Hunter and Reading's VRTX™, which employs a preemptive, priority based scheduling algorithm. Replacing FAISAT-1's C86 chip with a high speed chip, the system will easily service the expanded communications systems with Priority 1 tasks being the receivers, Priority 2 task being the mass memory and Priority 3 tasks being the transmitters. These tasks will be followed in priority by the lower level tasks for the various housekeeping functions.

The mass memory for storing the message traffic will be configured as four sections of 8 megabytes of RAM each. The memory will be controlled as a Priority 2 task of the central computer.

The GS-100 software as modified will be completely compatible with the RT and MT protocols discussed elsewhere and is based on the resident generic store and forward system principals. For the commercial FAISAT satellites, each transmitter modulator and each receiver demodulator has been implemented with a high speed chip which provides an ideal interface for interfacing to the high speed central computer. The elements of the subsystem were shown in the block diagram of Fig. II-4.

9. Space Segment Reliability and Operational Life

The FACS satellite system has been designed for a minimum of seven year mission life with an expected lifetime of ten years. Sufficient margin has been designed into the solar array to maintain the operation of the satellite for the ten year period. Component level redundancy will be implemented in the satellite to eliminate critical failures. Modified failure modes, and effects analyses will be conducted for all components of the bus and payload hardware. Electronic assembly performance will be tested to conform to a seven year life time. The overall satellite design attempts to ensure a graceful degradation mode of failure and reduces the likelihood for disabling redundant functional equipment. The major reliability feature of the satellite is the relative redundancy of electronic and electrical components and units.

B. Ground Components

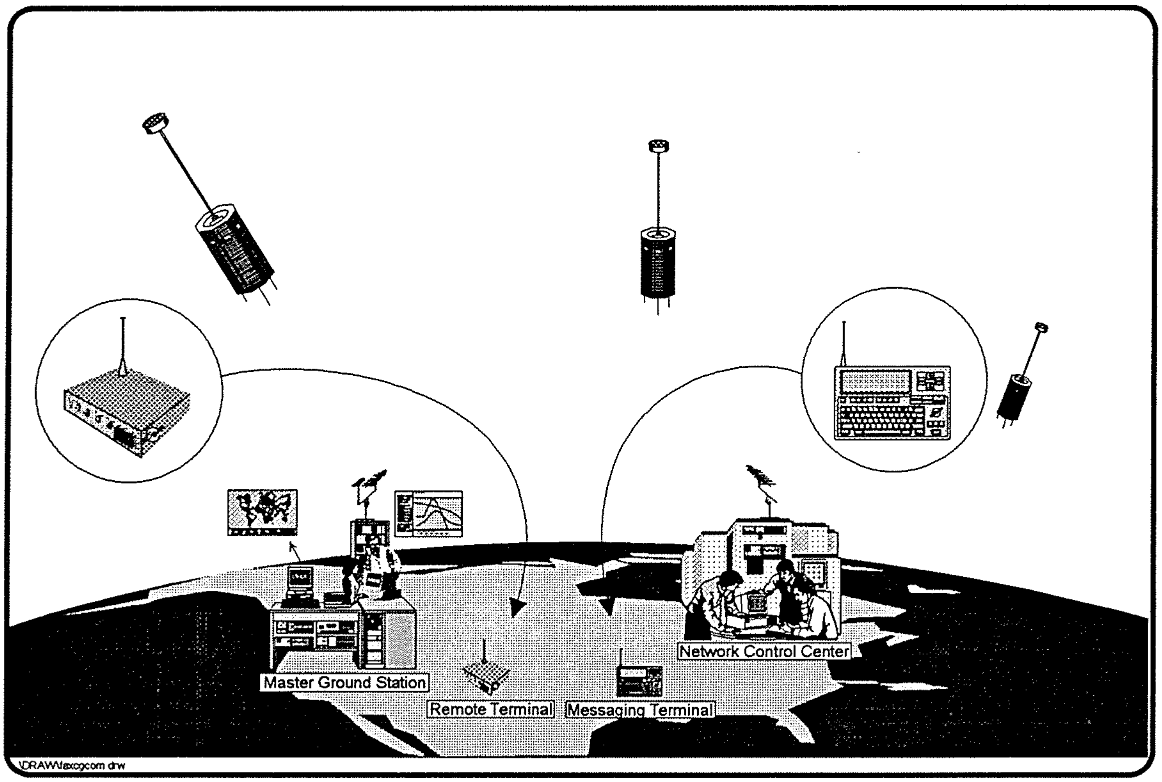
The ground components of the FACS System consist of the NCC in Greenbelt, Maryland, the MGS in Logan, Utah and the SGS on the east coast (location to be determined).

The FACS System services two types of users. Each type of user employs a transceiver ground terminal. The passive user which only collects data will use a RT to collect those data. The operation of the RT is described below. The active user will employ a terminal with an alphanumeric keyboard to create messages and interact with the satellite. This protocol and strategy is also described in the following paragraphs. The ground components are illustrated in Figure II-30

1. Network Control Center

The NCC will be located in the FACS corporate headquarters in Greenbelt, Maryland. The NCC will operate in a receive only mode and command the satellite system via telephone lines to the MGS in Logan, Utah. Technical operations and ephemeris determinations will be serviced in the NCC. Location and interrogation schedules of RTs and MTs will also be maintained in the NCC.

Figure II-30 FACS Ground Components

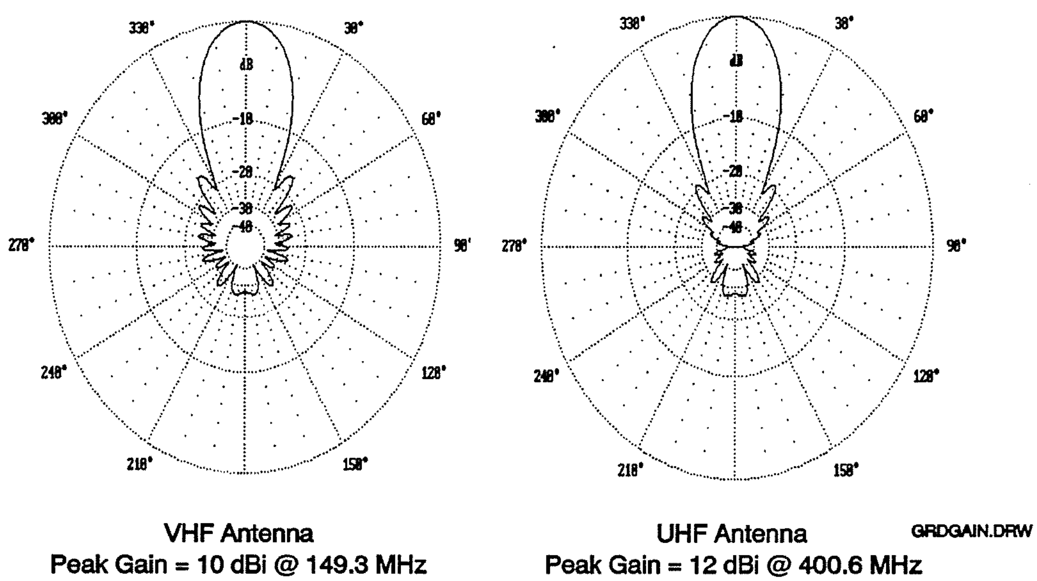


2. Master Ground Station

Ground control of the satellite will be performed at the MGS located in Logan, Utah. This is the primary facility to perform the tracking, telemetry, and control functions for the satellites. Separate channels on the satellite allow communications between the ground station and the satellite while the satellite is gathering data. Information such as polling lists for the RTs and any messages for MTs are uploaded to the satellite. Command and control functions such as telemetry request, system software patches and tests, and spacecraft subsystem monitoring are also conducted. Attitude control sequences are programmed at the MGS to adjust the attitude by commanding-on the magnetic torque coils of the satellite at specified times to remove libratory oscillations in the satellite. GPS data are downloaded as well as housekeeping data so that the satellite position can be updated for tracking programs and monitoring of satellite health. Multiple satellites will be generally in view, and TDMA sequences will be set up to have the satellites sequence in talking to the ground station on the UHF link. The MGS consists of a set of transceivers, computers and antenna clusters. The antenna cluster consists of 135-150 MHz band antenna and a 385-415 MHz band antenna which are mounted on a common azimuth/elevation rotator located on top of the Ground Station building. The MGS antenna gain pattern is shown in Figure II-31. A weather protection dome may be used to protect against inclement conditions. The antenna cluster can be contained in a ten foot diameter circle. Three or more ground station antenna clusters with UHF and VHF capabilities will be used for the satellites. A second ground station will be located on the east coast of the US. These ground stations will be online and available for use well within the 12 months after awarding of license as requested by the FCC. The

Logan, Utah ground station is currently being constructed under an experimental license recently awarded and should be in use by January 1995. Construction of the east coast ground station will begin after award of the FCC license. The Logan, Utah ground station has already developed the required satellite control and networking ground station software. The software is currently under test for support of FAISAT-1, which is being launched in December 1994 under an experimental license granted by the FCC.

Figure II-31 MGS Antenna Patterns



3. Secondary Ground Station

A SGS will be implemented on the east coast of the United States at such time as it becomes required to off-load the station in Logan. The SGS will be implemented in the same manner as the MGS and will serve as a support facility for the MGS while the satellite footprints are shared. The SGS will serve as a primary facility when the MGS exits the footprint and the secondary ground station remains in the footprint because of the 3,000 km separation of the stations.

4. Remote Terminals

The RT will be used to collect data for users from a wide variety of sources around the globe. These sources include industrial monitoring, environmental monitoring, utility monitoring, cargo and truck tracking, rail and ship tracking, and numerous other types of business sources.

The RT will be packaged to meet the requirements of these applications. The package will consist of a receiver in the 137-138 MHz band, a transmitter in the 148-150 MHz band, a linearly polarized antenna, a power supply, a controlling chip, and a sensor interface. Figure II-32 shows the RT block diagram and contains the technical parameters for a typical RT unit. Figure II-33 shows the antenna gain pattern for the linearly polarized antenna. User interface is provided by an RS-232 port which allows flexibility in monitoring data from many different packages. Each RT receiver is set to one of nine VHF beacon channels available for broadcast from the satellites.

Figure II-32 RT Block Diagram

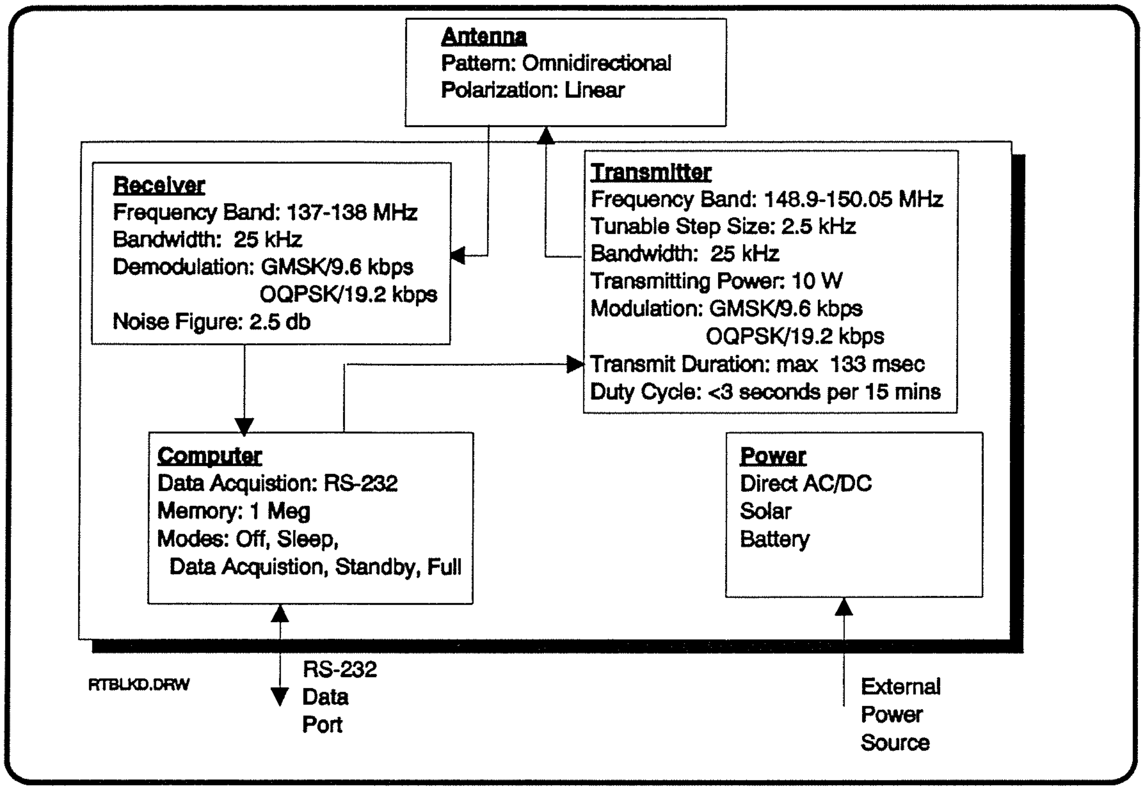
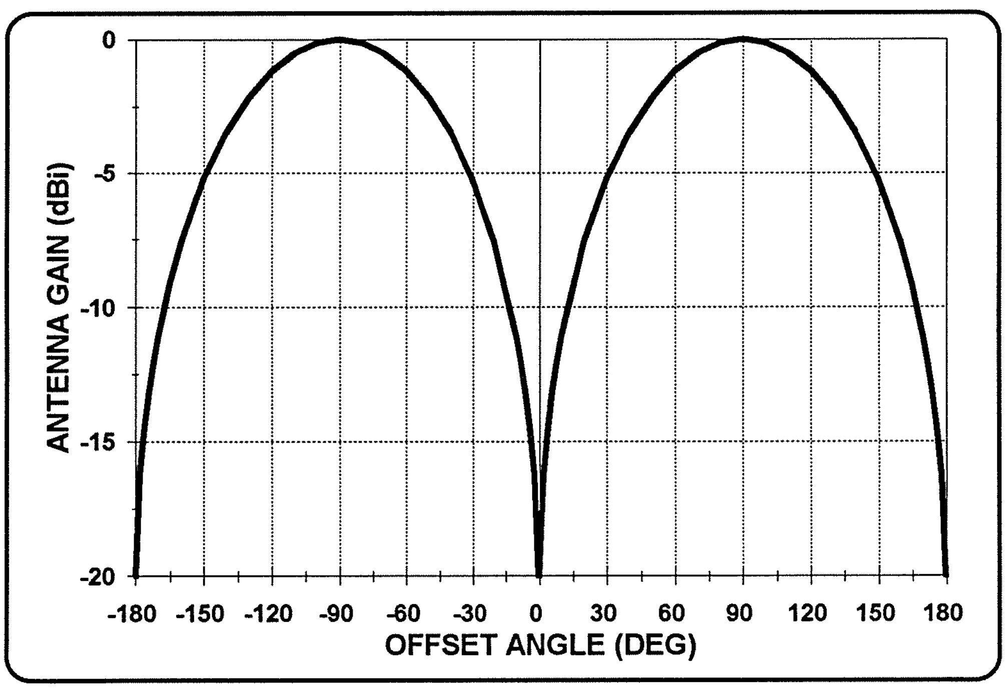


Figure II-33 RT/MT Antenna Gain Pattern



The NCC will maintain an accurate database of information on the RT ID codes, receiver assigned frequencies, and the locations of the RT installations, including latitude, longitude, altitude, and any elevation obstructions. The RT transmitter is tunable over the frequency band of 148.9 - 150.05 MHz in 2.5 MHz step size and is controlled by the FACS STAR System. The transmitter can be modulated in either the standard 9.6 kbps GMSK or within higher speed 19.2 kbps OQPSK. For the early operations, the transmitter will be modulated in GMSK at 9.6 kbps. The message length for the RT will be 128 bytes total. The 128 byte packet consists of 100 bytes of data and 28 bytes of overhead.

a. RT Polling Strategy

The polling strategy for recovery of RT data has been devised to access over two million terminals during a period of twenty four hours over the United States using the twenty six satellite constellation. Each satellite will be tracked and its ephemeris maintained by the NCC.

In order to collect data from the RTs, a polling scheme will be used to request each individual RT to transmit to the satellite. The polling strategy is initiated utilizing STARS and scanning the frequency spectrum available to select up to ten clear channels for usage by the RTs. This scanning activity requires about one second. The RT receives the beacon signal with its Identifying Code located in the queue and the frequency on which to broadcast. The RT transmission time is set by its queue position with each position delaying the transmission by 143 milliseconds. The set up of the queues is broadcast in series and the return signals are

III. INTERFERENCE AND FREQUENCY SHARING ANALYSIS

III. INTERFERENCE AND FREQUENCY SHARING ANALYSIS

A. Frequency Plan

Frequency bands below 1 GHz were allocated for the primary use of NVNG licensees as an outcome of WARC '92, and are shown in Figure III-1.

Figure III-1 NVNG Primary Frequency Allocation

Space - Earth (Downlink Band)	Bandwidth
137.0 - 137.025 MHz	25 KHz
137.175 - 137.825 MHz	650 KHz
400.15 - 401.0 MHz	850 KHz
Total	1.525 MHz

Earth - Space (Uplink Band)	Bandwidth
148 - 150.05 MHz*	2050 KHz
399.9 - 400.05 MHz**	150 KHz
Total	2.20 MHz

* 149.9 - 150.05 MHz will become primary after 1/1/97
**Primary after 1/1/97

Prior to January 1, 1997, a total of 1.525 MHz is allocated for space to earth links and 1.9 MHz is allocated for earth to space links. On January 1, 1997 the earth to space primary allocation increases to 2.2 MHz. However, footnotes to the WARC '92 primary allocations afford special protection to the existing services operating under primary status in all spectral bands allocated to NVNG systems. These other services include Fixed, Mobile, Meteorological Satellite, Space Operation, Space Research and Meteorological Aids.

