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October 30, 1997

Mr. William F. Caton
Acting Secretary
Federal Communications Commission
Internal Bureau - Satellites
P.O. Box 358210
Pittsburgh, PA 15251-5210

Re: Amendment to Application of Final Analysis Communication Services, Inc. for Authority to Construct, Launch and Operate a Low Earth Orbit Satellite System (File No. 25-SAT-P/LA-95)

Dear Mr. Caton:

Final Analysis Communication Services, Inc. ("Final Analysis"), by its attorneys, and pursuant to Part 25 of the Commission's Rules, hereby submits an original and nine copies of an Amendment to the above-captioned application.

Also enclosed is a completed FCC Form 159 and a check made payable to the order of the FCC in the amount of $3,645.00 to cover the filing fee specified for the Amendment. Please acknowledge receipt on the enclosed "stamp and return" copy and return with the courier for our records.

Should you have any questions concerning this submission, please contact the undersigned.

Sincerely,

Aileen A. Pisciotta
Counsel for Final Analysis
Communication Services, Inc.

Enclosures

FCC/MELLON OCT 30 1997 0456

READ INSTRUCTIONS CAREFULLY BEFORE PROCEEDING

(1) LOCKBOX # 358210

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FEDERAL COMMUNICATIONS COMMISSION REMITTANCE ADVICE

PAGE NO 1 OF 1

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SECTION A - PAYER INFORMATION

(2) PAYER NAME (if paying by credit card, enter name exactly as it appears on your card): Final Analysis Inc.

(3) TOTAL AMOUNT PAID (dollars and cents): $ 3,645.00

(4) STREET ADDRESS LINE NO. 1: 9701-E Philadelphia Court

Received

(5) STREET ADDRESS LINE NO. 2:

(6) CITY: Lanham

(7) STATE: MD

(8) ZIP CODE: 20706

NOV 6 1997

(9) DAYTIME TELEPHONE NUMBER (include area code): (301) 459-4100

(10) COUNTRY CODE (if not in U.S.A.):

IF PAYER NAME AND THE APPLICANT NAME ARE DIFFERENT, COMPLETE SECTION B
IF MORE THAN ONE APPLICANT, USE CONTINUATION SHEETS (FORM 159-C)

SECTION B - APPLICANT INFORMATION

(11) APPLICANT NAME (if paying by credit card, enter name exactly as it appears on your card): Final Analysis Communication Services, Inc.

(12) STREET ADDRESS LINE NO. 1: 9701-E Philadelphia Court

(13) STREET ADDRESS LINE NO. 2:

7-SAT-AMEND-98

(14) CITY: Lanham

(15) STATE: MD

(16) ZIP CODE: 20706

(17) DAYTIME TELEPHONE NUMBER (include area code): (301) 459-4100

(18) COUNTRY CODE (if not in U.S.A.):

COMPLETE SECTION C FOR EACH SERVICE, IF MORE BOXES ARE NEEDED, USE CONTINUATION SHEETS (FORM 159-C)

SECTION C - PAYMENT INFORMATION

(19) FCC CALL SIGN/OTHER ID	(20) PAYMENT TYPE CODE (PTC)	(21) QUANTITY	(22) FEE DUE FOR (PTC) IN BLOCK 20	FCC USE ONLY
(A) FCC File No. 25-SAT-P/LA-95	C A W	1	$ 3,645.00	
(B)			$	
(C)			$	
(D)			$	

(23A) FCC CODE 1 — (24A) FCC CODE 2

(23B) FCC CODE 1 — (24B) FCC CODE 2

(23C) FCC CODE 1 — (24C) FCC CODE 2

(23D) FCC CODE 1 — (24D) FCC CODE 2

SECTION D - TAXPAYER INFORMATION (REQUIRED)

(25) PAYER TIN: 0 5 2 1 7 6 5 7 8 2

(26) COMPLETE THIS BLOCK ONLY IF APPLICANT NAME IN B-11 IS DIFFERENT FROM PAYER NAME IN A-2: APPLICANT TIN 0 5 2 1 9 0 0 7 9 0

SECTION E - CERTIFICATION

(27) CERTIFICATION STATEMENT

I, Nader Modanlo (PRINT NAME), Certify under penalty of perjury that the foregoing and supporting information are true and correct to the best of my knowledge, infomation and belief. SIGNATURE [signature]

SECTION F - CREDIT CARD PAYMENT INFORMATION

MASTERCARD — MASTERCARD/VISA ACCOUNT NUMBER: — EXPIRATION DATE: MONTH YEAR

VISA — I hereby authorize the FCC to charge my VISA or MASTERCARD for the service(s)/authorization(s) herein described. — AUTHORIZED SIGNATURE — DATE

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FINAL ANALYSIS, INC.
9701-E PHILADELPHIA CT. 301-459-4100
LANHAM, MD 20706

PAY

Oct 30, 1997 *****$3,645.00*
DATE AMOUNT

Memo:

Three Thousand Six Hundred Forty-Five and 0/100 Dollars

TO THE
ORDER
OF: Federal Communications Comm.

⑈000456⑈ ⑆055003201⑆2040000044736⑈

FIRST UNION NATIONAL BANK
OF MARYLAND
BOWIE, MD

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⑈000456⑈ ⑆055003201⑆2040000044736⑈

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
FINAL ANALYSIS COMMUNICATION SERVICES, INC.	)	File Nos. 76-SAT-AMEND-96
	)	25-SAT-P/LA-95
Application for Authority to Construct,	)	
Launch and Operate a Non-Voice	)	
Non-Geostationary Mobile Satellite System	)	

To: Chief, International Bureau

AMENDMENT TO APPLICATION

Nader Modanlo, President
FINAL ANALYSIS COMMUNICATION SERVICES, INC.
9701-E Philadelphia Court
Lanham, MD 20706
(301) 459-4100

Of counsel:
Aileen A. Pisciotta
Peter A. Batacan
KELLEY DRYE & WARREN LLP
1200 19th Street, N.W.
Suite 500
Washington, D.C. 20036

October 30, 1997

TABLE OF CONTENTS

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
FINAL ANALYSIS COMMUNICATION SERVICES, INC.	)	File Nos. 76-SAT-AMEND-96
	)	25-SAT-P/LA-95
Application for Authority to Construct,	)	
Launch and Operate a Non-Voice	)	
Non-Geostationary Mobile Satellite System	)	

To: Chief, International Bureau

AMENDMENT TO APPLICATION

Final Analysis Communication Services, Inc. ("Final Analysis"), by its attorneys, hereby submits this amendment to its above-captioned application for authority to construct, launch and operate a non-voice non-geostationary mobile satellite service ("NVNG MSS" or "Little LEO") system.[1] As described more fully below, Final Analysis hereby proposes to modify various technical aspects of its "FAISAT" constellation as proposed in its Original Application[2], as

[1] *See* Final Analysis Communication Services, Inc., Application for Authority to Construct, Launch and Operate an NVNG MSS System, File No. 25-SAT-P/LA-95, filed on November 16, 1994.

[2] As referred to herein, Final Analysis's "Original Application" consists of its original application filed on November 16, 1994 and subsequent amendments filed on February 24, 1995, February 23, 1996, and August 19, 1996.

required to bring it into conformance with the rules and policies adopted by the Commission in the recently released NVNG MSS second round processing *Report and Order*.[3]

I. OVERVIEW

Final Analysis hereby amends its Original Application to apply for "System 2" as defined in the *Report and Order*[4] and consistent with the Joint Proposal[5] agreed to by the pending second-round NVNG MSS applicants. The *Report and Order* provides, among other things, that Final Analysis operate the FAISAT constellation in System 2 and time-share its downlink channels with the NOAA Meteorological Satellite Systems ("NOAA MetSats" or "Government satellites") in the 137-138 MHz band assigned to System 2.[6]

In order to conform the FAISAT constellation as proposed in Final Analysis's Original Application to the frequency plan and operating parameters subsequently assigned to System 2 by the *Report and Order* -- particularly implementation of the requirement to time-share downlink channels with the NOAA MetSats in the 137-138 MHz band -- it is necessary for Final Analysis to make the following modifications to its original system design by this Amendment: (i) change of the frequency plan to utilize the bands assigned to System 2; (ii) reduction in the

---

[3] *See Amendment of Part 25 of the Commission's Rules to Establish Rules and Policies Pertaining to the Second Processing Round of the Non-Voice, Non-Geostationary Mobile Satellite Service*, Report and Order, IB Docket No. 96-220, FCC 97-370 at ¶¶ 131, 138 (rel. October 15, 1997) ("*Report and Order*").

[4] *See Report and Order* at ¶¶ 31-37.

[5] *See* Joint Proposal of E-SAT, Inc. ("E-SAT"), Final Analysis Communication Services, Inc., Leo One USA Corp. ("Leo One"), Orbital Communications Corporation ("ORBCOMM") and Volunteers in Technical Assistance ("VITA"), filed in IB Docket No. 96-220 on September 22, 1997 ("Joint Proposal").

[6] *See Report and Order* at ¶¶ 34, 82-91; 47 C.F.R. § 25.259 *as amended*.

inclination of the orbital planes of the primary portion of the FAISAT constellation from 66° to 51°; (iii) decrease in the number of operational satellites in the each orbital plane comprising the primary, or orbital, portion of the FAISAT constellation from six (6) to five (5) satellites per plane; and (iv) increase in the number of orbital planes in the primary portion of the constellation from four (4) to six (6) evenly spaced orbital planes. The supplemental, or polar, portion of the constellation will remain unchanged consisting of two (2) satellites in quadrature orbits inclined to 83° to provide for enhanced polar coverage. Overall, these modifications will result in a modest increase in the size of the proposed constellation from 26 operational satellites with four (4) in-orbit spares to 32 operational satellites with six (6) in-orbit spares.

The altitude of circular orbits of the satellites of 1000 kilometers and the orbital eccentricity of approximately 0° specified in the Original Application will remain unchanged.

As the Commission stated in the *Report and Order*, amendments to NVNG MSS applications will be "accepted unconditionally" as minor conforming amendments to the extent that they are necessary to bring the application into conformance with the new rules and do not create new or increased frequency conflicts.[7] This formulation is consistent with Section 25.116 of the Commission's Rules which states that amendments will be treated as minor conforming amendments if they are "demonstrably necessitated" by a change in events that an NVNG MSS applicant could not have reasonably foreseen at the time it filed its original application.[8] The specific modifications proposed to the FAISAT constellation in this amendment fall within this definition of minor conforming amendment. Specifically, the proposed changes are necessary

---

7 *See Report and Order* at ¶ 131.

8 47 C.F.R. § 25.116(c)(4).

to minimize frequency conflicts with government and commercial users that may occur in implementing the time-sharing requirements in the frequencies assigned to System 2 while ensuring that System 2 has sufficient availability to provide a the full array of Little LEO services, including near real time services, required to meet the Commission's objective of licensing at least three full service competitors in the Little LEO market.[9]

When Final Analysis filed its Original Application on November 16, 1994, the Commission had not yet proposed time-sharing with government satellites in portions of the spectrum allocated at WARC-92 in the 137-138 MHz, 148-150.05 and 400.15-401 MHz bands (the "WARC-92 spectrum") to the NVNG MSS service. Thus, the proposed configuration of the FAISAT constellation in the Original Application of 24 primary satellites in four evenly spaced orbital planes (with 2 supplementary satellites for polar coverage) provided optimal coverage of the continental United States ("CONUS") of approximately 100 percent with only nominal service outages using the WARC-92 spectrum. However, with the subsequent release in 1996 of the *Notice* in IB Docket No. 96-220 proposing technical and licensing rules for second round NVNG MSS applicants, the FCC proposed limiting second round Little LEO operators to time-shared access of portions of the WARC-92 spectrum to facilitate co-existence with government satellite operations including the NOAA MetSats system in portions of the 137-

[9] *See Report and Order* at ¶ 35 and note 66.

138 MHz band[10] and the Department of Defense ("DoD") Defense Meteorological Satellite Program ("DMSP") system in portions of the 400.15-401 MHz band.[11]

As demonstrated in the record in IB Docket No. 96-220, the time-sharing requirements proposed in the *Notice* effectively reduce availability of a typical commercial Little LEO satellite system configuration such as the 26-satellite constellation proposed in Final Analysis's Original Application to about 65 percent availability and increase coverage outages to 35 percent.[12] Similarly, as the Joint Proposal and *Report and Order* require Final Analysis to operate downlink channels on a time-shared basis with NOAA MetSats in the 137-138 MHz band, operating the FAISAT constellation in the spectrum assigned to System 2 will result in coverage outages of approximately 35 percent and will limit coverage availability to approximately 65 percent.

To maintain availability of the FAISAT constellation to that originally proposed (26 satellites at 100%) in light of the time-sharing requirements imposed on System 2 by the *Report and Order* and the Joint Proposal, Final Analysis must increase the number of orbital planes by two (2) and increase the number of satellites by a total of six (6) in the primary portion of the constellation. These modifications to the constellation will allow Final Analysis to operate the

---

[10] The *Notice* also proposed time-sharing with other users in the 137-138 MHz downlink band including ORBCOMM's and Starsys's first round commercial Little LEO systems and France's S80-1 system, the European Meteorological Satellite system ("EUMETSAT") and Russia's METEOR system.

[11] *See Amendment of Part 25 of the Commission's Rules to Establish Rules and Policies Pertaining to the Second Processing Round of the Non-Voice, Non-Geostationary Mobile Satellite Service*, Notice of Proposed Rulemaking, IB Docket No. 96-220, FCC 96-426 (rel. Oct. 29, 1996) ("*Notice*").

[12] *See, e.g.*, Comments of Final Analysis Communication Services, Inc., filed in IB Docket No. 96-220 on December 20, 1996 at 20-22 and Autometric Study, Attachment A.

FAISAT constellation in the spectrum assigned to System 2 at about 80% of the original coverage availability, as proposed in the Original Application, while causing 20 percent less equivalent noise to government satellites than that which would have been generated by the originally proposed FAISAT constellation.[13]

In addition, the reduction in the degree of inclination of the orbital planes will reduce overlap conflict with the NOAA MetSats by distancing the primary portion of the FAISAT constellation from the NOAA MetSats constellation. Accordingly, the reconfiguration of the FAISAT constellation proposed herein is a minor conforming amendment as it: (i) is "demonstrably necessitated" by the time-sharing requirements imposed on Final Analysis by the *Report and Order* in order to operate the FAISAT constellation in the spectrum assigned to System 2; (ii) will minimize frequency conflicts with other existing and future users in the spectrum assigned to System 2 and; (iii) will resolve frequency conflicts with other pending second round NVNG MSS applicants by allowing implementation of the spectrum sharing plan contained in the Joint Proposal.[14]

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[13] As shown by Final Analysis's calculations herein, the noise caused by a 26 satellite constellation with 100 percent availability (as in Final Analysis's Original Application) is equivalent to the noise generated by a 40 satellite constellation with 65 percent availability, or the noise generated by 38 satellites with 68 percent availability. *See* Figure II-1, Final Analysis System Availability and Frequency Time-Sharing *infra*. Thus, Final Analysis's modified satellite constellation which proposes to have 32 operational (and 6 spare) satellites at 65 percent availability will cause 20 percent less equivalent noise than that which would be generated by the 26 satellite constellation with 100 percent availability as proposed in the Original Application. *See* Figure II-3, Final Analysis Constellation Footprint Coverage *infra*.

[14] *See Application of Orbital Communications Corp. for Authority to Construct, Launch and Operate a Non-Voice, Non-Geostationary Mobile-Satellite System,* Order and Authorization, 9 FCC Rcd 6476 at ¶¶ 19, 26 (1994) (the Commission treated ORBCOMM's amended system proposal to increase the number of satellites in its constellation from 20 to 36 as a minor (continued...)