Early in the design of the FAISAT communications system, the issues of frequency sharing and non-interference with the other NVNG applicants were a primary concern. ORBCOMM, STARSYS, and VITA submitted a joint frequency sharing plan to the FCC on August 7, 1992. This joint plan allows the first round applicants to operate compatibly in the 137-138 MHz, 148-149.9 MHz, and 400.15-401 MHz bands and purposefully leaves open spectrum available for other NVNG systems. FACS has used that plan as the basis for its frequency selection process/non-interference analysis. Section II of this application describes how specific frequencies will be used by the various components of the proposed system.

The 399.9-400.05 MHz band currently is allocated to TRANSIT, the Navy Navigation Satellite System. Footnote US326 allocates this band, after January 1, 1997, on a primary basis to NVNG MSS for uplink operation. FACS will use this 150 KHz segment for high data rate ground station to satellite uplinks as needs require. This would be an alterative to the 148-150.5 MHz band, for which heavy usage can be anticipated as more NVNG MSS systems become operational.

The following sections address the issue of coexistence with other users of these spectral bands. An outcome of the WARC'92 proceedings concerning NVNG MSS below 1 GHz allocations was the inclusion of certain constraints to provide protection to the existing users. These inclusions resulted in footnotes to the allocations containing specific technical constraints to protect the fixed and mobile operators in these bands. In addition, protection (on a less specific basis) was extended to existing users in nearby bands. This includes the radio astronomy community and aeronautical mobile services.

B. Coexistence with Other Authorized Users of Spectrum

The existing and planned users of the various NVNG allocated frequency bands are presented in Figures II-13, II-14 and II-15. FACS has developed a frequency plan whereby it will be able to share these bands efficiently with these users. The detailed sharing arrangements are discussed below.

1. 137-138 MHz Downlink Band

Referring to Figure II-6 and Figure II-15, FACS has requested nine 25 KHz wide channels for downlink transmissions in this band. These channels overlap the 905 KHz wide band requested by STARSYS. FACS will operate cross-polarized with respect to the STARSYS spread spectrum signals. STARSYS has agreed to sharing this part of the band with the type of cross-polarized multiple access signals proposed by FACS. Four of the nine channels requested by FACS overlap band segments used by the Government's meteorological satellites ("METSATs"). The METSATs will move to the edges of the 137-138 MHz band by January 1, 2000. FACS will not use these channels until after that date.

Coordination with terrestrial users in the 137-138 MHz band is required if the power flux density ("pfd") produced by the NVNG satellite exceeds -125 $dBW/m^2/4$ KHz at the earth's surface (footnote 599a). For the 25 KHz channels and the isoflux satellite antenna gain pattern of FAISAT, the maximum pfd is -137.2 dBW/m^2/4 KHz. Thus, coordination with terrestrial services will not be required.

2. 400.15-401 MHz Downlink Band

Referring to Figure II-6 and Figure II-13, FACS has requested four 50 KHz channels for use on the GSD link. A given satellite in the constellation will operate on only one of these channels. Two of these channels overlap the bands used by the Air Force's Defense Meteorological Satellite Program ("DMSP"). One channel overlaps the band requested by STARSYS for its outbound downlink, and one channel overlaps the VITA downlink band. FACS will avoid interfering with these various users or proposed users by not assigning the overlapping channel to a FAISAT satellite whose footprint overlaps the other user's footprint.

Coordination with terrestrial users in the 400.1-401 MHz band is required if the pfd produced by the NVNG satellite exceeds -125 dBW/m^2/4 KHz at the earth's surface (footnote 599a). For the 50 KHz channels and the isoflux satellite antenna gain pattern of the FAISAT, the maximum pfd is -139.2 dBW/m^2/4 KHz. Thus, coordination with terrestrial services will not be required.

3. 148-149.9 MHz Uplink

Limitations in this band are governed by footnote 608a, which states that the NVNG service shall not constrain the development and use of fixed, mobile and space operation services in this band. Referring to Figure II-6 and Figure II-14, FACS has proposed using the 148.905-149.9 MHz uplink band, which will be expanded to 148.905-150.05 MHz, after January 1, 1997 . As stated in Section II above, interference with other users of this band will be avoided by use of the Scanning Telemetry Activity Receiver System ('STARS"). In operation, the STARS receiver on-board the satellite will scan this band in 2.5 KHz steps and identify unused channels. These unused channels will be assigned as uplink frequencies for the RTs and MTs. This is similar to ORBCOMM's dynamic channel assignment system, which operates in this same band segment. The FACS and ORBCOMM systems will be operating cross-polarized to each other. In the joint frequency sharing plan, ORBCOMM indicated that it can share this band with other users. In addition, both ORBCOMM and VITA have ground station uplinks in this band segment. The active channel avoidance nature of FACS's STARS system will not permit the assignment of these band segments when they are being utilized by other NVNG systems.

The 148-149.9 MHz band also contains a number of government and non-government fixed and mobile terrestrial users. FACS designed its uplink communications system so that it would not interfere with these users by adhering to Footnote US 323, as follows:

(a) The STARS scheme will not assign an uplink frequency that is actively being used by fixed or mobile stations;

(b) The modified Time Division Multiple Access ("TDMA") polling scheme will limit transmissions to no more than 1% of the time during any 15 minute period and will limit the uplink message size such that a single transmission will not exceed 450 ms.

(c) Software in the terminals will provide for a minimum interval of 15 seconds between consecutive transmissions on a single frequency.

4. 149.9-150.05 MHz Uplink Band

The TRANSIT service is the primary user in this band. However, this operation will cease prior to January 1, 1997. FACS does not propose to use this band until after that date. Thus, there is no possibility of interference with the TRANSIT system.

5. Transponding of Received Power in the 148-150.05 MHz Uplink Band

NVNG systems must demonstrate that no signal received by a satellite from a source outside of the system shall be retransmitted by the satellite (Section 25.142 (a) (3)). The FACS system does not use turn-around transponders on the FAISAT satellites. All signal paths through the satellite require that the received signal be demodulated on board, stored, retrieved and remodulated prior to being re-transmitted. The system requires a command to the satellite to re-transmit specific stored data. Therefore, it is impossible to retransmit signals from outside the FACS system.

6. Out of Band Interference

The radio astronomy community operates very sensitive terrestrial receivers in the 150.05-153 MHz band and the 406.1-410 MHz band. Footnote 599a requires that all practical steps be taken to protect the radio astronomy service from harmful interference from unwanted emissions. The FACS on-board communications system contains three transmitters in the 137-138 MHz band and one transmitter in the 400.1-401 MHz band. The modulation schemes used in these transmitters exhibit high out of band spectrum roll off. In addition, the oscillators have extremely low phase noise. Both of these factors limit out of band emissions and result in essentially no emissions at the surface of the earth in the radio astronomy bands. The satellite is designed to be very quiet in the 148-150.05 MHz uplink band and is, therefore quiet in the adjacent 150.05-153 MHz radio astronomy band.

The Primary allocation in the 136-137 MHz band is for Aeronautical Mobile users. This includes Air Traffic Control and enroute Aviation Communications. This community has expressed concern with NVNG MSS out of band transmissions below 137 MHz caused by Doppler Shift and onboard oscillator drift. The FACS downlink frequency plan has the lowest channel at approximately 330 KHz from the 137 MHz edge. The maximum Doppler shift from a satellite at an altitude of 1,000 km at 137 MHz is ± 3.15 KHz and the oscillator stability over the projected 7-year satellite life is ± 0.3 KHz. Thus, the effects of Doppler

Shift and oscillator drift are approximately ± 3.5 KHz and will not result in any spillover of the FACS downlink transmissions into the adjacent Aeronautical Mobile band.

IV. PLAN FOR IMPLEMENTATION

IV. PLAN FOR IMPLEMENTATION

The construction of the first two satellites (FAISAT-1A and 2)will commence immediately upon award of the license by the FCC (the construction permit). The construction schedule is targeted to take twelve months and will result in a launch of the first operational FACS satellite in 14 months after award of license. The construction of the remaining 24 satellites will be phased at one satellite delivery every two months for a period of four years. The satellites will be launched either individually or in clusters depending on the launch services available in that time frame. The full 26 satellite constellation will be deployed and operational in orbit within 64 months of the FCC license award, well within the FCC target range of 72 months.

FAISAT-1A and 2 will be launched into 1000 km inclined circular orbits as piggy back payloads on COSMOS Launch Vehicles, the same as the FAISAT-1 spacecraft being launched in December 1994 under FCC experimental license KE2XGW. The injection of the remaining 24 satellites into 66° orbit planes at 1000 km can be accomplished by several launch service providers including Pegasus, LLV-1, Long March, and COSMOS. The launch service provider will be selected based on economic, performance, and schedule considerations.

The construction and launch schedule is shown in Figure IV-1. This schedule assumes an award of FCC commercial license in January 1995. A concomitant shift to the right in time for all events will take place based on the actual date of award of the FCC commercial license. However, some left shift compression in the fourth year and fifth year events may become practical and result in earlier launch opportunities for the last few satellites. The deployment of the full constellation of satellites into orbit is depicted in Figure IV-2.

The launch vehicle system will provide preliminary orbital parameters (orbital elements) upon injection of each satellite into orbit. The satellite will then be interrogated during the early passes to obtain data on its orbit position and time acquired for the GPS satellite constellation. A refined orbit will be generated from these data by the NCC for use in GS acquisition and MT user knowledge. This orbit will be used for MGS acquisition and by MT users for knowledge of when satellite footprints are in the MT users footprint.

Figure IV-1 FACS Constellation Construction and Launch Schedule

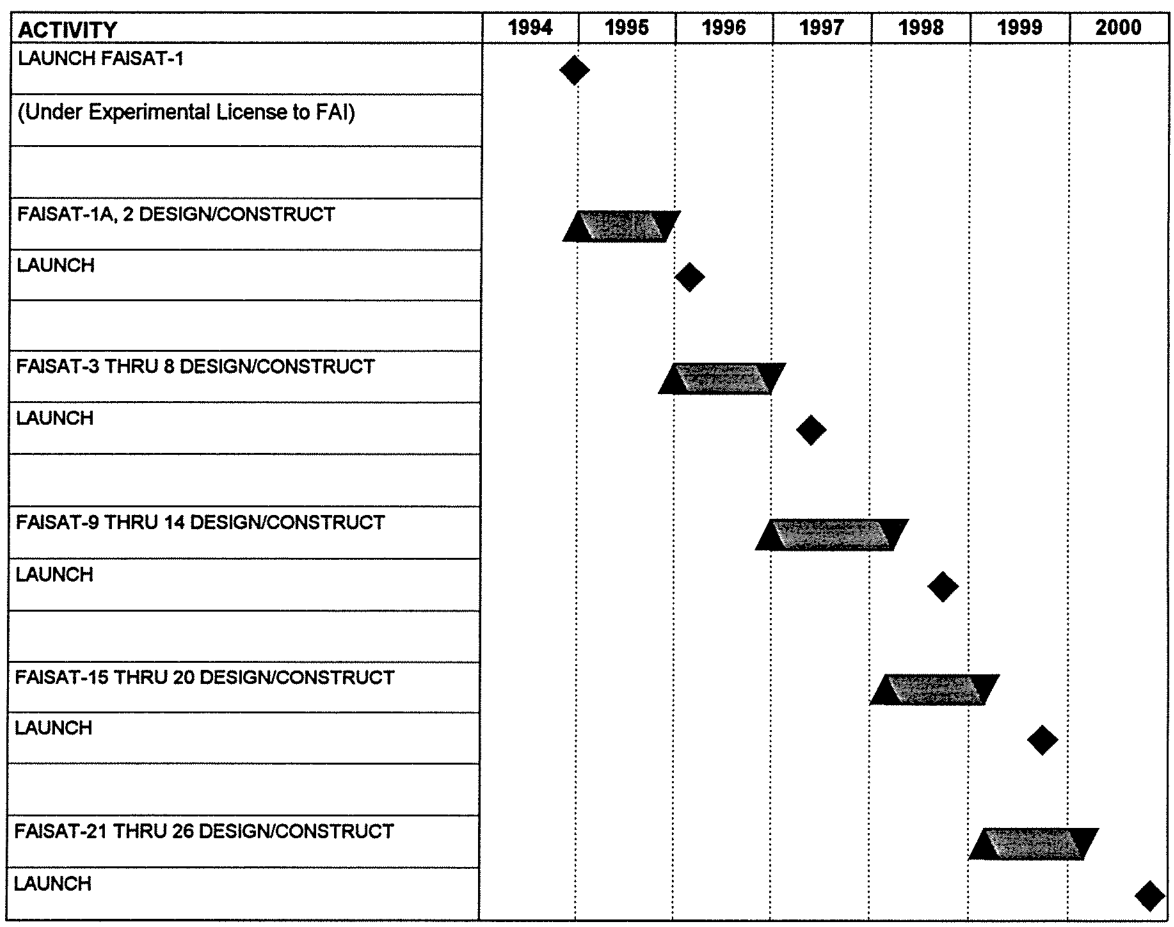
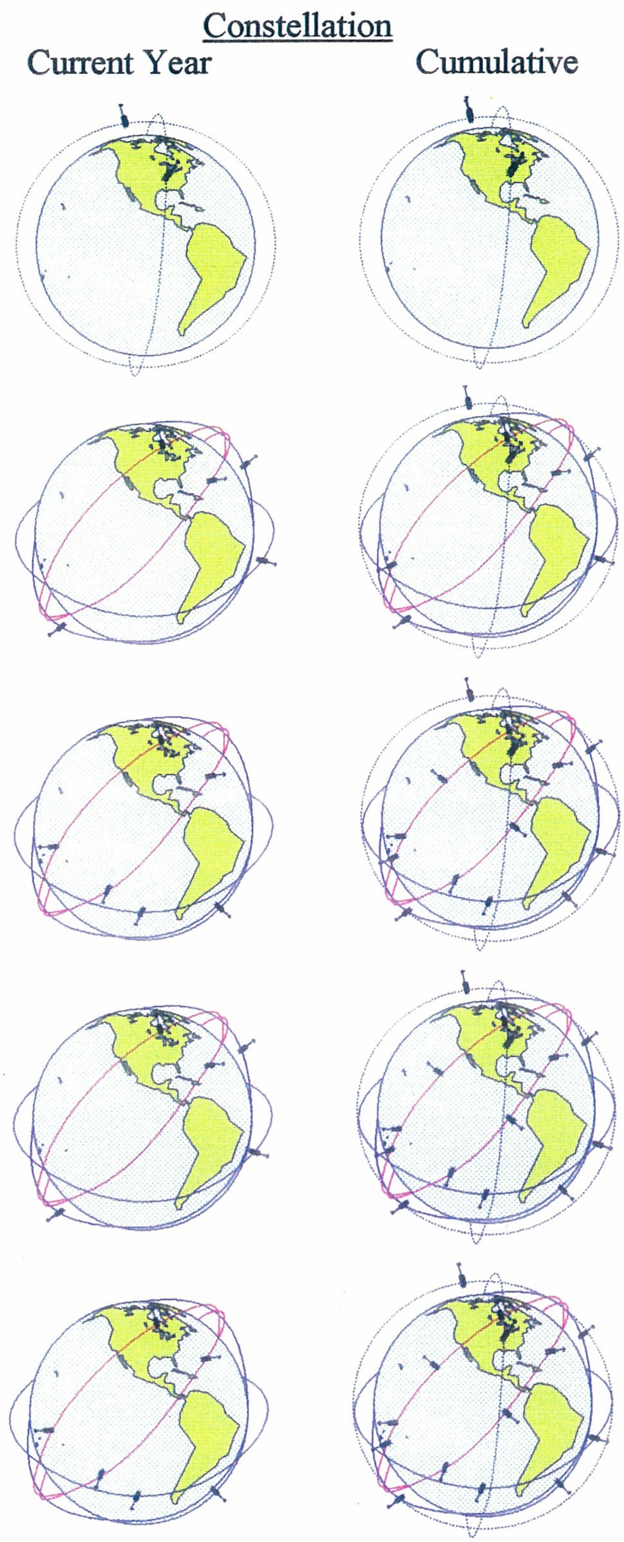


Figure IV-2 FACS Spacecraft Deployment into Orbit

Year	No. of Satellites
1996 (1 in 0 deg, 1 in 90 deg)	2
1997 (2 in 0 deg, 2 in 45 deg, 1 in 90 deg, 1 in 135 deg)	6
1998 (1 in 0 deg, 1 in 45 deg, 2 in 90 deg, 2 in 135 deg)	6
1999 (2 in 0 deg, 2 in 45 deg, 1 in 90 deg, 1 in 135 deg)	6
2000 (1 in 0 deg, 1 in 45 deg, 2 in 90 deg, 2 in 135 deg)	6



orbit5.drw

V. DESCRIPTION OF SERVICES, MARKETS AND PREDICTED DEMAND

V. DESCRIPTION OF SERVICES, MARKETS AND PREDICTED DEMAND

FACS intends to address a niche group of satellite communications users with data acquisition and messaging traffic that has a clearly defined telecommunications requirement. Specifically, FACS is in business of selling low cost commercial communications services to customers with message traffic requirements that are two way, short digital and alphanumeric messages. Within this niche market, we will target customers with data transmissions from sensors that are frequently inaccessible or too numerous for efficient manual recording and reporting. Initially, FACS will focus on a selected set of applications within the U.S. marketplace. By year 2000, FACS will expand operations internationally and will have completed the FACS satellite constellation. FACS will expand the user applications services to address the full spectrum of short message traffic that our subscribers will demand.