II. DESCRIPTION OF PROPOSED SYSTEM

A. Impact of Timesharing with NOAA

In its Original Application, Final Analysis proposed a constellation configuration of 26 satellites (plus 4 spares) to be placed in circular orbits at an altitude of 1000 km. The primary portion of the constellation consisted of 24 satellites (6 satellites in each of 4 planes), plus one spare for plane, in four evenly spaced orbital planes. (Each plane was inclined to the equator at an angle of 66°.) The supplemental portion of the constellation consisted of two satellites in quadrature orbits inclined 83° to provide enhanced polar coverage. Under the assumption that no time-sharing would be required, this system configuration maximized both coverage and availability within a cost efficient design, enabling Final Analysis to provide a fully competitive range of services, including near real time services, at a reasonable cost to subscribers.

In the *Report and Order*, the Commission has adopted the time-sharing approach initially proposed in the October 1996 *Notice*. The time-sharing requirement has several implications for Final Analysis's original system design. First, the time-sharing obligation requires that the system be redesigned to take into account the additional consideration, not present in the initial design, of minimizing frequency conflicts with the government and other users with whom timesharing must be implemented. Second, due to the significant impact of time-sharing on Final Analysis's system availability, the design must be revised to minimize the adverse impact on efficient use of spectrum. In particular, the Commission has noted that spectrum for Little

---

[14](...continued)
modification on the basis that it would not increase potential harmful interference to existing or planned systems and was incorporated to resolve frequency conflicts with another applicant).

LEO services is scarce.[15] In adopting the frequency plan put forth in the Joint Proposal, including in particular the first priority for System 2 to apply for Supplemental Spectrum,[16] the Commission expressed the expectation that such scarce spectrum will be utilized by System 2 to implement one of three "large systems providing a wide array of Little LEO services" to promote "consumer choice, rapid service deployment and lower prices for consumers."[17] As described herein, even with access to future Supplemental Spectrum, the achievement of such spectrum efficiency and the ability to meet the Commissions public policy goal of licensing an additional NVNGMSS Company which will operate a large system in competition with first round licenses, is dependent upon a constellation design that maximizes system availability. Thus, to the extent timesharing requirements diminish the availability of Final Analysis's constellation, system design modifications are required to achieve the market results the Commission has stated it intends to achieve by awarding a System 2 license.

A. Space Segment

1. Constellation Design

The two major impacts discussed above led Final Analysis to perform several complex studies aimed at minimizing the frequency conflicts and outages that will be caused by the time-sharing requirement. Specifically, Final Analysis studied the impact of the following factors, among others, to determine the necessary modifications to its constellation design: (i) inclination of the orbital planes; (ii) coverage outage experienced by the constellation; (iii) the requirement

---

[15] *See Report and Order* at ¶ 133.

[16] *See* discussion in Section **???** below.

[17] *See Report and Order* at ¶ 35.

to time-share spectrum with NOAA in the 137-138 MHz band; (iv) availability of launch services; and (v) the overall cost of the system. The specific modifications required as a result of this analysis are discussed below.

a. Change in Satellite Inclination

Final Analysis has determined that reducing the inclination of the FAISAT constellation would put greater distance between the footprints of FAISAT satellites and the NOAA satellites, which are in sun synchronous orbits (approximately 98° inclination). Overall, this modification is necessary to help reduce the overlap conflict between the FAISAT constellation and the NOAA satellites and to reduce the problems with time-sharing.

In addition, the 51° inclination orbit provides more rapid access for command and control of the spacecraft in lower latitude, more populated geographic areas because it enables Final Analysis to more cost-efficiently construct additional ground stations for satellite command and control if necessary. This reduces the risk of harmful interference to the NOAA constellation.

In determining the specific reduced inclination, Final Analysis had to take into account the capabilities of its prearranged launch vehicle. Final Analysis's committed launch vehicle, the COSMOS, can be launched from two sites in Russia: Plesetsk and Kapustin Yar. The minimal inclination achievable from Plesetsk is 66°, the inclination proposed for the constellation in our original application. The only inclination available from Kapustin Yar is 51°. Therefore the only reduced inclination we can achieve is the 51° inclination from Kapustin Yar[18].

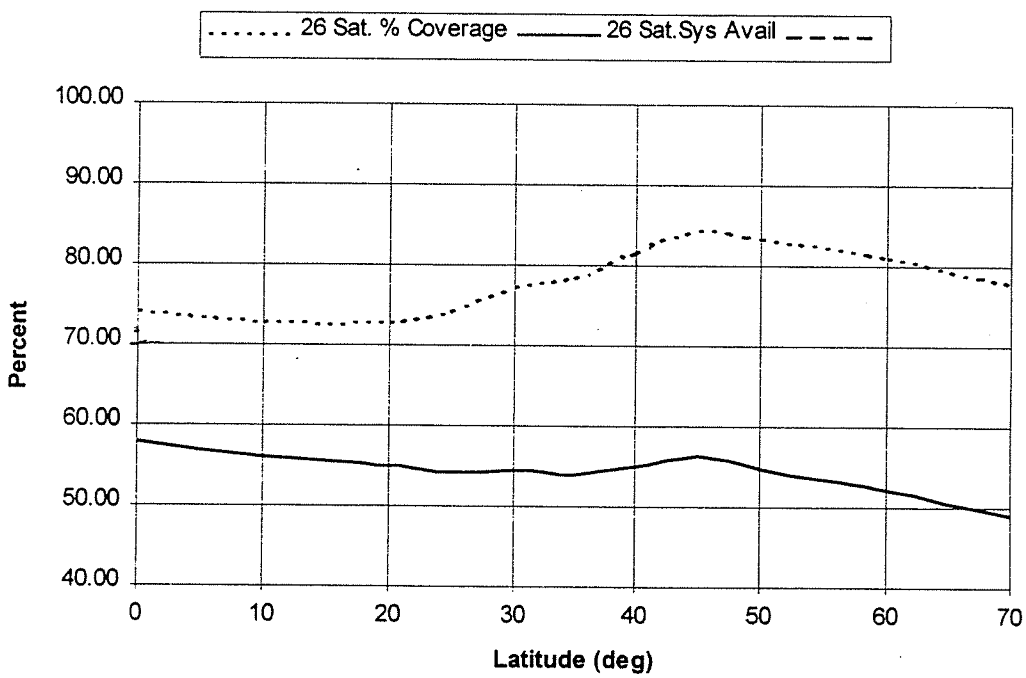
[18] Launches from KapustinYar would require approval by the Russian and Khazakstan governments. Such approvals have been granted in the past.

Consequently, as reflected in this Amendment, Final Analysis now plans to launch its full commercial constellation from Kapustin Yar.

b. Change in Number of Planes and Satellites

As discussed, a modified configuration is required to to compensate for a portion of the reduced availability caused by the requirement of time-sharing with Government satellites. In its comments to the *NPRM*, Final Analysis identified that a major drawback to time-sharing was the outage (i.e. non-availability) of communications with the constellation caused as a result of the need to cease transmission when in the footprint of a government satellite. This outage was estimated to be 35%. The coverage and availability of the original constellation is shown below.

***Figure II-1a Coverage and Availability of Original Constellation**



* <u>Coverage</u> *does not account for timesharing.* <u>Availability</u> *includes impact of timesharing.*

Under the non-timesharing assumptions embodied in Final Analysis's Original Application, coverage and availability were the same. However, the System 2 time-sharing requirements imposed in the *Report and Order* reduce availability. This chart (*i.e.* the solid line) illustrates the reduction in availability of about 35% as a result of the time-sharing requirement. This is a significant reduction in the original time available, resulting in significant constraints on Final Analysis's ability and to serve a number of market segments critical for fully competitive Little LEO operations, including near-real time services.