Our market analysis has revealed several million potential subscribers domestically and internationally with communications requirements that can be met by FACS capabilities. These subscribers fall within four distinct business areas: (A) Data Acquisition Services; (B) Supervisory Control and Data Acquisition ("SCADA"); (C) Message Services; and (D) Tracking Service.

Near Term marketing covers the four-year period from January 1995 through December 1998. During this period, we will pursue all four business areas set forth above. We consider that these that offer excellent opportunities to establish FACS as a major player broadcast in parallel producing a modified TDMA/FDMA strategy for data collection. Five hundred RT's transmitting on 10 channels (50 RTs/channel) can be received by the satellite each eight second period. The polling strategy and sequence is depicted in Figures II-34 and II-35.

5. Message Terminals

MTs are considered "active" transceivers. These units consist of a receiver at 137-138 MHz range, a transmitter at 148-150 MHz range, a linearly polarized antenna, power supply, and a user interface alphanumeric keyboard for data generation. The antenna gain pattern is the same as the RT gain pattern, as was shown in Figure II-33. The block diagram and technical specifications for the MT is shown in Figure II-36. The MT uses similar hardware components as the RT, thereby reducing costs and providing commonality.

a. Messaging Terminal Strategy

To initiate a MT operation, the user presses an enable button on the handset to inquire if there is a satellite channel present and available. The uplink channel for this polling will be dedicated on the satellite. If a satellite is available, the satellite responds to the MT and provides a frequency assignment on which to transmit. The MT then transmits its message on the appropriate frequency. After the message is received by the satellite, an acknowledgment is sent to the MT that the message was received. This ends the MT operation for sending a message.

Message traffic to the MT user is transmitted automatically when the satellite comes into the MT user footprint. The protocol for message receipt will be a "Message Received - MT-ID" response via the dedicated uplink.

A variation of the MT will be used as a distress beacon. A message would notify that the user is in distress to the MGS via the nearest satellite. The variation would have a GPS receiver to provide data on the location of the person in distress for broadcast to the satellite and on to the MGS.

Figure II-34 RT Polling Strategy

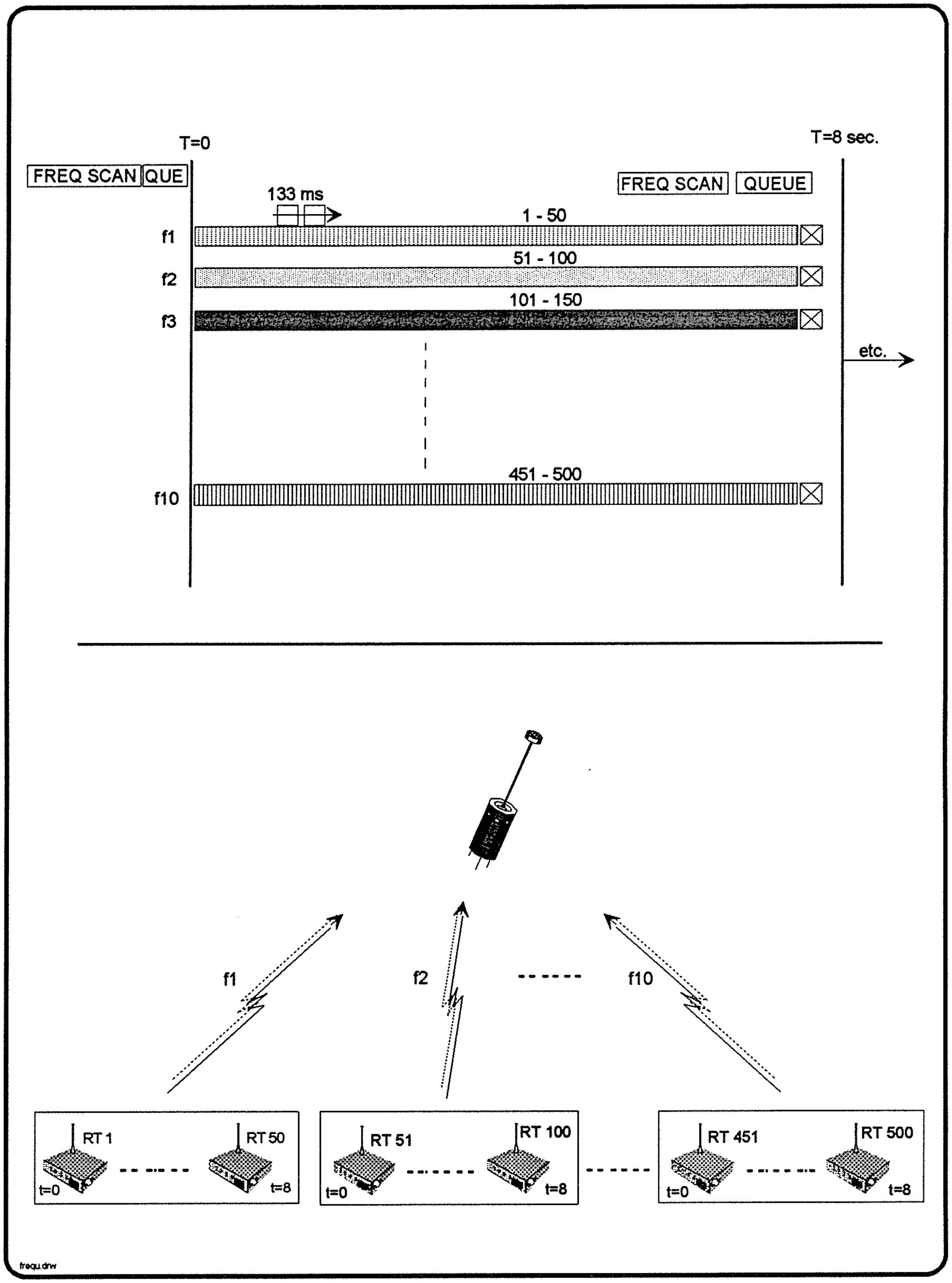


Figure II-35 RT Polling Sequence

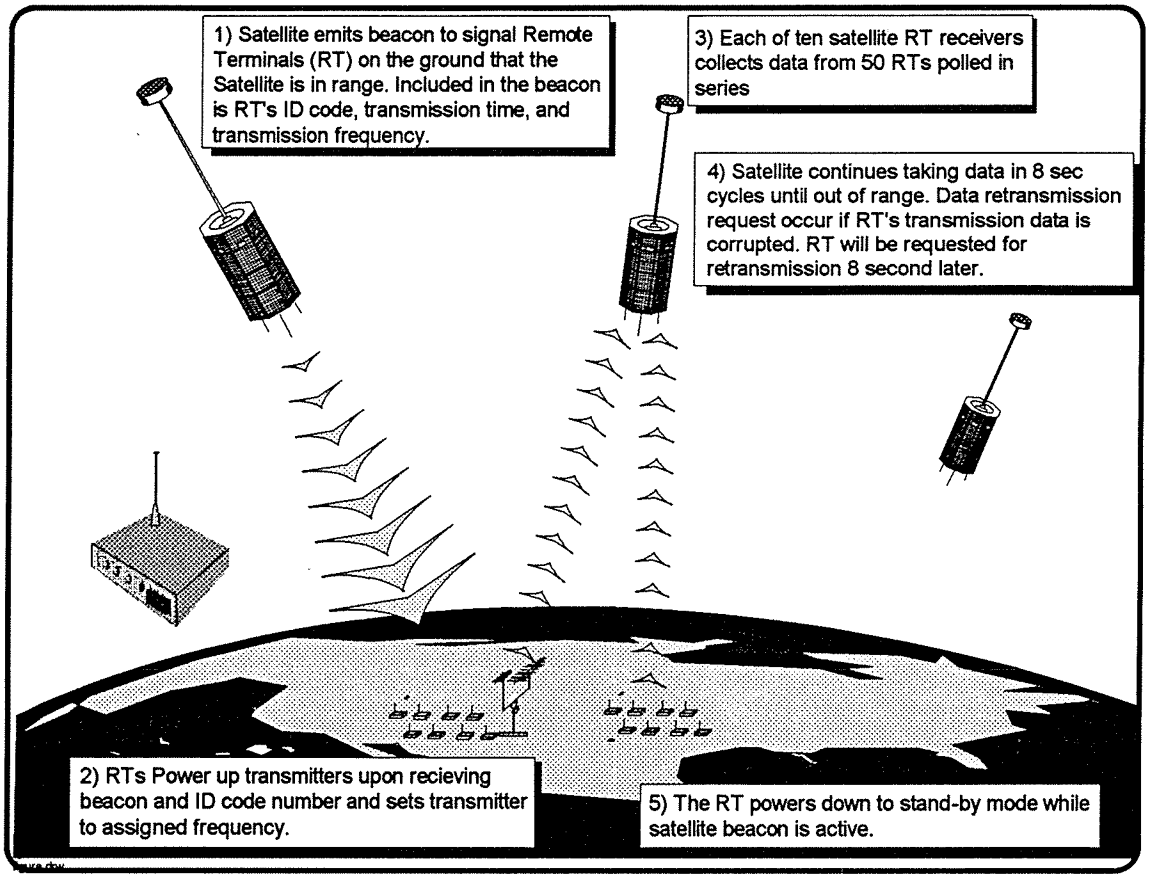
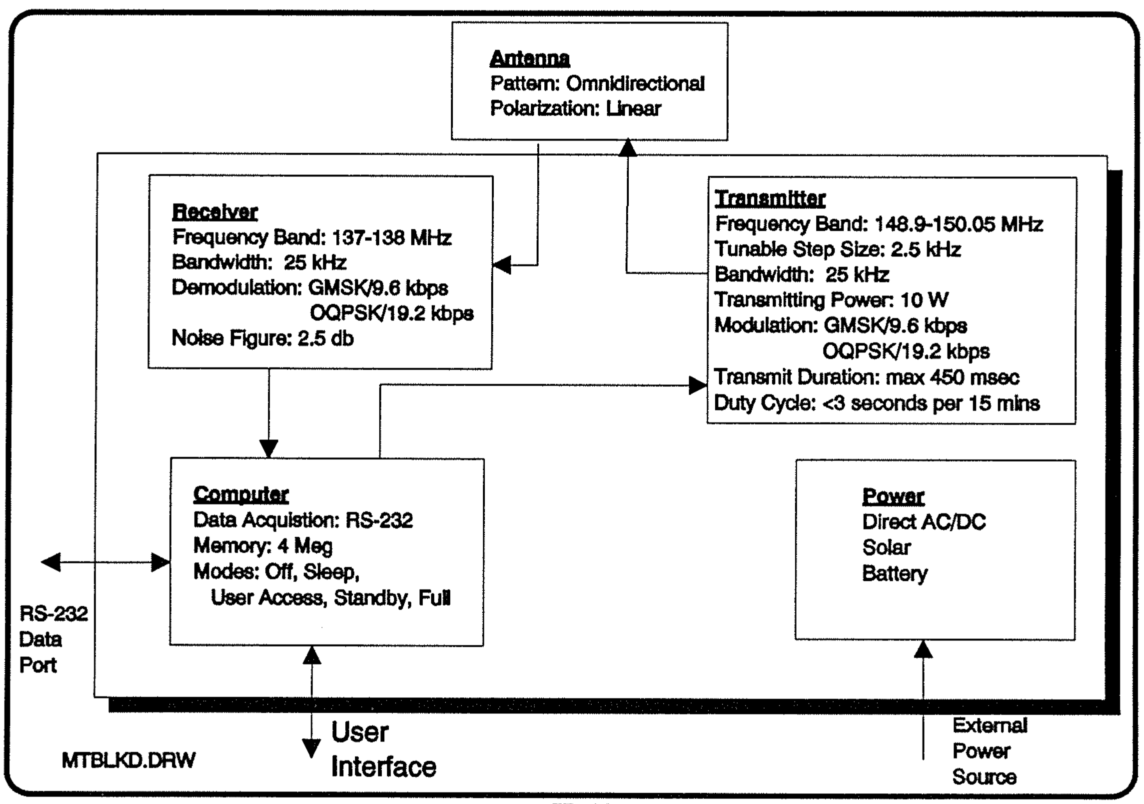


Figure II-36 MT Block Diagram



in satellite services for the commercial communications market.

A. Data Acquisition Services Offer Two Major Opportunities

1. In General

FACS will work closely with its corporate parent, FAI, to develop and refine marketing strategies for its commercial Little LEO NVNG communications services. With the launch of the FAISAT-1 experimental satellite in December 1994, FAI will conduct limited marketing studies of demand for Little LEO NVNG communications services, and these studies will provide empirical guidelines for the refinement of the FACS marketing plan. Data Acquisition Services will be the initial focus of FAI's marketing studies. FACS has evaluated a number of potential applications in this field applications to determine the likely demand for the type of data acquisition services FACS can provide. FACS has determined that the following three business applications hold the most promise at present: (1) Industrial and Utilities Monitoring; and (2) Oil and Gas Well Monitoring; and (3) Environmental Monitoring.

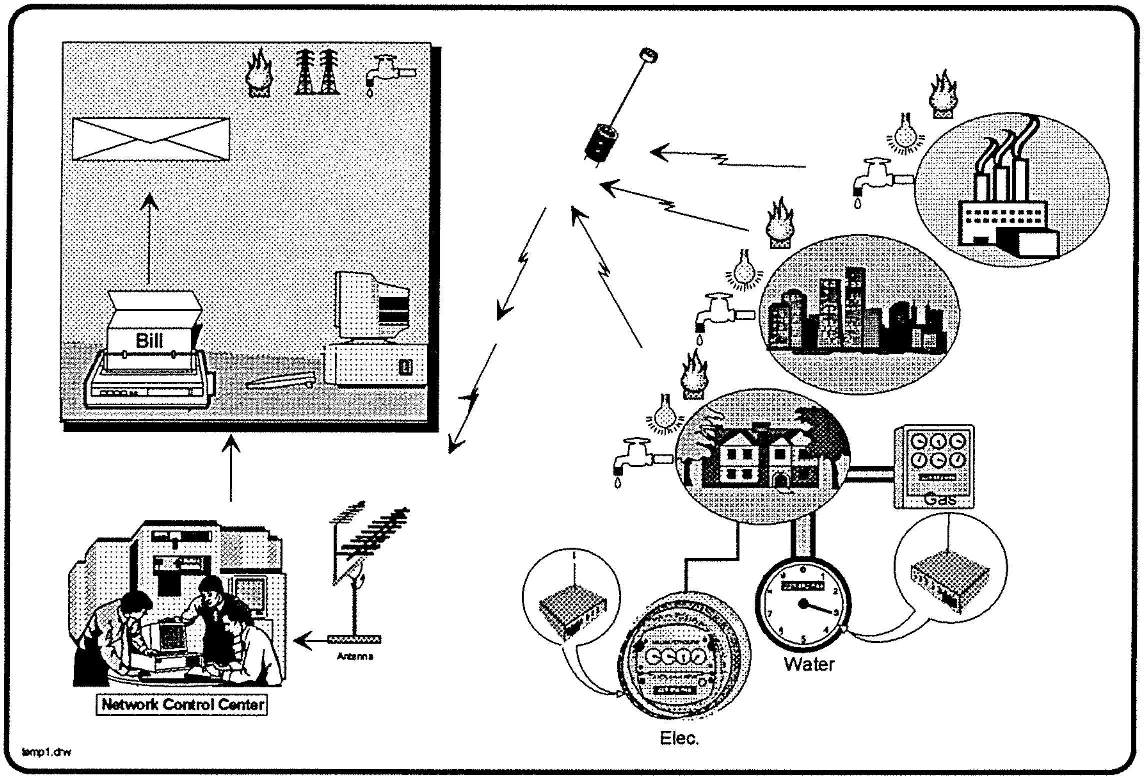
In both of these areas subscribers require low cost, two-way communications with sites that are often remote and unattended. Characteristically, there are no real time critical data, which makes early market entry easier because the full FAISAT constellation will not be available to provide near real time data handling. RTs must be low cost, durable, autonomously operated, require minimal maintenance, and have a long operational life. FACS' proposed system is well-suited to meet these requirements.

2. Industrial and Utilities Monitoring Services Opportunities

Key Industrial & Utilities Subscriber Benefits	
o	More Economical Status Monitoring
o	Easy Remote Area Servicing
o	Reduced Maintenance Costs
o	Early Problem Alert

There are major elements in this potential Little LEO application that are highly labor intensive. Approximately 112 million electric, 54 million gas and 74 million water meters are operated by over 5000 utility companies in the United States. Meters are read by technicians who then report readings for compilation, with usage estimates projected for sites not visited during the billing period. Using services provided by FACS, a utility will have the capability to receive utility meter readings for all meters on a periodic basis without the need to expend countless man-hours visiting sites. Accurate and timely information concerning utility usage can lead to more precise billing, elimination of erroneous estimates, and the compilation of detailed and valid user profiles and usage trends that can enable a utility to plan its operations more successfully. In this case, we contemplate that a passive RT would be specifically designed to interface with the relevant type of meter, and that scheduling software resident in the computers at the Master Ground Station would cause the satellites to query a given RT on a regular basis, store the information received and download it to the Ground Station where it could be compiled, organized and provided to the utility. This service, although requiring some modest start-up costs for installation of RTs, would unquestionably result in significant long-term savings to utility companies, and more efficient overall operations. Figure V-1 below illustrates use of the FACS system in industrial and utility monitoring.

Figure V-1: Use of the FACS System In Industrial and Utility Monitoring

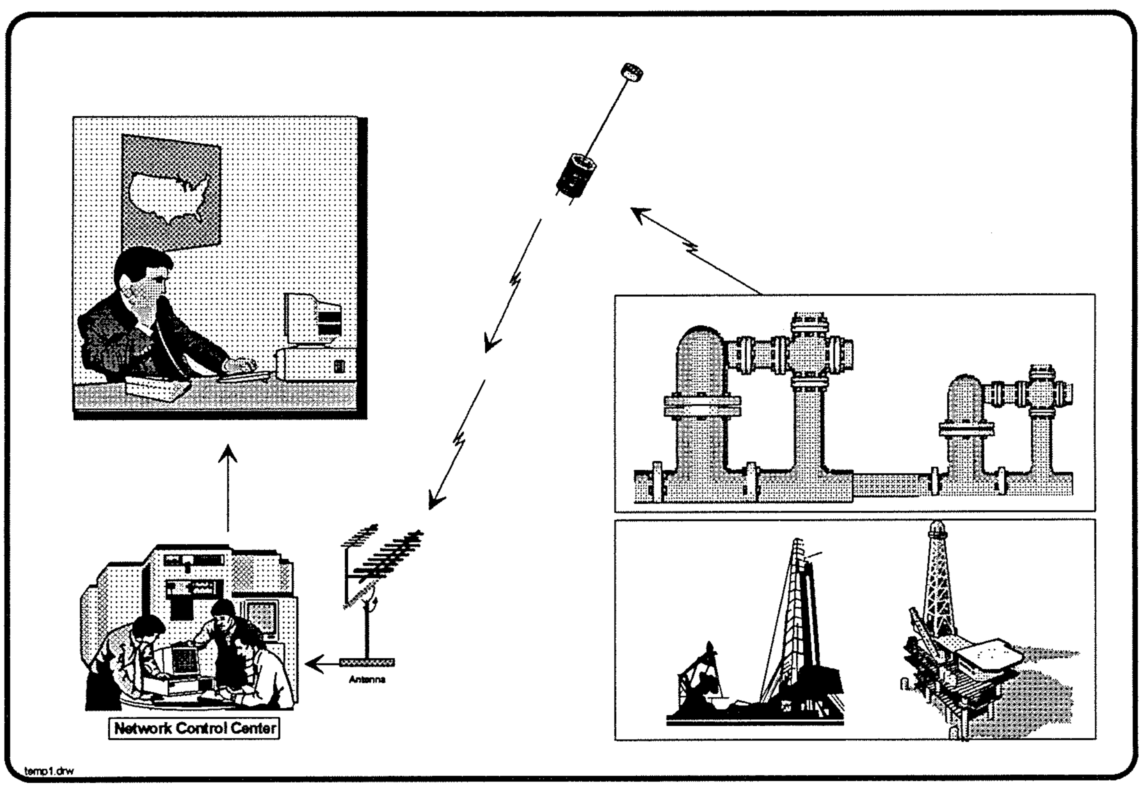


3. Oil and Gas Well Monitoring

Key Oil & Gas Well Monitoring Subscriber Benefits	
o	More Economical Status Monitoring
o	Easy Remote Area Servicing
o	Better Handling of Widely-Dispersed Assets
o	Early Problem Alert

Our inquiries have revealed that there are over 600,000 artificial lift oil wells in the U.S. that experience an annual failure rate greater than 50%. Pumping stations, wells, storage facilities, power generating equipment, energy load management, and control equipment are often distributed over large geographical areas that include remote locations. Today these petroleum facilities are monitored by technicians who are forced to report their findings by telephone, microwave radio, and in some instances, VSAT systems. FACS will support monitoring and control of remote stations within these established communications networks more effectively and at less cost. Figure V-2 illustrates this potential use.

Figure V-2: Use of the FACS System In Oil & Gas Well Management



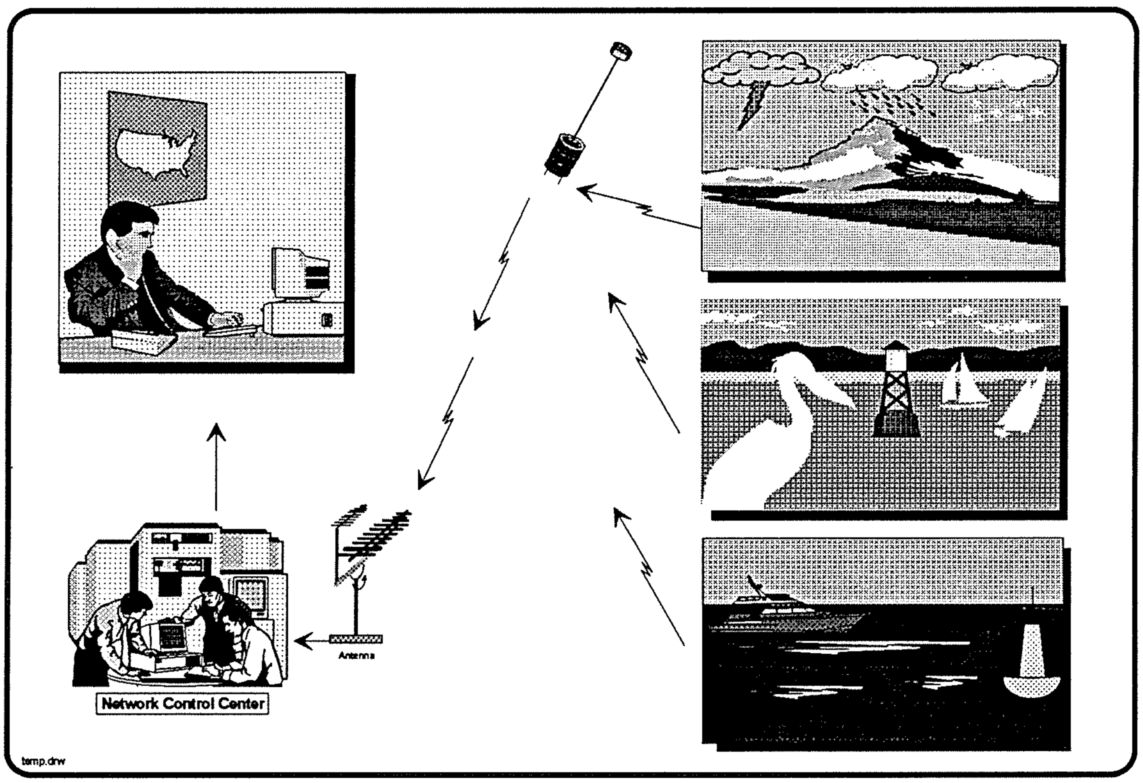
4. Environmental Monitoring

Key Environmental Subscriber Benefits
o Low Cost Permits Wide Deployment
o Low Power Consumption for Low Maintenance
o Small Size & Light Weight Ease Equipment Installation

There are over 100,000 stations operated by the U.S. Government for collecting data from numerous, often remote sensors, for the purpose of assessing soil, water, and climate conditions, ocean surveillance, weather forecasting, and geological surveyance. In support of environmental regulations recently enacted into law, the EPA specified the need for millions of additional remote sensors. Data from these sensor stations are characteristically collected irregularly over extended periods. Data for most of these applications can be collected by FAISAT, stored on board the satellite, then transmitted to FACS Ground Stations for processing and message delivery during off-peak hours to minimize costs to the subscriber.

Today, environmental data are collected by visual inspection of sensors and reported by voice over radio or phone. In some cases, Argos-equipped satellites are used for data collection and transmission to ground stations. Argos, however, is not suitable for wide use because it is not user friendly, and its higher equipment and operating costs are no longer competitive with current technology. FACS' low cost services will make it practical to fully-automate the environmental testing and data collection process. Principal customers will be: the Navy, the Army, U.S. Geological Survey, National Oceanographic and Atmospheric Administration, the EPA, Department of Agriculture, Department of the Interior, and state and local governments. Figure V-3, below, illustrates the use of the FACS system in environmental testing and monitoring.

Figure V-3: **<u>Use of the FACS System In Environmental Testing and Monitoring</u>**

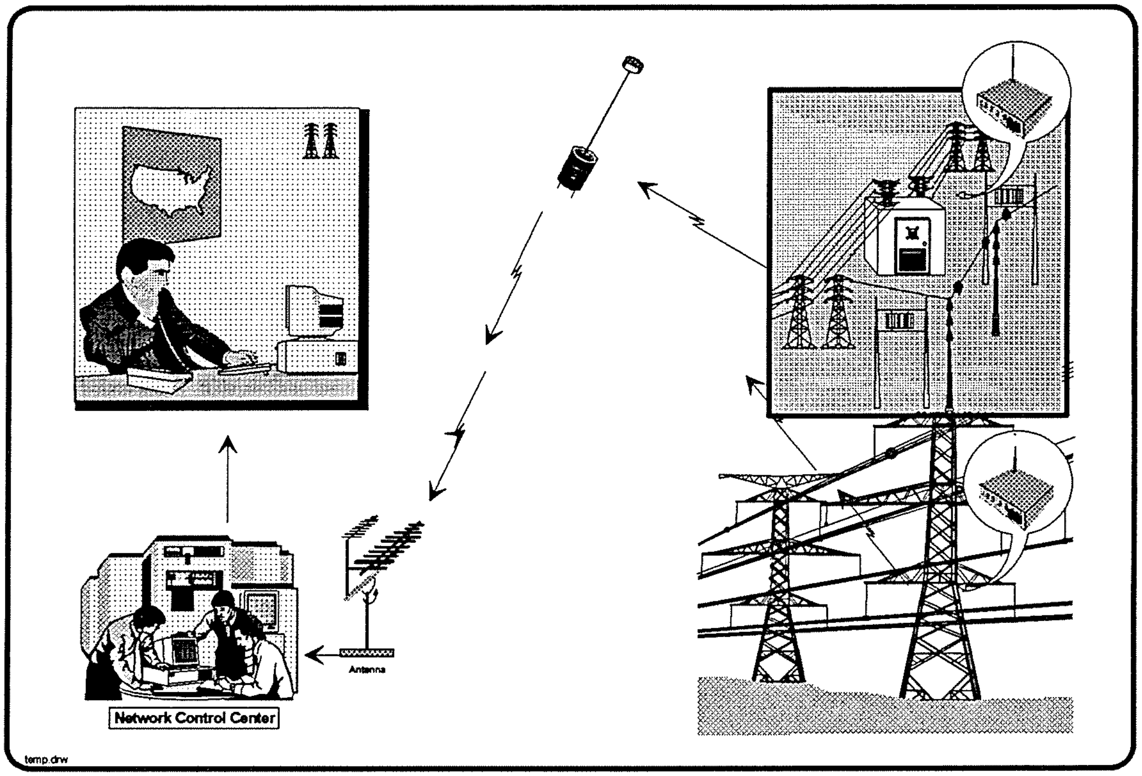


B. Supervisory Control and Data Acquisition ("SCADA") Can Reduce Operating Costs With FACS

Key SCADA Benefits
o Up to 100 Byte Messages with Low Error Rate
o Cost Effective Position Fixing (Accuracy Scaled to Requirements)
o High System Availability
o Long Battery Life
o Remote System Checking
o Stand-Alone Operation
o Low Power Requirements
o Minimal Maintenance

The SCADA market addresses fixed location communications presently provided to the petroleum industry by VSAT terminals using geostationary satellites, ground transmission over public switched networks, and radio/microwave systems. SCADA is most often associated with monitoring and controlling liquid petroleum pipelines and monitoring electric transmission networks that require instantaneous response and high reliability. FACS opportunities lie in providing these services with improved technology that is cheaper and offers better performance. FACS is well suited to SCADA operations because FAISATs are Low Earth Orbiting platforms, and inexpensive compared to geostationary satellites. FACS offers a more economical way to achieve the same results the petroleum and utility industry get today with technology that is not well matched to SCADA operational requirements. Figure V-4 illustrates use of the FACS system in SCADA applications.

Figure V-4: Use of the FACS System In SCADA Applications



C. Message Services Open a New Dimension To The Business And Personal Services Communications Industry

Message Service Subscriber Benefits
o Improved Data Availability
o Low Cost, Reliable, Durable, Autonomous Data Collection & Processing
o Improved Asset Management and Maintenance Service Planning
o Remote Status Checking
o Easy User Equipment Installation

FACS can fill an important communications role that supplements systems currently in use. Our principal target market with potential for world wide application of FACS capabilities includes two domestic and international primary messaging business areas: (1) Personnel and Business Messaging and (2) Remote Messaging. By 2000, when the full FACS constellation is operational, we expect Messaging Services to be one of our most important subscription market demands. FAISAT capabilities and our Message Terminals are well matched to Messaging Services requirements.

1. Personal and Business Messaging For Priority Communications

This service will send and receive messages to and from Messaging Terminals immediately for individuals who need this type of immediate communications with all others in their communications network. Cellular phones and paging services partially meet this requirement, but fall short in terms of geographic coverage. In addition, cellular phones and air time are expensive, and pagers can't provide immediate two way communications. As a measure of the size of this potential market, there are today 8.7 million pagers and 7 million cellular phones in operation. Communications industry studies predict that pagers and cellular phones will increase to a combined 35 million by 1996. Although the personal and business messaging services provided by Messaging Terminals will not include voice messages, and therefore do not compete directly with cellular phones, nevertheless it is anticipated that a new style of communications, employing brief, low-cost alphanumeric messages that can be conveyed virtually instantaneously to recipients within the "footprint" of the satellite relaying the message, and shortly to a person located anywhere in the world, will find ready acceptance in the increasingly demanding communications market of the near-term future.

2. Remote Messaging Will Be An Important Service By 2000

Millions of people around the globe are on the move every moment of every day. Most of these trips are completed successfully; however, a significant number are not. Cars break down, accidents happen, boats are stranded offshore, and people and sportsmen lose their way or need emergency assistance in remote areas. In many cases, help can be summoned by CB radio, telephone, cellular phone, or some other emergency communications device. For those situations where there is no way to communicate with the outside world, FACS offers a totally reliable means to communicate distress situations with precise location information. Technology is available now to produce small, lightweight, inexpensive FACS transmitters that can offer inexpensive emergency services for travellers. We expect low cost Little LEO communications terminals such as the ones proposed by FACS to be a standard feature in all vehicles, just as airbags and seatbelts are in automobiles today.

The international market demands are anticipated to develop at a significantly greater rate than the U.S. market. The vast, remote areas of the world are ready and waiting for low-cost communications services. FACS satellite system is designed to provide both low-cost hardware and services to meet these requirements. During the period from 1998 through 2003 the projected annual growth rate for remote message services is estimated to at least 40 percent. The developing countries of the world require LEO satellite communication, the most cost effective resource available to meet their immediate needs.

3. Emergency Communications Services

Emergency Services Requirements
o Reliable, Real-Time, Two-Way Communications
o Accurate Position Fixing
o Low Cost, Light Weight, Small Size, Lower Power
o Short But Accurate Messages
o Event Triggered
o Rugged
o Poll for Status
o Simultaneous Communication and Location

In addition to the travellers' remote service, FACS can also provide emergency medical communications for those in need. In the U.S. alone, there are 12 million people with serious health problems that are candidates for emergency communications services. These communications services, however, must be easily portable, very low cost, dependable, and able to furnish confirmation of message receipt. FACS is ideally suited for applications such as this. When both the originator and the recipient of the emergency message are simultaneously within the viewing satellite's footprint, as is expected to be the case in most instances (it does not make sense to summon help from across the world in most cases; the nearest possible emergency response resource is normally the best) the communication of the message is virtually instantaneous. This would be the case even before the full constellation of FAISAT satellites is deployed.

(3) The percentage of total voting stock held by each stockholder is as follows:

Stockholder Name	Percentage of Voting Stock Owned
Nader Modanlo	50%
Michael H. Ahan	50%

(4) The names and addresses of the President and Directors of FAI are:

Name	Address	Position/Title
Nader Modanlo	5 Crestview Court Potomac, MD 20854	President and Director
Michael H. Ahan	17208 Chiswell Road Poolesville, MD 20837	Executive Vice President and Director

D. Tracking Services Offers Major Long Range Potential

Tracking Service Subscriber Benefits
o Improved Source of Vital Control Information
o Cost Savings Over Current Systems
o Improved Asset Management
o Improved Tracking Performance
o Deterrent to Theft
o Reduced Insurance Premiums
o Rapid Recover of Stolen Property

FACS is still analyzing the Tracking Services business area; however, we have identified the principal applications. The three most important applications for FACS in the Tracking Services business area: (1) Transportation Asset Management; (2) Shipping Container Tracking; and (3) Tracking of High Items In International Shipping.