Since the issuance of the *Report and Order* Final Analysis has studied several alternative configurations which would restore a portion of the availability lost from the initially proposed system due to timesharing requirements. An elementary calculation shows that an increase to 40 satellites actually would be required to compensate for the 35% outage resulting from the imposition of timesharing requirements on a 26 satellite constellation[19]. However, through the application of a cost-benefit analysis, including taking into account the benefits of reducing the orbital inclination of the primary portion of the constellation from 66° to 51°, we have determined that a balanced solution for maximization of service availability and minimization of user interference is a 32 operational satellite constellation with an additional 6 satellites as in-orbit spares.

Figure II-1b illustrates the improved availability made possible by the modified configuration.

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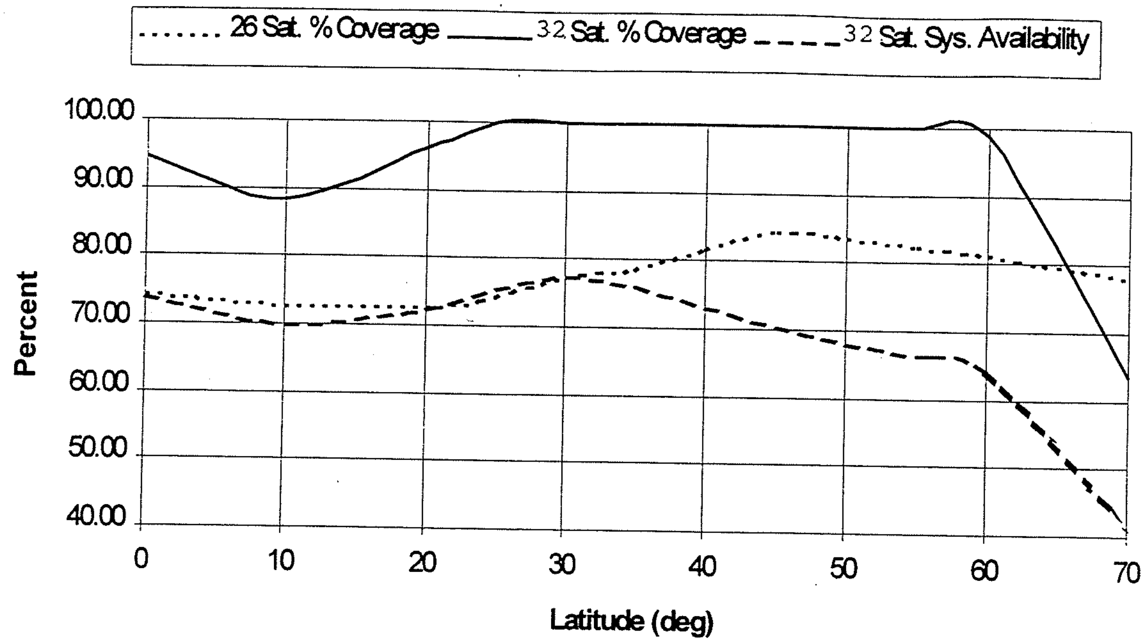
[19] 26 divided by (1.0 - 0.35)=40

Figure II-1 b Final Analysis System Availability and Frequency Timesharing



* Coverage does not account for timesharing. Availability includes impact of time-sharing.

Thus, even though the modified configuration provides a larger coverage than originally proposed (as shown in Fig. II-1b) the resultant availability of the modified configuration is slightly improved, although it is still less than the original constellation[20]. For example the availability of the two constellations are almost identical for latitudes of 0° to about 33°, after which the modified constellation availability reduces substantially from the original availability.

---

[20] Absent a requirement for time-sharing, there would be no need to increase the number of satellites. Increasing the number of satellites results in a significant increase in satellite construction costs, system operational costs, ground station costs, and launch costs. These additional costs have been imposed by the need to reduce the impact of outages caused by time-sharing, and they would not have been imposed through increasing the number of satellites in response to any other circumstances.

However, this modified constellation is still the optimum configuration achievable based on the factors set forth above.

With regard to time-sharing, the System 2 satellites must be capable of turning on transmissions or switching to a different frequency, when in view of NOAA satellites. To do so, each satellite will be programmed to operate only while not in view of a NOAA satellite. The time-sharing operation of each satellite will be completely independent of the operation of the other satellites in the FAISAT constellation. Each satellite will be independently turned off or switched to a different frequency when entering the footprint of a NOAA satellite and will be turned on or switched back to the original frequency when exiting the footprint of the NOAA satellite. The time-sharing operation of each FAISAT spacecraft is only dependent on the orbital parameters of itself and of the NOAA satellites involved in the overlapping footprint. Each satellite will be operated as an independent entity in the FAISAT constellation. Therefore, Final Analysis believes that the modest number of additional satellites proposed should not cause concern to the government satellite operation because adding additional satellites doesn't increase each satellite's complexity or increase processing commands for any one satellite.

The Final Analysis modified system will consist of a constellation of 32 operational satellites, plus 6 additional orbital spares, designated as FAISAT-1A[21] through FAISAT-38 launched over a period of six years. The satellites will all be placed in circular orbits at an altitude of 1000 km. The primary portion of the constellation will consist of 30 operational satellites in six evenly-spaced orbital planes with five operational satellites per plane and one

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[21] The first satellite in the constellation is known as FAISAT-1A due to the fact that FAI's experimental satellite is named "FAISAT-1." The designation of the satellite following FAISAT-1A is FAISAT-2, and so on, through FAISAT-38.

spare per plane, each plane being inclined with respect to the equator at an angle of 51° [22]. A supplemental portion of the constellation consisting of two satellites in two quadrature orbits inclined 83° will provide polar coverage.

The orbit planes for the 36 satellite primary portion of the constellation are evenly spaced at Right Ascensions of 0°, 60°, 120°, 180°, 240° and 300°. The five operational satellites in each of the orbits will be evenly spaced 72° apart. 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 early years of operation.

The constellation coverage statistics are shown in Figure II-1b and the orbital details are shown in Figure II-2. The footprint coverage for the 32 operational satellite constellation is shown in Figure II-3. This amendment alters the previous constellation design by increasing the number of operational satellites from 26 to 32 (increasing the number of orbital spares from 4 to 6 maintaining the original design of one spare per plane) and decreasing the orbital inclination from 66° to 51°. This requires a change in the COSMOS launch site from Plesetsk to Kapustin Yar as previously discussed, for the primary portion of the constellation. These changes in fact result in decreased interference in the 137-138 band.[23]

---

[22] Actual inclination is dependent upon approval on launch from Kapustin Yar by both the Russian Federation and Khazakstan.

[23]The total noise generated by a constellation of 26 satellites 100% of the time is equivalent to the noise generated by a 40 satellite constellation by 65% of the time. Therefore the noise generated by a 32 satellite constellation abut 65% of the time is abut 20% less than that generated by our original 26 satellite constellation 100% of the time.