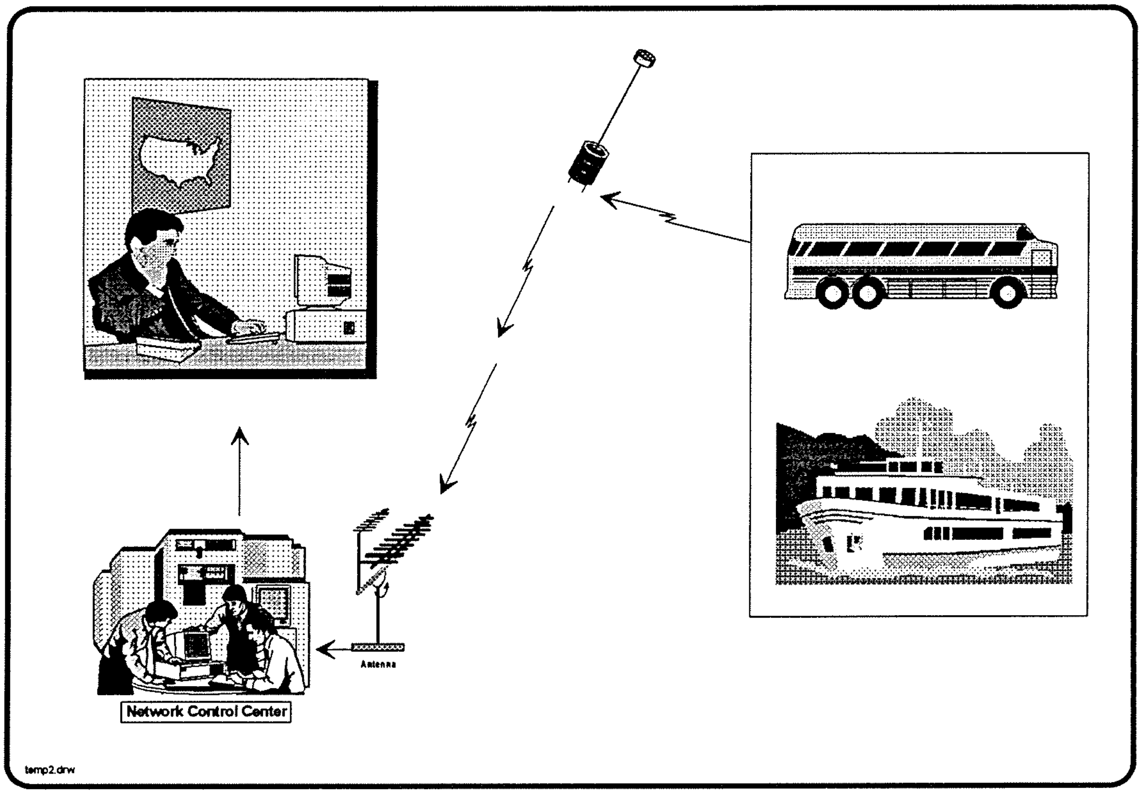
1. Transportation Asset Management Improves Control Of Valuable Mobile Equipment

There are approximately 1.5 million tractor trailer long haul trucks and an estimated additional 3.0 million medium over the road commercial vehicles in the U.S. The worldwide commercial truck traffic is estimated at 3 times the U.S. volume. In this important industry, there is a growing trend among many trucking companies to install messaging and position locating systems in their vehicles and dispatch centers to provide accurate information for more effectively managing their vehicles. These services are currently offered by

QUALCOMM, AMSC and GEOSTAR, via geostationary satellites. Truck mounted remote terminals and service charges for two way messaging and position-fixing from these geostationary satellite services are expensive, due to the greatly higher costs associated with construction and placement of the satellites in high earth orbit, and the more sophisticated gear needed to access them. This tends to limit the use of messaging and location systems to larger trucking fleets, and to those with operations requiring frequent communications or modifications to dispatching instructions. FACS will reduce equipment prices to well under current prices, with a corresponding reduction in communications service charges to subscribers. This price reduction will open the market significantly to smaller, less well financed organizations with similar operating requirements, as well as the international market. FACS offers an economical alternative to serve those customers that find current satellite based services unaffordable and exceeding their communications and position fixing requirements.

FACS offers another major advantage over vehicle location systems in use today. FACS will make reliable communications possible with vehicles in cities because our low orbit satellite presents a constantly changing "look angle" with respect to the vehicle. Variable look angle prevents communications from being permanently blocked by tall buildings. This is a major weakness in high orbit geostationary satellites that present a constant look angle that is susceptible to communications blockage by large structures. Use of the FACS System in Transportation Asset Management is illustrated in Figure V-5.

Figure V-5: Use of the FACS System In Transportation Asset Management

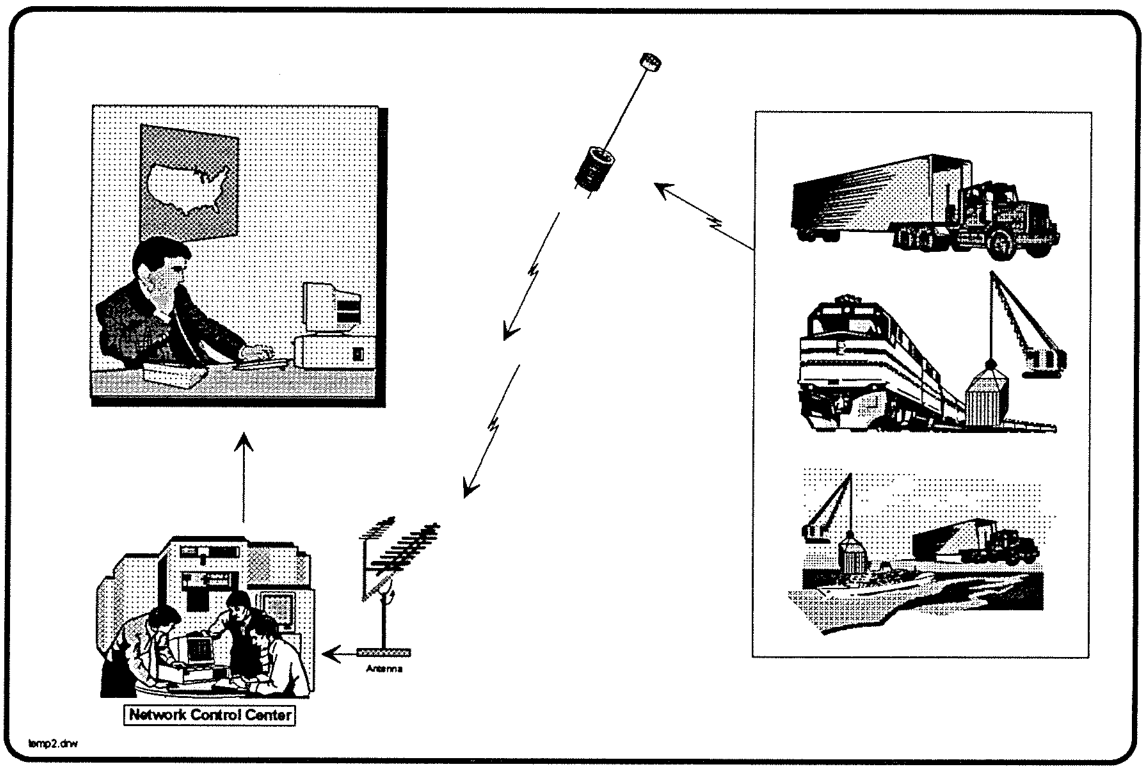


2. Little LEO Services Will Revolutionize Tracking of Shipping Containers

In addition to the trucking sector, there is a large market for low cost communications and position determination devices that can be attached to railroad cars and large shipping containers. To show the size of this market, there are 13 million railroad boxcars and 500,000 multimode shipping containers in use with over 100,000 containers of indeterminate location at any given time. Because multimode containers move by rail, air, and sea, they travel long distances and can be frequently lost within the transportation network. Shippers demand to have better control over this process in order to provide better service to their customers.

Today there are 5,000 tracking units in service; however, these are relatively expensive units that are economical only for high value items, or critical material that must be accounted for at all times. FACS provides major equipment and usage fee savings compared to any tracking system operational today. FACS will be highly competitive in this market. Use of the FACS System in Shipping is illustrated in Figure V-6, below.

Figure V-6: **Use of the FACS System In Shipping**



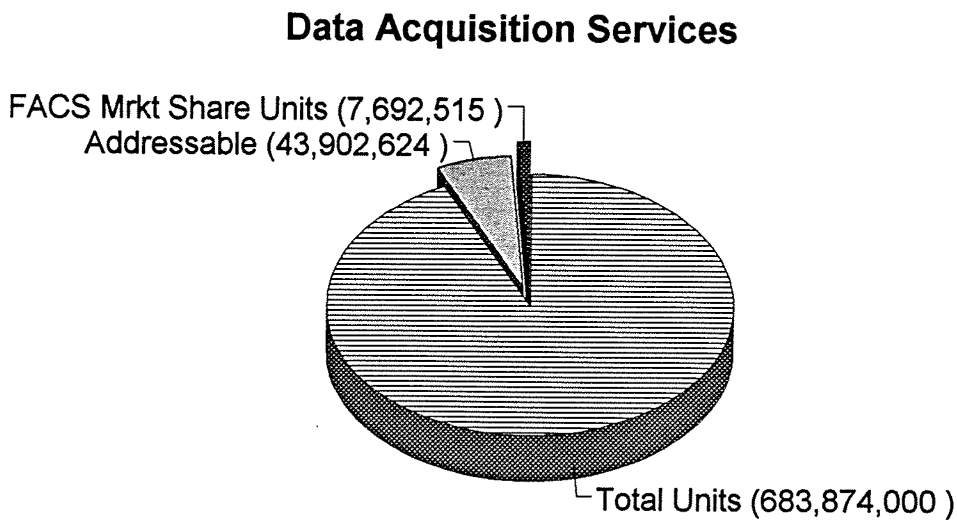
3. FACS Will Permit Tracking of High Interest Items In International Shipping

In addition to the many items shipped internationally in multimode containers, other large items or individual consignments travel through the international material transportation pipeline. These are also candidates for FACS services with all the key subscriber services and benefits that apply to multimode shipping container tracking. By attaching low cost terminals to items of interest, federal agencies and private firms can determine precise locations of shipments, and when they have reached their destinations. Federal agencies can attach low cost terminals to consignments suspected of including contraband, narcotics, or other items of interest to U.S. Customs to alert agents when the items of interest arrive at U.S. ports. Hazardous materials and high value items can be tracked and monitored in near real time, or as required.

E. **Conclusion**

Within the four business areas discuss above, we have identified a significant addressable market for transmission services, RTs and MTs from these four business areas. Although there are other alternatives both presently and in the future for these communications service, the ubiquitous coverage and low-cost of Little LEO systems such as the one proposed by FACS will provide serious competition in many present markets that do not require real-time voice messaging, and will help to create new and expanded markets for communications services that were not formerly economically viable. FACS' conservative market projections are reflected in Figures V-7 and V-8, below.

Figure V-7: <u>Projected Demand for Data Acquisition and SCADA Services</u>



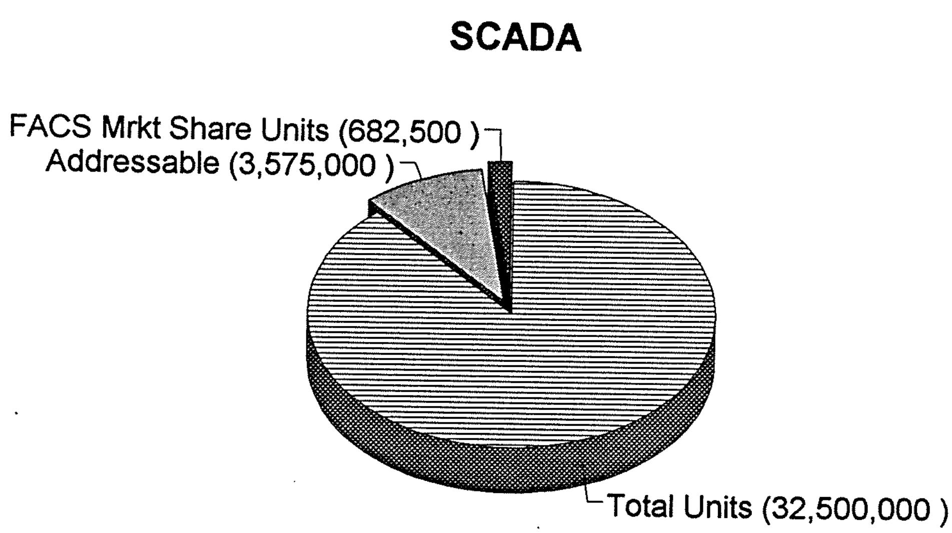
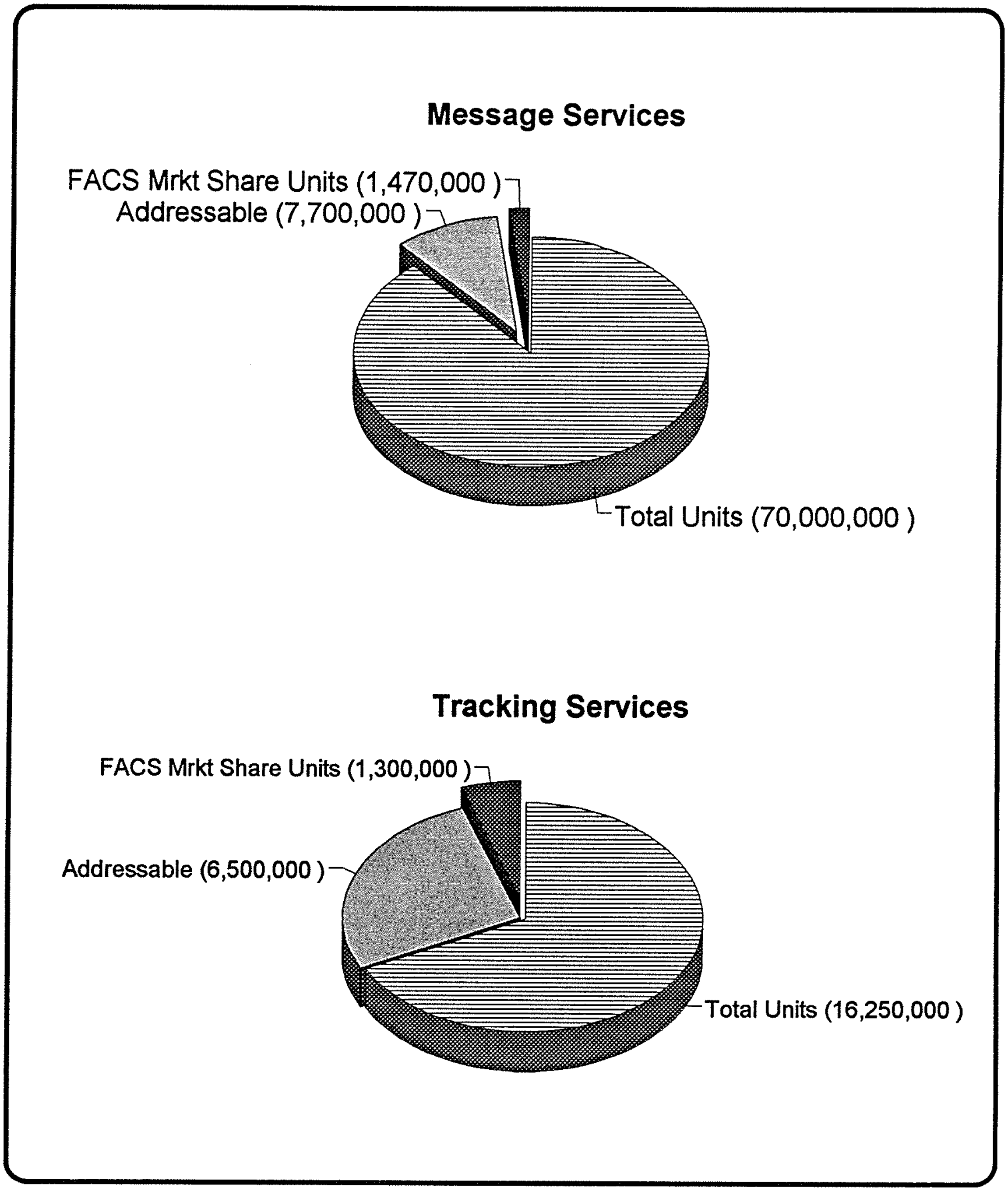


Figure V-8: Projected Demand for Messaging and Tracking Services



VI. LEGAL QUALIFICATIONS OF FACS

VI. LEGAL QUALIFICATIONS OF FACS

As established in the FCC 430 Form and Exhibits thereto included in this Section VI, FACS is legally qualified to hold Commission license in this service. FACS is a wholly-owned subsidiary of Final Analysis, Inc. ("FAI"), a for-profit Maryland business corporation with principal offices in Greenbelt, MD. FAI is owned equally by two shareholders, Dr. Nader Modanlo and Michael H. Ahan, both of whom are United States citizens, and neither of which hasany other ownership interests in communications facilities or ventures.

FCC 430

FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

Approved by OMB
3060 0105
Expires 2/28/96

LICENSEE QUALIFICATION REPORT

See reverse side for information regarding public burden statement.

INSTRUCTIONS

A. The "Filer" of this report is defined to include: (1) An applicant, where this report is submitted in connection with applications for common carrier and satellite radio authority as required for such applications; or (2) A licensee or permittee, where this report is required by the Commission's Rules to be submitted on an annual basis.

B. Submit an original and one copy (sign original only) to the Federal Communications Commission, Washington, DC 20554. If more than one radio service is listed in Item 6, submit an additional copy for each such additional service. If this report is being submitted in connection with an application for radio authority, attach it to that application.

C. Do not submit a fee with this report.

1. Business Name and Address (Number, Street, State and ZIP Code) of Filer's Principal Office:
Final Analysis Communication Services, Inc.
7500 Greenway Center, Suite 1240
Greenbelt, MD 20770

2. (Area Code) Telephone Number:
(301)474-0111

3. If this report supercedes a previously filed report, specify its date:
N/A

4. Filer is (check one):
☐ Individual ☐ Partnership ☒ Corporation
☐ Other (Specify):

5. Under the laws of what State (or other jurisdiction) is the Filer organized?
Maryland

6. List the common carrier and satellite radio services in which Filer has applied or is a current licensee or permittee: Final Analysis Communication Services, Inc. ("FACS") is an applicant for a license in the NVNG MSS Below 1 GHz. FACS' corporate parent, Final Analysis, Inc., holds an Experimental Radio Service authorization.