Figure II-2 Constellation Orbital Parameters

Sa No	Alt (km)	Inc (Deg	Ecc (Deg)	Arg (Deg	Ra (Deg)	M (Deg)	S (Deg
1A	1000.	83	0	0	0	0	360
2	1000.	83	0	0	90	90	360
3	1000.	51	0	0	0	0	360
4	1000.	51	0	0	0	72	360
5	1000.	51	0	0	0	144	360
6	1000.	51	0	0	0	216	360
7	1000.	51	0	0	0	288	360
8*	1000.	51	0	0	0	0	360
9	1000.	51	0	0	60	0	360
10	1000.	51	0	0	60	72	360
11	1000.	51	0	0	60	144	360
12	1000.	51	0	0	60	216	360
13	1000.	51	0	0	60	288	360
14*	1000.	51	0	0	60.	0	360
15	1000.	51	0	0	120	0	360
16	1000.	51	0	0	120	72	360
17	1000.	51	0	0	120	144	360
18	1000.	51	0	0	120	216	360
19	1000.	51	0	0	120	288	360

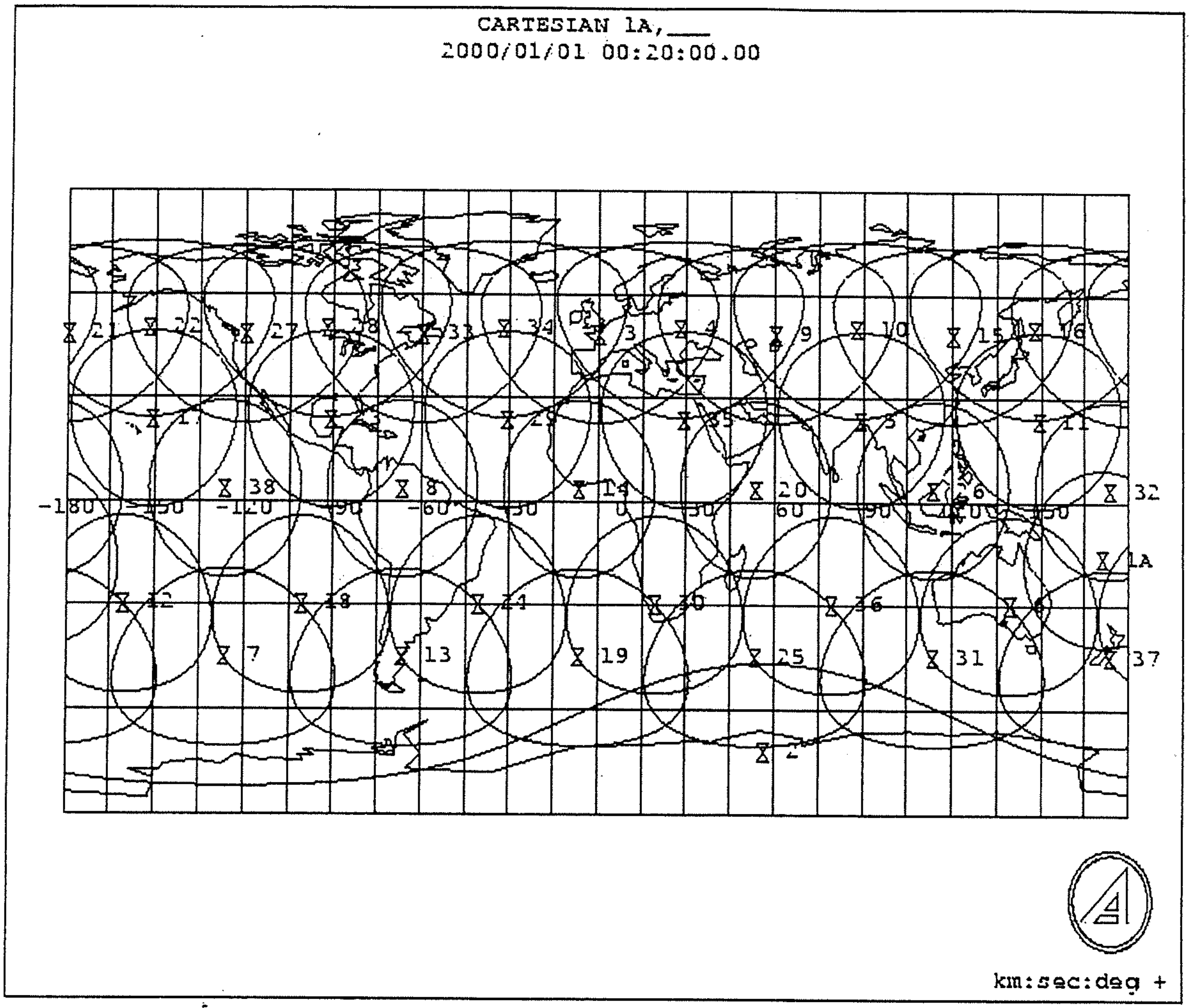
Sa No	Alt (km)	Inc (Deg	Ecc (Deg)	Arg (Deg	Ra (Deg)	M (Deg)	S (Deg
20*	1000.	51	0	0	120	0	360
21	1000.	51	0	0	180	0	360
22	1000.	51	0	0	180	72	360
23	1000.	51	0	0	180	144	360
24	1000.	51	0	0	180	216	360
25	1000.	51	0	0	180	288	360
26*	1000.	51	0	0	180	0	360
27	1000.	51	0	0	240	0	360
28	1000.	51	0	0	240	72	360
29	1000.	50	0	0	240	144	360
30	1000.	50	0	0	240	216	360
31	1000.	50	0	0	240	288	360
32*	1000.	50	0	0	240	0	360
33	1000.	50	0	0	300	0	360
34	1000.	50	0	0	300	72	360
35	1000.	50	0	0	300	144	360
36	1000.	50	0	0	300	216	360
37	1000.	50	0	0	300	288	360
38	1000.	50	0	0	300	0	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

*The following satellite numbers represent spares: 8, 14, 20, 26, 32, and 38.

*Figure II-3 Final Analysis Constellation Footprint Coverage



*This chart shows the footprints of five operational satellites per plane, with the spare satellite occupying the same footprint as the first satellite in each plane.

2. Technical Description of Spacecraft

The FAISAT spacecraft have been designed to meet the technical standards contained in Commission regulations for NVNG MSS operations. The spacecraft design is a follow-on to the experimental FAISAT-1[24] and FAISAT-2v[25] spacecraft authorized by the FCC, which were launched in January 1995 and September 1997 respectively. By using information gathered from the first two spacecraft, an approach was employed which minimizes complexity and thereby increases reliability by using flight proven technology.

The FAISAT-1 spacecraft provided many valuable lessons with respect to interfacing with the Cosmos launch vehicle; volume, mass, and stiffness requirements; early on-orbit operations; and communications link and protocols. The knowledge gained from the FAISAT-1 spacecraft, shown in figure II-4a, led to the configuration of the FAISAT-2v spacecraft, shown in figure II-4b. Additional insights garnered from the launch and on-going operation of FAISAT-2v in orbit have already led to additional enhancements to support the operation of the constellation FAISAT spacecraft.

Figure II-5a is the FAISAT block diagram. Major system specifications are shown in Figure II-5b. The following subsections describe in greater detail all pertinent aspects of the FAISAT satellite system.

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[24] *See* Final Analysis Inc. Experimental Satellite Radio Authorizations under FCC call signs KE2XGU, KE2XGV, KE2XGW, KE2XGX, KE2XGY.

[25] *See* Final Analysis Inc. Experimental Satellite Radio Authorizations under FCC call signs KS2XCY, KS2XCZ, KS2XDA and WA2XHE.