7(a) Has the Filer or any party to this application had any FCC station license or permit revoked or had any application for permit, license or renewal denied by this Commission? *If "YES", attach as Exhibit I a statement giving call sign and file number of license or permit revoked and relating circumstances.* ☐ Yes ☒ No

(b) Has any court finally adjudged the Filer, or any person directly or indirectly controlling the Filer, guilty of unlawfully monopolizing or attempting unlawfully to monopolize radio communication, directly or indirectly, through control of manufacture or sale of radio apparatus, exclusive traffic arrangement, or other means of unfair methods of competition? *If "YES", attach as Exhibit II a statement relating the facts.* ☐ Yes ☒ No

(c) Has the Filer, or any party to this application, or any person directly or indirectly controlling the Filer ever been convicted of a felony by any state or Federal Court? *If "YES", attach as Exhibit III a statement relating the facts.* ☐ Yes ☒ No

(d) Is the Filer, or any person directly or indirectly controlling the Filer, presently a party in any matter referred to items 7(b) and 7(c)? *If "YES", attach as Exhibit IV a statement relating the facts.* ☐ Yes ☒ No

8. Is the Filer, directly or indirectly, through stock ownership, contract or otherwise, currently interested in the ownership or control of any other radio stations licensed by this Commission? *If "YES", submit as Exhibit V the name of each such licensee and the licensee's relation to the Filer.* ☒ Yes ☐ No

If Filer is an individual (sole proprietorship) or partnership, answer the following and item 11:

9(a) Full Legal Name and Residential Address (Number, Street, State and ZIP Code) of Individual or Partners:

N/A

(b) Is individual or each member of a partnership a citizen of the United States? ☐ Yes ☐ No

(c) Is individual or any member of a partnership a representative of an alien or of a foreign government? ☐ Yes ☐ No

If Filer is a corporation, answer the following and Item 11:

10(a) Attach as Exhibit VI the names, addresses, and citizenship of those stockholders owning of record and/or voting 10 percent or more of the Filer's voting stock and the percentages so held. In the case of fiduciary control, indicate the beneficiary(ies) or class of beneficiaries.

See Exhibit VI

(b) List below, or attach as Exhibit VII the names and addresses of the officers and directors of the Filer.

See Exhibit VII

(c) Is the Filer directly or indirectly controlled by any other corporation? [X] Yes [ ] No

If "YES", attach as Exhibit VIII a statement (including organizational diagrams where appropriate) which fully and completely identifies the nature and extent of control. Include the following: (1) the address and primary business of the controlling corporation and any intermediate subsidiaries; (2) the names, addresses, and citizenship of those stockholders holding 10 percent or more of the controlling corporation's voting stock; (3) the approximate percentage of total voting stock held by each such stockholder; and (4) the names and addresses to the president and directors of the controlling corporation.

See Exhibit VIII

(d) Is any officer or director of the Filer an alien? [ ] Yes [X] No

(e) Is more than one-fifth of the capital stock of the Filer owned of record or voted by aliens or their representatives, or by a foreign government or representative(s) thereof, or by a corporation organized under the laws of a foreign country? [ ] Yes [X] No

(f) Is the Filer directly or indirectly controlled: (1) by any other corporation of which any officer or more than one-fourth of the directors are aliens, or (2) by any foreign corporation or corporation of which more than one-fourth of the capital stock is owned or voted by aliens or their representatives, or by a foreign government or representatives thereof. [ ] Yes [X] No

(g) If any answer to questions (d), (e) or (f) is "YES", attach as Exhibit IX a statement identifying the aliens or foreign entities, their nationality, their relationship to the Filer, and the percentage of stock they own or vote.

11. CERTIFICATION

This report constitutes a material part of any application which cross-references it, and all statements made in the attached exhibits are a material part thereof. The ownership information contained in this report does not constitute an application for, or Commission approval of, any transfer of control or assignment of radio facilities. The undersigned, individually and for the Filer, hereby certifies that the statements made herein are true, complete and correct to the best of Filer's knowledge and belief, and are made in good faith.

WILLFUL FALSE STATEMENTS MADE ON THIS APPLICATION ARE PUNISHABLE BY FINE AND IMPRISONMENT (U.S. Code, Title 18, Section 1001) and/or REVOCATION OF ANY STATION LICENSE OR CONSTRUCTION PERMIT (U.S. Code, Title 47, Section 312(a)(1)).	Date 11/15/94	Filer *(Must correspond with that shown in item 1)* Final Analysis Communication Services, Inc.	Typed or Printed Name Nader Modanlo
	Signature [signature]		Title President

NOTICE TO INDIVIDUALS REQUIRED BY THE PRIVACY ACT OF 1974 AND THE PAPERWORK REDUCTION ACT OF 1980

The solicitation of personal information requested in this form is to determine if you are qualified to become or remain a licensee in a common carrier or satellite radio service pursuant to the Communications Act of 1934, as amended. No authorization can be granted unless all information requested is provided. Your response is required to obtain the requested authorization or retain an authorization.

Public reporting burden for this collection of information is estimated to average 2 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Federal Communications Commission, Office of Managing Director, Washington, DC 20554, and to Office of Management and Budget, Paperwork Reduction Project (3060-0105), Washington, DC 20503.

EXHIBIT V
FCC FORM 430

Final Analysis, Inc., a Maryland corporation which is the corporate parent of the applicant Final Analysis Communication Services, Inc. holds Experimental Radio Service Authorizations to operate facilities with the call letters KE2XGU, KE2XGV, KE2XGW, KE2XGX, and KE2XGY.

EXHIBIT VI
FCC FORM 430

The names, addresses and citizenship of those stockholders owning of record and/or voting 10 percent or more of the voting stock of the applicant Final Analysis Communication Services, Inc. ("FACS"), and the percentages so held are as follows:

Stockholder Name	Address	Citizenship	OwnershipPercentage
Final Analysis, Inc.	7500 Greenway Center Suite 1240 Greenbelt, MD 20770	USA (MD)	100%

Final Analysis Communication Services, Inc. has only one class of common (voting) stock.

EXHIBIT VII
FCC FORM 430

The names and addresses of the officers and directors of the applicant Final Analysis Communication Services, Inc. are as follows:

Name	Address	Position/Title
Nader Modanlo	5 Crestview Court Potomac, MD 20854	President and Director
Michael H. Ahan	17208 Chiswell Road Poolesville, MD 20837	CEO and Director

EXHIBIT VIII
FCC FORM 430

The Applicant, Final Analysis Communication Services, Inc ("FACS")., is a wholly-owned subsidiary of Final Analysis, Inc. ("FAI"), a for-profit corporation incorporated under the laws of, and doing business in, the State of Maryland. The stock of FACS is owned directly by FAI, with no intermediate subsidiaries.

(1) FAI's primary business is aerospace engineering. FAI's address is:

Final Analysis, Inc.
7500 Greenway Center
Suite 1240
Greenbelt, MD 20770

(2) The names, addresses and citizenship of those stockholders owning 10% or more of FAI's voting stock are:

Stockholder Name	Address	Citizenship
Nader Modanlo	5 Crestview Court Potomac, MD 20854	USA
Michael H.Ahan	17208 Chiswell Road Poolesville, MD 20837	USA

Figure VII-1

Estimated Costs of Construction and Launch of FACS' First Two Satellites and Operation for One Year

Figure VII-1

Estimated Costs of Construction and Launch of FACS'
First Two Satellites and Operation for One Year

Construction Cost	$2,968,245
Launch & Launch Services	$1,932,200
RT & Ground Station	$480,000
Satellites Operations	$361,845
FACS Business Operating, Product Services, & Admin. Cost	$474,275
Total	$6,216,565

Figure VII-2A

Detailed Schedule of Estimated Costs for FACS Proposed System for Expected Lifetime of System

Figure VII-2A

Detailed Schedule of Estimated Costs for FACS
Proposed System for Expected Lifetime of System

	1995	1996	1997	1998	1999	2000	2001	2002	Total
FACS Satellite System Operating Cost		$361,845	$518,645	$1,194,066	$1,283,621	$2,382,605	$2,518,011	$2,753,398	$11,012,189
NRE for RT Develop., Completion, & Prototype Fab.(see Note 1)	$320,000								$320,000
NRE for G.S. Develop., Completion, & Install.(see Note 1)	$160,000								$160,000
FACS Business Operating, Product Services, & Admin. C	$474,275	$1,052,048	$2,128,482	$3,869,185	$6,461,275	$8,178,670	$8,805,015	$9,361,659	$40,330,609
FAISAT-1A & 2:									
CONSTRUCTION COST	$2,968,245								$2,968,245
LAUNCH & LAUNCH SERVICES COST	$1,932,200								$1,932,200
SATELLITES & LAUNCH INSURANCE COST	$865,538								$865,538
TOTAL FAISAT - 1A & 2									$5,765,983
FAISAT - 3 THROUGH 8:									
CONSTRUCTION COST		$6,931,742	$4,621,161						$11,552,904
LAUNCH & LAUNCH SERVICES COST		$7,841,280	$5,227,520						$13,068,800
SATELLITES & LAUNCH INSURANCE COST		$2,569,221	$1,712,814						$4,282,035
TOTAL FAISAT - 3 THROUGH 8									$28,903,739
FAISAT - 9 THROUGH 14:									
CONSTRUCTION COST			$5,083,278	$7,624,916					$12,708,194
LAUNCH & LAUNCH SERVICES COST			$5,750,272	$8,625,408					$14,375,680
SATELLITES & LAUNCH INSURANCE COST			$1,884,096	$2,826,143					$4,710,239
TOTAL FAISAT - 9 THROUGH 14									$31,794,113
FAISAT - 15 THROUGH 20:									
CONSTRUCTION COST				$2,795,803	$11,183,211				$13,979,013
LAUNCH & LAUNCH SERVICES COST				$3,162,650	$12,650,598				$15,813,248
SATELLITES & LAUNCH INSURANCE COST				$1,036,253	$4,145,010				$5,181,263
TOTAL FAISAT - 15 THROUGH 20									$34,973,524
FAISAT - 21 THROUGH 26:									
CONSTRUCTION COST					$3,075,383	$12,301,532			$15,376,915
LAUNCH & LAUNCH SERVICES COST					$3,478,915	$13,915,658			$17,394,573
SATELLITES & LAUNCH INSURANCE COST					$1,139,878	$4,559,511			$5,699,389
TOTAL FAISAT - 21 THROUGH 26									$38,470,877
Overall Total Annual Cost	**$6,720,258**	**$18,756,136**	**$26,926,267**	**$31,134,423**	**$43,417,891**	**$41,337,976**	**$11,323,025**	**$12,115,057**	**$191,731,034**
FAISAT1A through 26 Including Launch & Insurance C									**$139,908,235**
Total System Construction & Satellites Operating Cost									**$151,400,425**

Note 1: FAI has capitalized and incurred the initial development cost.

Figure VII-2B

Graphical Depiction of Estimated Costs for FACS
Proposed System for Expected Lifetime of System

Figure VII-2B

Graphical Depiction of Estimated Costs for FACS
Proposed System for Expected Lifetime of System

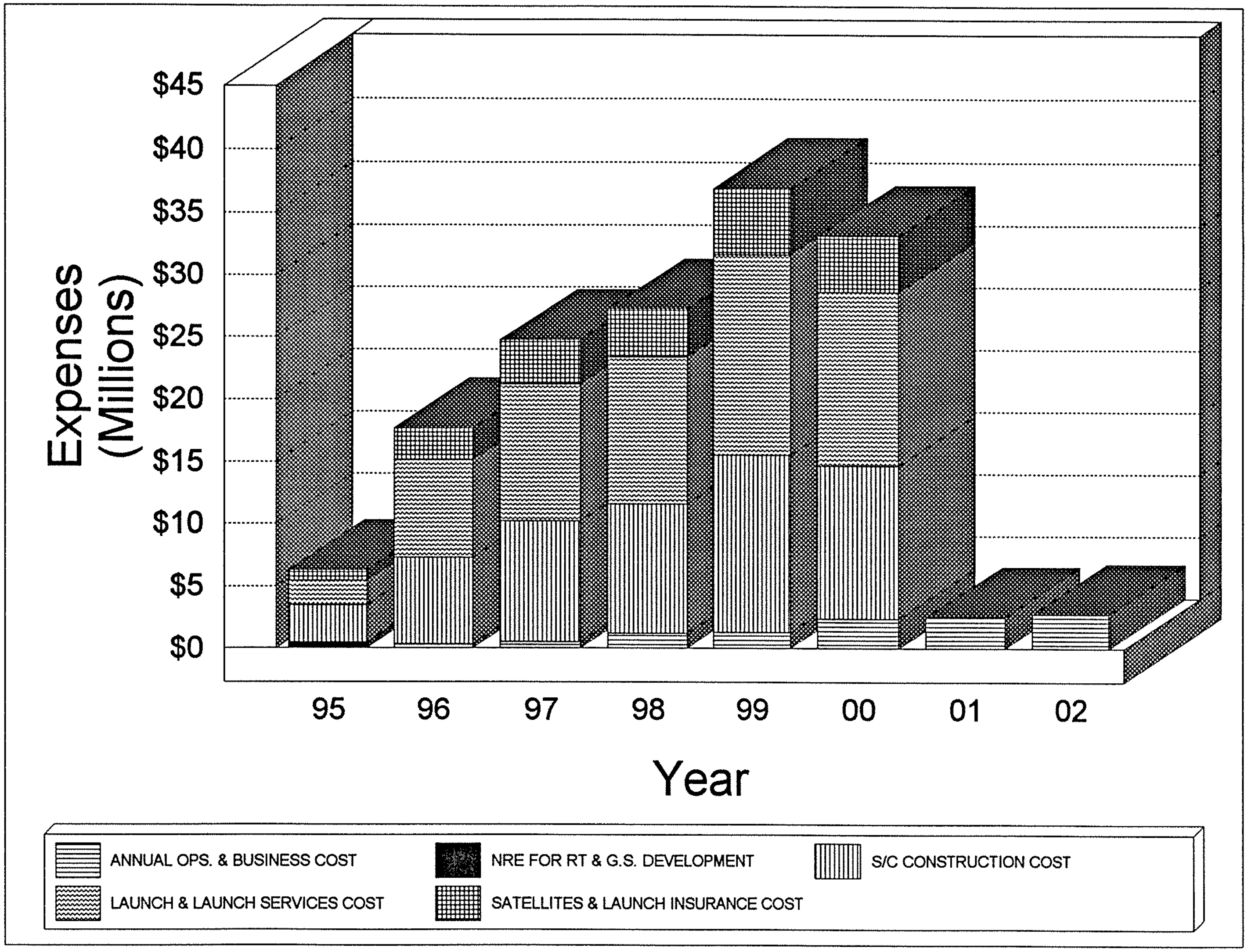


Figure VII-3

Projected Income Statement for FACS
Proposed System for Expected Lifetime of System

PRIVILEGED AND CONFIDENTIAL* Figure VII-3 FACS Projected Income Statement

Revenue:	12/31/1994 PROJECTIONS	12/31/1995 PROJECTIONS	12/31/1996 PROJECTIONS	12/31/1997 PROJECTIONS	12/31/1998 PROJECTIONS	12/31/1999 PROJECTIONS	12/31/2000 PROJECTIONS	12/31/2001 PROJECTIONS	12/31/2002 PROJECTIONS
Projected Service Revenue	$0	$0	$6,151,039	$14,914,769	$89,357,037	$170,050,098	$251,267,159	$329,314,580	$407,459,201
Projected RT Sale Revenue	$0	$0	$63,396,906	$80,299,156	$90,420,523	$91,661,792	$91,640,421	$82,182,424	$80,302,549
Ground Station (GS) Sale Revenue	$0	$0	$82,560	$202,104	$204,480	$273,696	$273,696	$204,480	$51,120
Secondary Payload Revenue	$0	$1,700,000	$3,200,000	$2,050,000	$1,400,000	$8,350,000	$900,000	$0	$0
Total Revenue	$0	$1,700,000	$72,830,505	$97,466,029	$181,382,040	$270,335,586	$344,081,277	$411,701,484	$487,812,870
Expenses:									
RT Expenses	$0	$0	$50,717,525	$64,239,325	$72,336,419	$73,329,434	$73,312,337	$65,745,939	$64,242,039
GS Expenses	$0	$0	$68,800	$168,419	$170,399	$228,079	$228,079	$170,399	$42,600
RT Development/Completion Expenses	$0	$320,000	$0	$0	$0	$0	$0	$0	$0
GS Development/Completion Expenses	$0	$160,000	$0	$0	$0	$0	$0	$0	$0
FACS Annual Operating Expenses	$123,800	$474,275	$2,057,893	$7,222,407	$25,410,650	$51,108,680	$79,009,967	$87,258,892	$104,873,627
Accumulative Depreciation & Amortization	$0	$839,175	$1,427,305	$5,154,031	$12,357,292	$18,369,477	$23,763,490	$15,216	$0
Secondary Payloads Expenses	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Expenses	$123,800	$1,793,450	$54,271,522	$76,784,182	$110,274,760	$143,035,670	$176,313,873	$153,190,447	$169,158,266
Net Income(Loss)	($123,800)	($93,450)	$18,558,982	$20,681,847	$71,107,280	$127,299,916	$167,767,403	$258,511,037	$318,654,604

* pursuant to Sections 0.457(d) and 0.459 of the Commission's Rules, Final Analysis Communication Services, Inc. has requested confidential treatment of the material in this table Consequently, the information in this table should be withheld from public inspection.

Figure VII-4

Projected Cashflow Statement for FACS
Proposed System for Expected Lifetime of System

VII. FINANCIAL QUALIFICATIONS OF FACS

VII. FINANCIAL QUALIFICATIONS OF FACS

A. FACS Has the Current Financial Ability to Meet The Costs of the Initial Project Phase In Satisfaction of the Commission's Rules

FACS is financially qualified to be a licensee in the NVNG MSS Below 1 GHz. FACS is relying on its parent corporation, Final Analysis, Inc., for funding of the construction and launch of the first two satellites in its system, and operation for a period of one year (the "Initial Project Phase"). As set forth in Figure VII-1, FACS estimates the cost associated with the Initial Project Phase to be $6,216,565.00.

As established in the attached letter of Nader Modanlo, President of FAI to William F. Caton, Acting Secretary of the Federal Communications Commission (attached as Exhibit VII-4), FAI has committed to fund FACS' efforts for the Initial Project Phase.

FAI's audited financial statement for the period ending October 31, 1994 (attached as Exhibit VII-2) demonstrates FAI's current financial ability to fund the Initial Project Phase for its subsidiary, FACS. FAI's audited financial statement for the period ending December 31, 1993 is attached as Exhibit VII-1; and FACS' audited balance sheet for the period ending October 31, 1994 is attached as Exhibit VII-3.

With the support of its corporate parent, FACS has the current financial ability to meet the costs associated with the Initial Project Phase, and to proceed expeditiously with the construction, launch, and operation for one year of the first two space stations in its system immediately upon grant of the FCC authorization.

B. Financial Projections for the FACS System

A detailed exposition of estimated investment and operating costs for the proposed system year-by-year for the expected lifetime of the FACS system is set forth in Figure VII-2A. A graphical depiction of these costs is set forth in Figure VII-2B.

Also included are additional exhibits which detail the estimated annual revenue requirements of the system on a year-by-year basis over the estimated design lifetime of the satellites. Figure VII-3 is the projected income statement; Figure VII-4 is the projected cashflow statement, and Figure VII-5 is the projected balance sheet.

After the Initial Project Phase, FACS will seek additional funding for the development of its system through financing in the debt and equity markets.

The financial information set forth in this exhibit is verified by an affidavit executed by Nader Modanlo, President of FACS.

VIII. TECHNICAL QUALIFICATIONS OF FACS

FACS is technically very well-qualified to develop, construct, launch and operate a low earth orbit satellite system. FACS was formed by its corporate parent, FAI, for the purpose of pursuing commercial opportunities in the low-earth orbit communications satellite business. As a wholly-owned subsidiary collocated with FAI, FACS is able to draw on the expertise and experience of the aerospace engineers, scientists and marketing experts of FAI. FAI personnel have extensive experience in the design, development, launch and operation of a variety of Government and commercial satellites. Information concerning the key members of FACS' team is set forth in Exhibit VIII-1 hereto.

FACS has made extensive use of FAI's technical personnel and facilities in the planning and design of its proposed system, and in the preparation of the technical portions of this application. In addition, FACS will directly benefit from the research and development efforts undertaken by FAI in concert with the United States Air Force Phillips Lab, the NASA Center for Space Power and the NASA Space Communications Technology Center related to the launch and operation of FAI's experimental LEO satellite, FAISAT-1. FAISAT-1 will provide a wealth of data for FACS' use in the refinement of techniques and equipment for NVNG satellite operations.

Exhibit VIII-1

Background Information on Key Members of FACS' Team

Key members of the FACS team

Dr. Nader Modanlo. Dr. Modanlo is the President of Final Analysis Communication Services, Inc. He has over twelve years experience in spaceborne systems engineering. His areas of expertise are aeronautics and aerodynamics, fluid mechanics, and solid and fracture mechanics. Dr. Modanlo played key roles on a number of important NASA programs such as the Conestoga launch vehicle where he was responsible for structural, stress, aerodynamic, thermal loading, and trajectory analyses, structural design, and mechanical and electronic packaging design. Prior to forming FACS, he held senior management positions with two aerospace firms where he was responsible for technical leadership and business development of groups engaged in programs such as NASA/GSFC spaceflight payloads and instrumentation, and Space Shuttleborne payloads for the Special Payload of Opportunity Carrier, Cosmic Background Explorer, Get Away Special, and the Broadband X-ray Telescope missions. Dr. Modanlo received his B.S., Mechanical Engineering, M.S. Aeronautical Engineering, and Ph.D from George Washington University.

Dr. L. Rex Megill. Dr. Megill has forty years experience in aerospace sciences. His expertise is in atmospheric sciences and spacecraft and instrumentation design. Dr. Megill is Chief Scientist at FACS where he directs all activities associated with spacecraft development and mission planning. He is specifically responsible for FAISAT development. Dr. Megill's long and distinguished career includes senior management and technical positions in aerospace industry, at federal government research laboratories, and at Utah State University, where he is Emeritus Professor, Director of the Center for Atmospheric and Space sciences, and is an Advisor for the GAS Space Shuttle Program. At the university, he was Professor of Physics and Professor of Electrical Engineering. Dr. Megill also served in the National Science Foundation, and advisory groups for NASA, the International Steering Committee for the Middle Atmosphere Program, and the Interdepartmental Committee on Atmospheric Sciences. He received his B.S. and M.A. from the University of Nebraska, and his Ph.D from the University of Colorado.

Michael H. Ahan. Mr. Ahan is FACS's Chief Executive Officer. He has over 15 years experience in senior management and technical program management, including positions at NASA, the Department of Defense, and in the aerospace industry. He worked on major space systems programs including the Space Transportation System, the Expendable Launch Vehicle, and the Conestoga Launch Vehicle. Mr. Ahan received his B.S., Mechanical Engineering from the University of Akron and has been a member of the American Society of Mechanical Engineers for 15 years.

Donald F. Erat. Mr. Erat is Director of Marketing at FACS and is responsible for business development and marketing for FACS. He has over thirty five years marketing experience in the aerospace industry. Since 1978, Mr. Erat has worked extensively with space programs. His primary area of expertise is marketing commercial launch vehicles and services for both federal government and commercial accounts. His experience includes marketing launch services to Iridium, Globalstar, Ellipsat, and several small spacecraft programs. He has worked with Congress and other civil agencies on space program issues including FCC requirements relating to communications satellites. He is a member of the National Space Club and AIAA, and was NERO President in 1979, and Chairman in 1980. Mr. Erat earned a B.S. in Finance and Accounting from Lycoming College, and received his marketing training from the IBM Federal Systems Division's marketing education program. He was an IBM employee for 28 years, 18 of which were in marketing.

<u>**Affidavit of Nader Modanlo**</u>

I, Nader Modanlo, being duly sworn, hereby state as follows:

1. I am the President of Final Analysis Communication Services, Inc. ("FACS"), the applicant in the foregoing Application for license to construct, operate and launch a NVNG MSS System Below 1 GHz.

2. I am also President of Final Analysis, Inc. ("FAI"), which is the corporate parent and 100% owner of FACS.

3. Exhibits VII-1, VII-2, VII-3, and VII-4, being respectively: (i) the audited financial statement of FAI for the period ending December 31, 1993; (ii) the audited financial statement of FAI for the period ending October 31, 1994; (iii) the audited balance sheet of FACS for the period ending October 31, 1994; and (iv) a letter of irrevocable commitment from FAI to FACS for comprehensive funding of the construction, launch and operation of the first two satellites by FACS for a period of one year, are true and complete photocopies.

4. In accordance with Section 25.140(d) of the Commission's Rules, 47 C.F.R. § 25.140(d), I hereby verify that the information contained in the foregoing Financial Qualifications exhibit is true and correct.

[signature]
Nader Modanlo

COUNTY OF PRINCE GEORGES)
) SS:
STATE OF MARYLAND)

On this 15th day of November, 1994 came before me Nader Modanlo, well known to me or having furnished acceptable proof of identity, and, being duly sworn, executed the foregoing Affidavit in my presence.

Jacqueline L. Hunt
Notary Public [SEAL]
JACQUELINE L. HUNT
NOTARY PUBLIC STATE OF MARYLAND
My Commission Expires March 4, 1998

My Commission Expires: March 4, 1998

Business Accounting Services

B.A.S.

8015 Cloverwood Ct.
Gaithersburg, MD 20879
Tel: 301-840-0227
Fax: 301-840-0BAS

INDEPENDENT AUDITORS' REPORT
BUSINESS ACCOUNTING SERVICES
8015 CLOVERWOOD CT
GAITHERSBURG, MD 20879

NOVEMBER 14, 1994

BOARD OF DIRECTORS
FINAL ANALYSIS, INC.

WE HAVE AUDITED THE ACCOMPANYING BALANCE SHEET OF FINAL ANALYSIS, INC., AS OF DECEMBER 31, 1993 AND CASH FLOWS FOR THE PERIOD THEN ENDED. THESE FINANCIAL STATEMENTS ARE THE RESPONSIBILITY OF THE COMPANY'S MANAGEMENT. OUR RESPONSIBILITY IS TO EXPRESS AN OPINION ON THE FINANCIAL STATEMENTS BASED ON OUR AUDIT.

WE CONDUCTED OUR AUDIT IN ACCORDANCE WITH GENERALLY ACCEPTED AUDITING STANDARDS. THOSE STANDARDS REQUIRE THAT WE PLAN AND PERFORM THE AUDIT TO OBTAIN REASONABLE ASSURANCE ABOUT WHETHER THE FINANCIAL STATEMENTS ARE FREE OF MATERIAL MISSTATEMENT. AN AUDIT INCLUDES EXAMINING, ON A TEST BASIS, EVIDENCE SUPPORTING THE AMOUNTS AND DISCLOSURES IN THE FINANCIAL STATEMENTS. AN AUDIT ALSO INCLUDES ACCESSING THE ACCOUNTING PRINCIPLES USED AND SIGNIFICANT ESTIMATES MADE BY MANAGEMENT, AS WELL AS EVALUATING THE OVERALL FINANCIAL STATEMENT PRESENTATION. WE BELIEVE THAT OUR AUDIT PROVIDES A REASONABLE BASIS FOR OUR OPINION.

IN OUR OPINION, THE FINANCIAL STATEMENTS REFERRED TO ABOVE PRESENT FAIRLY, IN ALL MATERIAL RESPECTS, THE FINANCIAL POSITION OF FINAL ANALYSIS, INC. AS OF DECEMBER 31, 1993, AND THE RESULTS OF ITS OPERATIONS AND ITS CASH FLOWS FOR THE PERIOD THEN ENDED IN CONFORMITY WITH GENERALLY ACCEPTED ACCOUNTING PRINCIPLES.

SINCERELY,

FARROKH A. BAIK, C.P.A.
CERTIFIED PUBLIC ACCOUNTANT

PRIVILEGED AND CONFIDENTIAL*

Figure VII-4 FACS Projected Cash Flow

Cash Flows From Operating Activities:	12/31/1994 PROJECTIONS	12/31/1995 PROJECTIONS	12/31/1996 PROJECTIONS	12/31/1997 PROJECTIONS	12/31/1998 PROJECTIONS	12/31/1999 PROJECTIONS	12/31/2000 PROJECTIONS	12/31/2001 PROJECTIONS	12/31/2002 PROJECTIONS
Service Revenue	$0	$0	$6,151,039	$14,914,769	$89,357,037	$170,050,098	$251,267,159	$329,314,580	$407,459,201
RT Sale Revenue	$0	$0	$63,396,906	$80,299,156	$90,420,523	$91,661,792	$91,640,421	$82,182,424	$80,302,549
Ground Station (GS) Sale Revenue	$0	$0	$82,560	$202,104	$204,480	$273,696	$273,696	$204,480	$51,120
Secondary Payload Revenue	$0	$1,700,000	$3,200,000	$2,050,000	$1,400,000	$8,350,000	$900,000	$0	$0
RT Expenses	$0	$0	$50,717,525	$64,239,325	$72,336,419	$73,329,434	$73,312,337	$65,745,939	$64,242,039
GS Expenses	$0	$0	$68,800	$168,419	$170,399	$228,079	$228,079	$170,399	$42,600
FACS Annual Operating Expenses	$123,800	$474,275	$2,057,893	$7,222,407	$25,410,650	$51,108,680	$79,009,967	$87,258,892	$104,873,627
Secondary Payloads Expenses	$0	$0	$0	$0	$0	$0	$0	$0	$0
Net Cash Flow From Operating Activities	($123,800)	$1,225,725	$19,986,287	$25,835,878	$83,464,572	$145,669,393	$191,530,893	$258,526,253	$318,654,604

Cash Flows From Investing Activities - *Capital Expenditures:*	12/31/1994 PROJECTIONS	12/31/1995 PROJECTIONS	12/31/1996 PROJECTIONS	12/31/1997 PROJECTIONS	12/31/1998 PROJECTIONS	12/31/1999 PROJECTIONS	12/31/2000 PROJECTIONS	12/31/2001 PROJECTIONS	12/31/2002 PROJECTIONS
RT Development/Completion Expenses	$0	($320,000)							
GS Development/Completion Expenses	$0	($160,000)							
FAI Satellite 1 Expense	$0	$0	$0	$0	$0	$0	$0	$0	$0
FAI Satellite 1A & 2 Expense	$0	($5,765,983)	$0	$0	$0	$0	$0	$0	$0
FAI Satellite 3-26 Expense	$0	$0	($17,342,243)	($24,279,141)	($26,071,173)	($35,672,995)	($30,776,701)	$0	$0
Net Cash Flow From Investing Activities	$0	($6,245,983)	($17,342,243)	($24,279,141)	($26,071,173)	($35,672,995)	($30,776,701)	$0	$0
Cash Flows From Financing Activities:									
Capital Stock	$705,000	$6,000,000	$0	$0	$0	$0	$0	$0	$0
Net Cash From Financing Activities	$705,000	$6,000,000	$0	$0	$0	$0	$0	$0	$0
Total Cash From All Activities	*$581,200*	*$979,742*	*$2,644,044*	*$1,556,737*	*$57,393,400*	*$109,996,398*	*$160,754,192*	*$258,526,253*	*$318,654,604*
Cash At Beginning Of Operation/Year	*$0*	*$581,200*	*$1,560,942*	*$4,204,986*	*$5,761,723*	*$63,155,123*	*$173,151,521*	*$333,905,713*	*$592,431,967*
Cash At End Of Year	$581,200	$1,560,942	$4,204,986	$5,761,723	$63,155,123	$173,151,521	$333,905,713	$592,431,967	$911,086,571

* pursuant to Sections 0.457(d) and 0.459 of the Commission's Rules, Final Analysis Communication Services, Inc. has requested confidential treatment of the material in this table Consequently, the information in this table should be withheld from public inspection.

Figure VII-5

Projected Balance Sheet for FACS
Proposed System for Expected Lifetime of System

PRIVILEGED AND CONFIDENTIAL*

Figure VII-5 FACS Projected Balance Sheet

ASSETS:	12/31/1994 PROJECTIONS	12/31/1995 PROJECTIONS	12/31/1996 PROJECTIONS	12/31/1997 PROJECTIONS	12/31/1998 PROJECTIONS	12/31/1999 PROJECTIONS	12/31/2000 PROJECTIONS	12/31/2001 PROJECTIONS	12/31/2002 PROJECTIONS
Cash	$581,200	$1,560,942	$4,204,986	$5,761,723	$63,155,123	$173,151,521	$333,905,713	$592,431,967	$911,086,571

Equipment:

Satellite 1A & 2	$0	$5,765,983	$5,765,983	$5,765,983	$5,765,983	$5,765,983	$5,765,983	$5,765,983	$5,765,983
Satellite 3-26	$0	$0	$17,342,243	$41,621,384	$67,692,557	$103,365,551	$134,142,252	$134,142,252	$134,142,252
RT & GS Development Cost	$0	$480,000							
Start-up Cost(Licensing & Legal Fee)	$0								
Subtotal	**$0**	**$6,245,983**	**$23,108,226**	**$47,387,387**	**$73,458,540**	**$109,131,534**	**$139,908,235**	**$139,908,235**	**$139,908,235**
Less: Accumulative Depreciation	$0	$823,959	$1,412,089	$5,138,815	$12,342,076	$18,354,261	$23,748,274	$0	$0
Less: Accumulative Amortization	$0	$15,216	$15,216	$15,216	$15,216	$15,216	$15,216	$15,216	$0
Total Equipment	$0	$5,406,808	$21,680,921	$42,233,336	$61,101,248	$90,762,057	$116,144,746	$139,893,019	$139,908,235
Total Assests	**$581,200**	**$6,967,750**	**$25,885,907**	**$47,995,060**	**$124,256,371**	**$263,913,579**	**$450,050,459**	**$732,324,986**	**$1,050,994,807**

Liabilities and Stockholders Equity

	12/31/1994 PROJECTIONS	12/31/1995 PROJECTIONS	12/31/1996 PROJECTIONS	12/31/1997 PROJECTIONS	12/31/1998 PROJECTIONS	12/31/1999 PROJECTIONS	12/31/2000 PROJECTIONS	12/31/2001 PROJECTIONS	12/31/2002 PROJECTIONS
Capital Stock	$705,000	$7,061,200	$7,326,925	$27,313,212	$53,149,090	$144,063,663	$283,183,056	$473,813,949	$732,340,202
Loan From/To Stock Holders	$0	$0	$0	$0	$0	$0	$0	$0	$0
Retained Earnings	($123,800)	($93,450)	$18,558,982	$20,681,847	$71,107,280	$119,849,916	$166,867,403	$258,511,037	$318,654,604
Total Liabilities and Stockholders Equity	**$581,200**	**$6,967,750**	**$25,885,907**	**$47,995,060**	**$124,256,371**	**$263,913,579**	**$450,050,459**	**$732,324,986**	**$1,050,994,807**

* pursuant to Sections 0.457(d) and 0.459 of the Commission's Rules, Final Analysis Communication Services, Inc. has requested confidential treatment of the material in this table Consequently, the information in this table should be withheld from public inspection.