FIGURE II-4a FAISAT-1 Ilustration

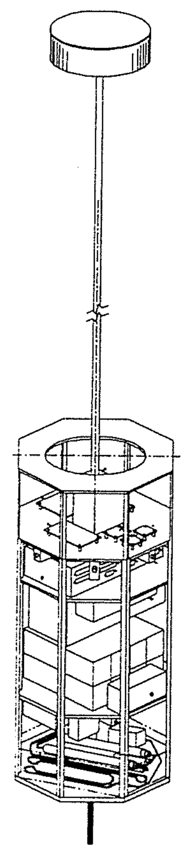


Figure II-4b FAISAT-2v Illustration

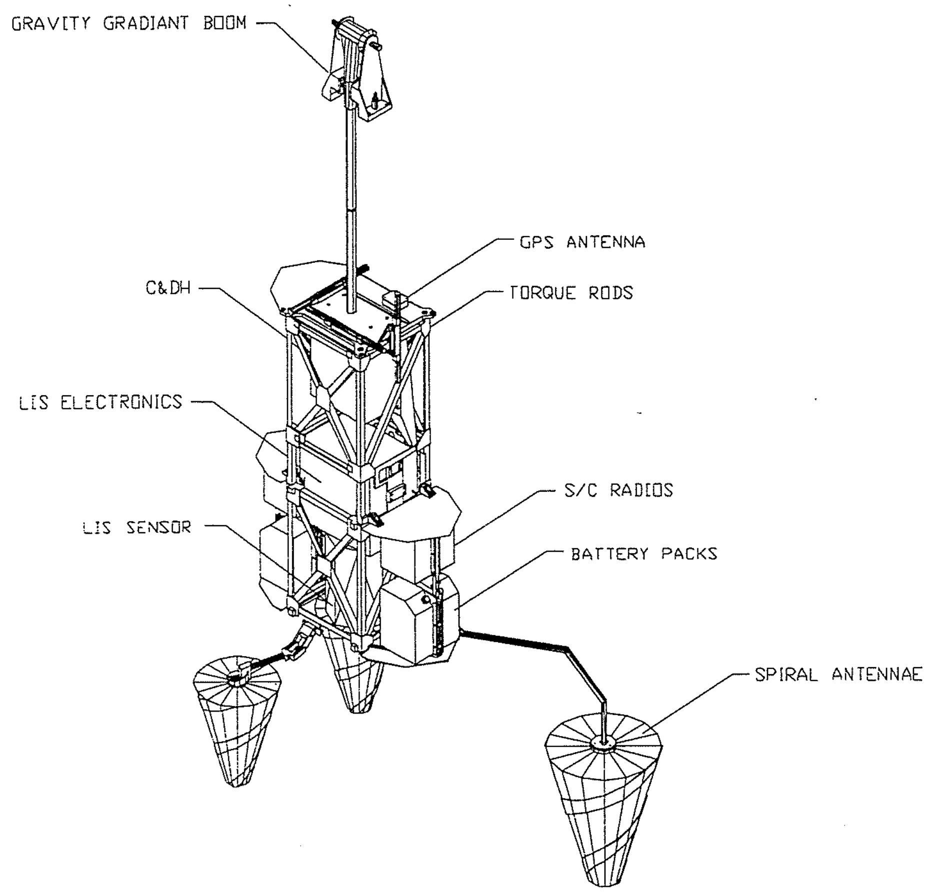


Figure II-5a FAISAT Block Diagram

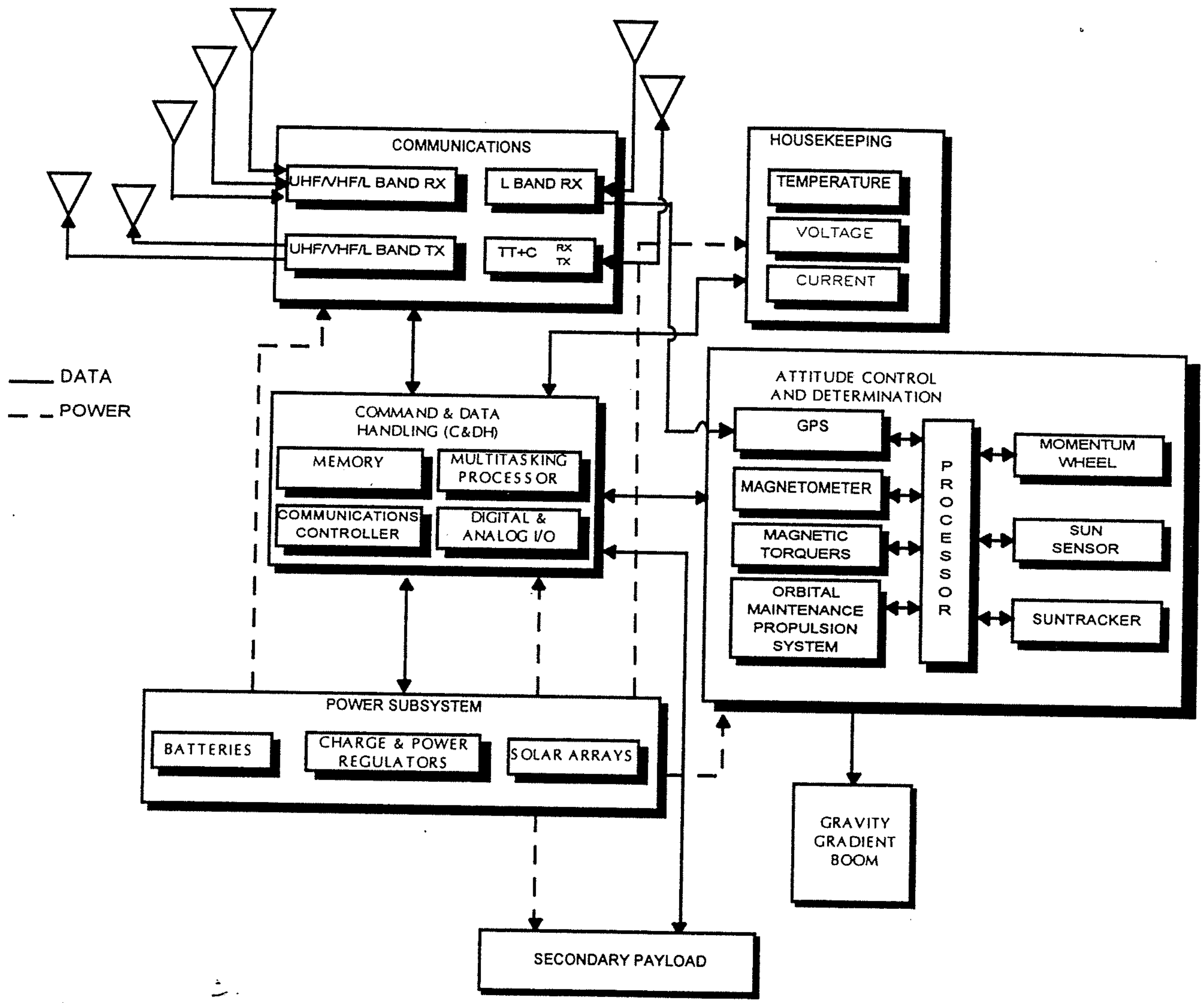


Figure II-5b FAISAT System Specification

Constellation	32 Satellites Total (plus 6 orbital spares)
Primary (51°)	30 Satellites (plus 6 orbital spares)
Supplementary (83°)	2 Satellites
Altitude	1000 km circular
Footprint Coverage	5600 km diameter
Weight	150 kg
Size	
Launch Configuration (stowed)	1100 × 600 × 600 mm
Solar Arrays Deployed	1100 × 2800 × 600 mm
Gravity Gradient Boom Deployed	6100 × 2800 × 600 mm
Solar Array Power	
Max BOL EOL	370 watts 300 watts
Orbital Average EOL (max eclipse)	175 watts
Spacecraft Power Consumption (Average)	160 watts
Transmitters (UHF/VHF)	
Service	10
TT&C	2
Receivers	
Service	40
TT&C	2
Attitude & Position GPS (L Band)	4
Mass Memory	128 MB to 1 GB
Attitude Control	Gravity Gradient with Momentum Wheel
Orbital Maintenance	Cold Gas or Plasma Engine Propulsion
Launch Vehicle	Cosmos
S/C Lifetime	7 years

3. Communications Subsystem - The Payload

Over the past several years, Final Analysis has applied its significant aerospace expertise to the performance of substantial R&D resulting in the development of a state-of-the-art frequency agile, multiple-baud-rate communication payload. Final Analysis "software radios" can operate simultaneously in VHF, UHF and L-band frequency at multiple data rates from 1.2 kbps to 307 kbps in uplink and downlink bands, both feeder and service. This enhanced technology combined with the powerful radiation hardened RISC 6000 on-board computer allows Final Analysis to accommodate any future frequency assignments and also addresses the needs of the international market place for larger data file transfer capabilities[26,27].

Specifically, the flight radios will have the capability to fully operate in the bands made available for System 2 in the *Report and Order*: 148-150.05 MHz (uplink), 137-138 MHz and 400.1-401 MHz (downlink). As referred to above, Final Analysis's software radios can also be tuned to the anticipated domestic allocation of WRC-95 Region 2 frequency band within the 450-470 MHz range.

In its Original Application, Final Analysis requested nine (9) service downlink channels, three (3) feeder downlinks, one (1) feeder uplink, and multiple service uplink channels under STARS operation (STARS is an enhanced version of DCAAS). As explained above, however, restrictions imposed by the *Report and Order* -- namely, time-sharing -- have required Final Analysis to modify its system by adding two more orbital planes. Full implementation of this modified system would optimally call for twelve (12) service downlink channels, four (4) feeder downlinks and four (4) feeder uplinks with each feeder link

---

[26]FAISAT-2v already incorporates such "software" radios capable of operations in various bands from 137-460 MHz.

[27]1.4 GHz experimental and future capability.

operating at 307 kbps. However, we will begin implementing our constellation by using the limited spectrum assigned to System 2. Any additional future allocations will be used to further optimize the implementation of the FAISAT system. *See* discussion of first priority on 210 kHz of "Future Spectrum" and Doppler shift "Supplemental Spectrum *infra.*

Each operational satellite will have 40 uplink (Earth-to-space) receiver channels (including one STARS receiver scanner), one four-channel GPS receiver, 10 transmitter downlink (space-to-Earth) channels, and 2 sets of TT&C receiver and transmitters.[28]. With regard to System 2 spectrum allocation, Final Analysis will perform its feeder uplink operations in the 150-150.05 MHz portion of the Transit band, and will perform service uplink in the 148-149.9 MHz band as proposed by the *Report and Order*. With regard to System 2 downlink, Final Analysis will primarily utilize the 400-401 MHz allocation of System 2 for service downlinks. The 137-138 MHz band will be used primarily for feeder downlinks. Since the 400-401 MHz band can provide 2 or at best 3 service downlinks (depending on the result of coordination with S80 of France). Final Analysis will be anticipating the additional spectrum for completion of its service links.

a. Subsystem Description

The FAISAT on-board communications system consists of receiver modules, transmitter modules, and the antenna subsystem.

As noted, these radio components were developed through extensive R&D and are highly sophisticated, next generation digital radios based on those designed for the FAISAT-

[28] As explained above, FAISAT capability, designed to mitigate this against unknown future market change and regulatory coordination, provides capability in excess of that needed to meet the Report and Order's System 2 requirements. However, we are not applying for authority to operate at this built-in level; indeed, the capability allowed for by System 2 is less than that applied for in our original application.

2v. Numerous methods have been employed to prevent unwanted interference from FAISAT constellation radio sources.

The satellite receivers include various filters to limit the effective noise bandwidth. Likewise, the satellite transmitters also include filters to minimize out-of-band spurious emissions. In addition, the Gaussian Minimum Shift Keying (GMSK) modulation is highly efficient in reducing out-of-band emissions. Emission responses for the various transmitters are presented in Figure II-6.

Figure II-6 Transmitter Emission Characteristics

Percent Bandwidth from Center Freq.	Spurious Emission Below Peak
50 to 100%	-25 dBc[29]
100 to 250%	-35 dBc
>250%	-60 dBc

The FAISAT antenna subsystem incorporates several antennas to allow operation in the various bands - VHF, UHF and L-bands. The specific assignment of System 2 requires 3 antennas: two transmitter antennas and one receiver antenna. The receiver antenna services the 148 to 150.05 MHz band and is left hand circularly polarized (LHCP). The transmit antennas operating in the 400 - 401 and 137 - 138 MHz bands are each right hand circularly polarized (RHCP). The use of LHCP antennas for the 148 - 150.05 band reduces potential interference from/to Russian RNSS satellites, which use RHCP antennas. Final Analysis's proposed polarization plan for System 2 is shown in Figure II-6a.

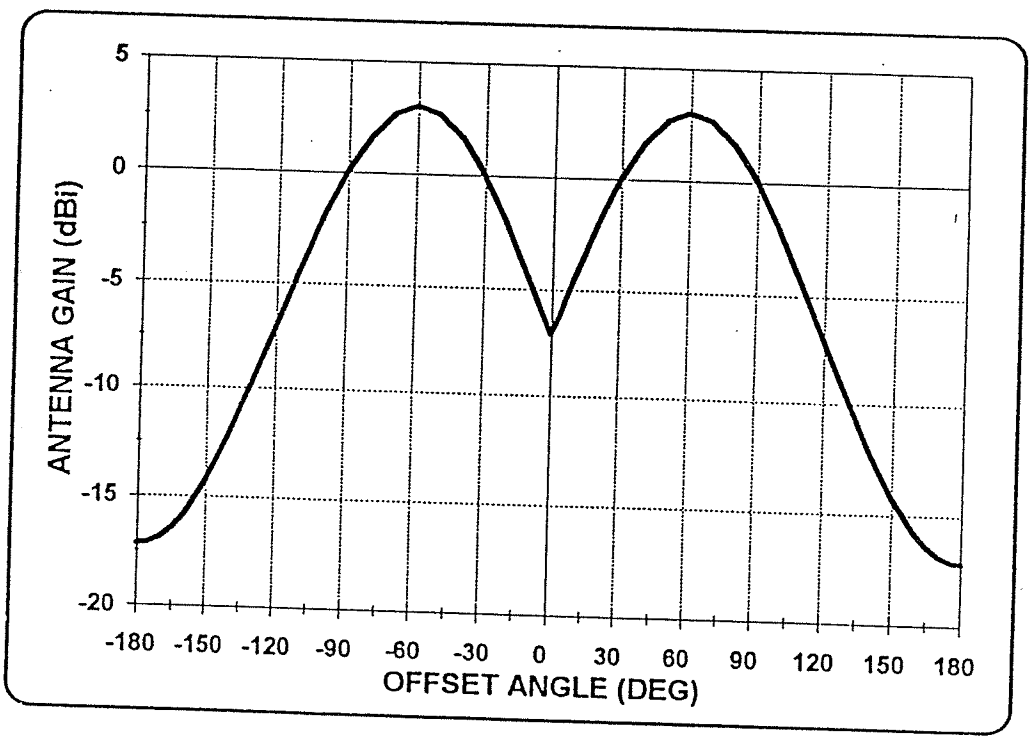
[29]"dBc" refers to "dB relative to the peak carrier level."

Figure II-6a. System 2 Antenna Polarization

Link	Polarization
Service Uplink	Vertical
Service Downlink	RHCP
Feeder Uplink	LHCP
Feeder Downlink	RHCP

In addition, the downlink antennas have an isoflux gain pattern to compensate for the difference in path loss between 5° (minimum elevation angle for system coverage) and 90° elevation angles. For a 1000 km orbit the path loss difference is about 10.1 dB. A typical gain pattern is shown in Figure II-6b. The gain at 5° elevation (about 60° off nadir) is 3 dBi, while the gain at 90° elevation (zero degrees off nadir) is about -7.1 dBi. This results in a near constant power flux density within the footprint of the satellite antenna.

Figure II-6b Typical Satellite Antenna Gain Pattern



The receive module contains 42 VHF/UHF/L-band receivers which will be allocated for various uses: (i) reception of data from either an RT or MT; (ii) receive feeder link transmissions from gateways; and (iii) scanning the desired frequency band for available channels for transmission from the ground.

The heart of the interference avoidance system for the uplink band is the Scanning Telemetry Activity Receiver System (STARS).[30] The STARS receiver will scan the assigned uplink sub-bands in approximately 1 second and measure the spectral power density in each channel. This information will be processed onboard the satellite to determine the best uplink channels, based on minimum power density, to be utilized for the next uplink series.

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

The satellite transmitter module contains VHF/UHF/L-band transmitters for communications with MTs, RTs, and feeder links. The satellite transmitter module contains the modulators, synthesized oscillators, power amplifiers, and filters necessary to generate and shape the transmitted signals.