VIII. TECHNICAL QUALIFICATIONS OF FACS

Business Accounting Services

B.A.S.

8015 Cloverwood Ct.
Gaithersburg, MD 20879
Tel: 301-840-0227
Fax: 301-840-0BAS

INDEPENDENT AUDITORS' REPORT
BUSINESS ACCOUNTING SERVICES
8015 CLOVERWOOD CT
GAITHERSBURG, MD 20879

NOVEMBER 14, 1994

BOARD OF DIRECTORS
FINAL ANALYSIS COMMUNICATION SERVICES, INC.

WE HAVE AUDITED THE ACCOMPANYING BALANCE SHEET OF FINAL ANALYSIS COMMUNICATION SERVICES, INC., AS OF OCTOBER 31, 1994. THIS CURRENT ASSETS STATEMENT IS THE RESPONSIBILITY OF THE COMPANY'S MANAGEMENT. OUR RESPONSIBILITY IS TO EXPRESS AN OPINION ON THE BALANCE SHEET BASED ON OUR AUDIT.

WE CONDUCTED OUR AUDIT IN ACCORDANCE WITH GENERALLY ACCEPTED AUDITING STANDARDS. THOSE STANDARDS REQUIRE THAT WE PLAN AND PERFORM THE AUDIT TO OBTAIN REASONABLE ASSURANCE ABOUT WHETHER THE FINANCIAL STATEMENTS ARE FREE OF MATERIAL MISSTATEMENT. AN AUDIT INCLUDES EXAMINING, ON A TEST BASIS, EVIDENCE SUPPORTING THE AMOUNTS AND DISCLOSURES IN THE FINANCIAL STATEMENTS. AN AUDIT ALSO INCLUDES ACCESSING THE ACCOUNTING PRINCIPLES USED AND SIGNIFICANT ESTIMATES MADE BY MANAGEMENT, AS WELL AS EVALUATING THE OVERALL FINANCIAL STATEMENT PRESENTATION. WE BELIEVE THAT OUR AUDIT PROVIDES A REASONABLE BASIS FOR OUR OPINION.

IN OUR OPINION, THE BALANCE SHEET REFERRED TO ABOVE PRESENT FAIRLY, IN ALL MATERIAL RESPECTS, THE FINANCIAL POSITION OF FINAL ANALYSIS COMMUNICATION SERVICES, INC. AS OF OCTOBER 31, 1994, AND THE RESULTS OF ITS OPERATIONS AND ITS CASH FLOWS FOR THE PERIOD THEN ENDED IN CONFORMITY WITH GENERALLY ACCEPTED ACCOUNTING PRINCIPLES.

SINCERELY,

FARROKH A. BAIK, C.P.A.
CERTIFIED PUBLIC ACCOUNTANT

FINAL ANALYSIS COMMUNICATION SERVICES, INC.
SCHEDULE OF ASSETS
FOR THE PERIOD
JANUARY 1, 1994 THROUGH OCTOBER 31, 1994

ASSETS

Cash		$5,000
Accounts Receivables		0
Security Deposit		0
RT & GS Development/Work in Process	$1,595,500	
Less: Accum. Depreciation/	0	1,595,500
Start Up Cost	247,970	
Less: Accum. Amortization	0	247,970
TOTAL ASSETS		$1,848,470

See accompanying notes to financial statements.

Exhibit VII-1

Audited Financial Statement for Final Analysis, Inc.
For the Period Ending December 31, 1993

FINAL ANALYSIS, INC.
BALANCE SHEET
FOR THE YEAR ENDED DECEMBER 31, 1993

ASSETS

Cash		$82,803
Accounts Receivables		452,082
Security Deposit		1,878
Equipment	87,823	
Less: Accum. Depreciation/	34,058	53,765
TOTAL ASSETS		$590,528

LIABILITIES

Stockholders' Capital	$80,864
Accrued Payables	$23,285
TOTAL LIABILITIES	$104,149

STOCKHOLDERS EQUITY

Capital Stock (100 Shares of Common Stock Issued and Outstanding)	$ 100
Retained Earnings	$486,279
TOTAL STOCKHOLDERS EQUITY	$486,379
TOTAL LIABILITIES AND STOCKHOLDERS EQUITY	$590,528

Notes: Accounts Receivables include an invoice dated 01/11/93 for the amount of $300,000; Invoice dated 12/3/93 for the amount of $80,406 and an Invoice dated 12/31/93 in the amount of $71,676.

Equipment depreciated using MACRS 7 year class with Midyear Convention.

50 shares each are issued to Nader Modanlo and Mike Ahan.

See accompanying notes to financial statements.

FINAL ANALYSIS, INC.
STATEMENT OF INCOME AND EXPENSES
FOR THE YEAR ENDED DECEMBER 31, 1993

INCOME FROM OPERATIONS:

RECEIVED	$875,094
BILLED BUT NOT RECEIVED	452.082
TOTAL INCOME	$1,327,176

EXPENSES:

Advertising	$ 805
Computer Subscriptions	4,930
Computer Supplies	6,787
Conferences	579
Dues and Subscriptions	722
Equipment Rentals	14,163
Depreciation Expense	21,508
Employee Benefit Programs	15,462
Repairs	300
Licenses	5,359
Miscellaneous Expenses	31,710
Outside Services/Contractors	64,959
Taxes	13,287
Postage	625
Printing and Reproduction	9,061
Accounting and Payroll Fees	1,985
Professional Fees-Engineering Contractors	403,972
Professional Fees-Consulting	6,016
Rent	22,540
Research and Development Costs	38,127
Satellite Obsolence Costs	37,500
Salaries	149,023
Supplies	6,601
Travel Expenses	32,528
Utilities	17,723
TOTAL EXPENSES	$906,272
NET INCOME	$420,904

See accompanying notes to financial statements.

Exhibit VII-2

Audited Financial Statement for Final Analysis, Inc.
For the Period Ending October 31, 1994

FINAL ANALYSIS, INC.
CONSOLIDATED STATEMENT OF CASH FLOWS
FOR THE YEAR ENDED DECEMBER 31, 1993

CASH FLOWS FROM OPERATING ACTIVITIES:

Net Income		$420,904
Adjustments to Reconcile Net Income to Net Cash Provided by Operating Activities:		
Depreciation and Amortization	$ 21,508	
Increase in Accounts Receivable	(367,449)	
Increase in Payables/Accrued Exp.	23,285	
Total Adjustments		$(322,656)
Net Cash Provided by Operating Activities		$98,248

CASH FLOWS FROM INVESTING ACTIVITIES:

Capital Expenditures	$ (57,407)	
Net Cash Used in Investing Activities		$ (57,407)

NET INCREASE IN CASH AND CASH EQUIVALENTS	$ 50,126
CASH/EQUIVALENTS AT BEGINNING OF YEAR	$ 32,677
CASH/EQUIVALENTS AT END OF YEAR	$ 82,803

See accompanying notes to financial statements.

FINAL ANALYSIS, INC.
STATEMENT OF CHANGES IN RETAINED EARNINGS
FOR THE YEAR ENDED DECEMBER 31, 1993

RETAINED EARNINGS JANUARY 1, 1993	$65,375
NET INCOME 1993	$420,904
RETAINED EARNINGS DECEMBER 31, 1993	$486,279

See accompanying notes to financial statements.

Business Accounting Services

B.A.S.

8015 Cloverwood Ct.
Gaithersburg, MD 20879
Tel: 301-840-0227
Fax: 301-840-0BAS

INDEPENDENT AUDITORS' REPORT

BUSINESS ACCOUNTING SERVICES
8015 CLOVERWOOD CT
GAITHERSBURG, MD 20879

NOVEMBER 14, 1994

BOARD OF DIRECTORS
FINAL ANALYSIS, INC.

WE HAVE AUDITED THE ACCOMPANYING BALANCE SHEET OF FINAL ANALYSIS, INC., AS OF OCTOBER 31, 1994 AND CASH FLOWS FOR THE PERIOD THEN ENDED. THESE FINANCIAL STATEMENTS ARE THE RESPONSIBILITY OF THE COMPANY'S MANAGEMENT. OUR RESPONSIBILITY IS TO EXPRESS AN OPINION ON THE FINANCIAL STATEMENTS BASED ON OUR AUDIT.

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SINCERELY,

FARROKH A. BAIK, C.P.A.
CERTIFIED PUBLIC ACCOUNTANT

FINAL ANALYSIS, INC.
BALANCE SHEET
FOR THE PERIOD
JANUARY 1, 1994 THROUGH OCTOBER 31, 1994

ASSETS

Cash		$86,873
Accounts Receivables		612,722
Security Deposit		6,099
Equipment	9,907,810	
Less: Accum. Depreciation/	163,798	9,744,012
Capital Lease	18,840	
Less: Accum. Amortization	3,768	15,072
TOTAL ASSETS		$10,464,778

LIABILITIES

Stockholders' Capital	$8,634,254
Accounts Payables	210,000
Lease Obligation	12,262
TOTAL LIABILITIES	$8,856,516

STOCKHOLDERS EQUITY

Capital Stock (100 Shares of Common Stock Issued and Outstanding)	$ 100
Retained Earnings	$1,608,162
TOTAL STOCKHOLDERS EQUITY	$1,608,262
TOTAL LIABILITIES AND STOCKHOLDERS EQUITY	$10,464,778

Notes: Accounts Receivables include an invoice dated 7/1/94 for the amount of $2,722; Invoice dated 7/31/94 for the amount of $455,000 and an Invoice dated 10/30/94 in the amount of $155,000.

Equipment depreciated using MACRS 7 year class with Midyear Convention.

50 shares each are issued to Nader Modanlo and Mike Ahan.

See accompanying notes to financial statements.

FINAL ANALYSIS, INC.
STATEMENT OF INCOME AND EXPENSES
FOR THE PERIOD
JANUARY 1, 1994 THROUGH OCTOBER 31, 1994

INCOME FROM OPERATIONS:

RECEIVED	$1,409,465
BILLED BUT NOT RECEIVED	612,722
TOTAL INCOME	$2,022,187

EXPENSES:

Amortization Expense	$3,768
Advertising	387
Computer Subscriptions	6,245
Computer Supplies	7,890
Conferences	1,102
Dues and Subscriptions	1,832
Depreciation Expense	129,740
Employee Benefit Programs	3,440
Insurance	2,753
Books and Resources	1,068
Legal Services	2,627
Licenses	140
Miscellaneous Expenses	6,043
Outside Services/Contractors	23,519
Taxes	63,630
Postage and Delivery	2,012
Printing and Reproduction	5,101
Accounting and Payroll Fees	3,497
Professional Fees-Engineering Contractors	240,917
Professional Fees-Consulting	57,849
Rent	27,411
Repairs	1,084
Salaries	247,517
Supplies	7,946
Travel Expenses	40,570
Utilities	11,420
Interest	796
TOTAL EXPENSES	$900,304
NET INCOME	$1,121,883

See accompanying notes to financial statements.

FINAL ANALYSIS, INC.
STATEMENT OF CHANGES IN RETAINED EARNINGS
FOR THE PERIOD
JANUARY 1, 1994 THROUGH OCTOBER 31, 1994

RETAINED EARNINGS JANUARY 1, 1993	$486,279
NET INCOME 1993	$1,121,883
RETAINED EARNINGS DECEMBER 31, 1993	$1,608,162

See accompanying notes to financial statements.

FINAL ANALYSIS, INC.
CONSOLIDATED STATEMENT OF CASH FLOWS
FOR THE PERIOD
JANUARY 1, 1994 THROUGH OCTOBER 31, 1994

CASH FLOWS FROM OPERATING ACTIVITIES:		
Net Income		$1,121,883
Adjustments to Reconcile Net Income to Net Cash Provided by Operating Activities:		
Depreciation and Amortization	$ 133,508	
Increase in Accounts Receivable	(160,640)	
Increase in Payables/Accrued Exp.	198,977	
Total Adjustments	171,845	
Net Cash Provided by Operating Activities		$1,293,728
CASH FLOWS FROM INVESTING ACTIVITIES:		
Capital Expenditures	$.(9,819,987)	
Net Cash Used in Investing Activities		$(9,819,987)
CASH FLOWS FROM FINANCING ACTIVITIES:		
Net Increase in Security Deposit	$(4,221)	
Net Cash Provided by Financing Activities		$(4,221)
NET INCREASE IN CASH AND CASH EQUIVALENTS		$ 4,070
CASH/EQUIVALENTS AT BEGINNING OF YEAR		$ 82,803
CASH/EQUIVALENTS AT END OF YEAR		$ 86,873

See accompanying notes to financial statements.

Exhibit VII-3

Audited Balance Sheet for Final Analysis Communication Services, Inc.
For the Period Ending October 31, 1994

Exhibit VII-4

Letter Evidencing Commitment of Financial Support from Final Analysis, Inc. to Final Analysis Communication Services, Inc.

Final Analysis Inc.
7500 Greenway Center. suite 1240. Greenbelt, Maryland 20770. Tel: (301) 474-0111 Fax: (301) 474-3228

November 15, 1994

Mr. William F. Caton
Acting Secretary
Federal Communications Commission
1919 M Street, N.W.
Washington, D.C. 20554

Re: Application of Final Analysis Communication Services, Inc. For Authorization to Construct, Launch and Operate a Non-Voice, Non-Geostationary Mobile Satellite System Below 1 GHz

Dear Mr. Caton:

In connection with the filing by Final Analysis Communication Services, Inc. ("FACS"), a wholly-owned subsidiary of Final Analysis, Inc. ("FAI") of an Application for authorization to construct, launch and operate a NVNG MSS system below 1 GHz, FAI hereby represents that it will fund: (i) the construction costs associated with the first two FACS satellites; (ii) the cost of their launches, and (iii) the first year's operating costs for the FACS system (hereinafter referred to as the "Initial Project Phase").

FACS has projected a requirement for $6,216,565.00 for the Initial Project Phase. As established in the financial qualifications section of FACS application, FAI has sufficient current assets and operating income to support FACS' financial needs for the Initial Project Phase as required by 47 C.F.R. § 25.140(c) and (d).

If there are any questions concerning the foregoing, kindly contact me directly.

Sincerely,

Nader Modanlo
President

IX. ADDITIONAL REPRESENTATIONS OF FACS

IX. ADDITIONAL REPRESENTATIONS OF FACS

A. Waiver of Use of Frequencies

The Applicant, Final Analysis Communication Services, Inc., hereby waives any claim to the use of any particular frequency or of the electromagnetic spectrum as against the regulatory power of the United States because of the previous use of the same, whether by license or otherwise, and requests an authorization in accordance with the foregoing Application.

B. Regulatory Classification of Service

FACS intends to operate its proposed NVNG MSS system on a non-common carrier basis.

X. CONCLUSION

X. CONCLUSION

Final Analysis Communication Services, Inc., with the showings contained in the foregoing Application, submits that it has demonstrated its legal, technical and financial qualifications to serve as a licensee in the Non-Voice, Non-Geostationary Mobile Satellite Service Below 1 GHz, and that the grant of its Application for license to construct, launch and operate the proposed FACS system will serve the public interest, convenience and necessity. Accordingly, FACS respectfully requests that the Commission grant its Application.

The undersigned, in his individual capacity and on behalf of the Applicant, certifies that the statements made in this Application are true, complete and correct to the best of his knowledge and belief, and are made in good faith.

Respectfully submitted,

FINAL ANALYSIS COMMUNICATION SERVICES, INC.

By______________________
Nader Modanlo, President

FINAL ANALYSIS COMMUNICATION SERVICES, INC.
7500 Greenway Center, Suite 1240
Greenbelt, MD 20770
Telephone: (301) 474-0111

Of Counsel:
Albert J. Catalano
Ronald J. Jarvis
CATALANO & JARVIS, P.C.
1101 30th Street, N.W. Ste. 300
Washington, D.C. 20007

Date: November 16, 1994

XI. APPENDICES

Certification of Engineer

I, Burton J. Levin, Ph.D., BSEE, by my signature affixed below, hereby certify that:

(i) I am the technically qualified person responsible for preparation of the engineering information contained in this Application;

(ii) I am familiar with Part 25 of the Commission's Rules;

(iii) I have either prepared or reviewed the engineering information submitted in this Application; and

(iv) It is complete and accurate to the best of my knowledge.

Burton J. Levin

Burton J. Levin, Ph.D., BSEE
13634 Orchard Drive
Clifton, VA 22024
(703) 802-6796

Dated: November 16, 1994

Certification

Final Analysis Communication Services, Inc. hereby certifies that it is not subject to denial of Federal benefits that include Federal Communications Commission benefits pursuant to the provisions of Section 5301 of the Anti-Drug Abuse Act of 1988.

FINAL ANALYSIS COMMUNICATION SERVICES, INC.

By: ______________________
Nader Modanlo, President

Dated: November 16, 1994

Certification

Final Analysis Communication Services, Inc. hereby certifies that it is not subject to denial of Federal benefits that include Federal Communications Commission benefits pursuant to the provisions of Section 5301 of the Anti-Drug Abuse Act of 1988.

FINAL ANALYSIS COMMUNICATION SERVICES, INC.

By: ______________________________
Nader Modanlo, President

Dated: November 16, 1994