---

[30] STARS is an enhanced version of DCAAS.

b. Frequency Plan

The following chart, Fig. II-7, describes our use of the spectrum identified for System 2 in the *Report and Order*.

FIGURE II-7. SYSTEM 2 FREQUENCIES

Link	Frequency Band	Licensed Frequencies MHz
Service Uplink	148-149.9 MHz	148-148.25[1] 148.75-148.855[1] 148.855-148.905[2] 148.905-148.955[3] 148.955-149.585[4] 149.635.149.81[4]
Service Downlink	400.15-401 MHz	400.505-400.5517[5] 400.5517-400.5983[6] 400.5983-400.645[7]
Feeder Uplink	149.9-150.05 MHz	150-150.05 MHz[9]
Feeder/ Service Downlink	137-138 MHz	137-137.025[12] 137.025-137.175[9,11] 137.333-137.4125[9,10,1,13] 137.475-137.525[9,11] 137.595-137.645[9,11] 137.753-137.787[9,11] 137.825-138[9,11]

1. Shared with System 1, System 3, and ORBCOMM, subject to coordination with the S80 system.

2. If System 3 does not use this band for feeder links, this band may be shared with System 1 and ORBCOMM. (Since System 3 proposed to perform its feeder uplink operation outside of CONUS, this band can be used for service uplink within CONUS).

3. If S80 does not use this band for feeder links operation, this band may be shared with System 1 and ORBCOMM.

4. Shared with System 1, and ORBCOMM.

5. Subject to time sharing with VITA's satellite authorized in the first processing round.

6. Use pending permission from France; may be used until S80 system commences operations in this spectrum.

7. Subject to time-sharing with the VITA satellite if VITA receives permission from the Commission in the second round to construct, launch, and operate this satellite.

8. Subject to coordination the Russian RNSS system. If System 2 is authorized to relocate its feeder uplinks to spectrum allocated to Little LEO service at WRC-97 or a future world radio conference and domestically allocated by the Commission, System 2 shall vacate this band.

9. Subject to time sharing with NOAA.

10. Subject to time sharing with the Russian METEOR system (137.375-137.4125).

11. Subject to coordination with System 3, consistent with the agreements GE-Starsys entered into with ORBCOMM and coordination with the NOAA and the S80 system.

12. Use upon System 1's surrender of its authorization.

13. The 137.367 - 137.4125 band will be time shared and subject to coordination with the Russian METEOR system.

The FAISAT modulation plan and data rate for our use of System 2 is shown in Figure II-8. As the chart indicates, Final Analysis plans to use GMSK Modulation for service and feeder uplinks and downlinks. The chart further describes the additional capability designed into the FAISAT constellation (FAISAT capability column). The actual planned use of System 2 is described in the column following.

Figure II-8 Modulation Plan and Data Rate

	MAXIMUM BIT RATE		
Link	FAISAT Capability	System 2 Availability	Modulation
Service Uplink	1.2 to 307 kbps[1]	9.6 kbps	GMSK
Service Downlink	4.8 to 307[1] kbps	19.2 kbps	GMSK
Feeder Uplink	307 kbps	28 kbps[2]	GMSK
Feeder Downlink	307 kbps	112 kbps[3]	GMSK

[1] Only for fixed Service Link.

[2] Due to limited 50 khz uplink feeder operation allocated for System 2.

[3] Only the 137.825-138 portion of the 137-138 MHz is adequate for this data rate, lower data rate is required at other segments of this band.

With regard to the specific use of the 137-138 MHz band, it is Final Analysis's intention to use these frequencies primarily for feeder downlinks. In response to the Commission's requirement in Part 25 to identify a specific center point with a unique emission designator, listed below is a tentative band center and emission designator for the 137 channels. However, Final Analysis's use of these bands is subject to coordination with multiple other users of the 137-138 band and so the specific center and designator are subject to modification. With that caveat, the following are the proposed 137-138 band centers/designators: 137.025-1376.175 center is 137.100, with data rate of 96 kbps and designator of 150KF1D; 137.333-137.4125 center is 137.37275, with data rate of 48 kbps and designator 77K51D; 137.475-137.525 center is 137.5500 with data rate of 28 kbps and designator of 47K51D; 137.595-137.6450 center is 137.6200 with data rate of 28 kbps and designator 47K5F1D; 137.753-137.787 center is 137.770 with data rate of 18 kbps and designator 32K5F1D; 137.825-138 center is 137.9125 with data rate of 112 kbps and designator 174KF1D.

With regard to the specific use of the 400 band, Final Analysis intends to use it primarily for service downlinks. Specifically, 400.505-400.5517 center is 400.528 with data rate of 19.2 kbps and designator 45K0F1D; 400.5983-400.645 center would be 400.622 with same data rate and designator as the previous band. Should coordination with S-80 of France be successful and Final Analysis is able to operate from 400.5517-400.5983 center is 400.575 with data rate of 19.2 kbps and designator of 45K0F1D.

With regard to proposed service uplinks in the band 148-149.81, Final Analysis will perform STARS/DCAAS operation in this band to find available channels. Final Analysis proposes to perform service uplink operations at 9.6 kbps with designator 20K0F1D.

With regard with to feeder links, as System 2 allows, we will operate in 150-150.05 MHz band. The center frequency would be 150.025 with data rate of 28 kpbs and designator of 50K0F1D.

c. Link Analysis

The link margin and analysis results for the various uplinks and downlinks are shown in the following figures.

Figure II-9
Service Downlink (400-401 MHz)

Frequency (Typical)	400.528 MHz
Transmitter Power	32 W
Transmitter Power	15 dBW
Transmitter Line Loss	-0.2 dB
Transmitter Antenna Gain	3.0 dBi
EIRP	17.8 dBW
Slant Range	3194.5 km
Space Loss	-154.5 dB
Polarization Loss	-0.5 dB
Atmospheric Loss	-1.0 dB
Receive Antenna Gain	0 dBi
System Noise Temperature	505 K
Data Rate	19,200 bps
Eb/No	20.6 dB
Bit Error Rate (BER)	1E-5
Required Eb/No	13.5 dB
Implementation Loss	-2.0 dB
Margin	5.1 dB

Figure II-10
Service Uplink (148-149.81 MHz)

Frequency (Typical)	149 MHz
Transmitter Power	20 W
Transmitter Power	13 dBW
Transmitter Line Loss	-0.2 dB
Transmitter Antenna Gain	0 dBi
EIRP	12.8 dBW
Slant Range	3194.5 km
Space Loss	-145.9 dB
Polarization Loss	-3.0 dB
Atmospheric Loss	-1.0 dB
Receive Antenna Gain	3.0 dBi
System Noise Temperature	940 K
Data Rate	9600 bps
Eb/No	26.9 dB
Bit Error Rate (BER)	1E-05
Required Eb/No	25.0 dB
Implementation Loss	-2.0 dB
Margin	9.6 dB

Figure II-11
Feeder Uplink (149.9-150.05 MHz)

Frequency	150.025 MHz
Transmitter Power	150 W
Transmitter Power	21.8 dBW
Transmitter Line Loss	-1.0 dB
Transmitter Antenna Gain	12.0 dBi
EIRP	32.8 dBW
Slant Range	3194.5 km
Space Loss	145.9 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	28,000 bps
Eb/No	42.8 dB
Bit Error Rate (BER)	1E-05
Required Eb/No	13.5 dB
Implementation Loss	-2.0 dB
Margin	27.3 dB

Figure II-12
Feeder Downlink (137-138 MHz)

Frequency (Typical)	137.9125 MHz
Transmitter Power	32 W
Transmitter Power	15 dBW
Transmitter Line Loss	-0.2 dB
Transmitter Antenna Gain	3.0 dBi
EIRP	17.8 dBW
Slant Range	3194.5 km
Space Loss	-145.3 dB
Polarization Loss	-0.5 dB
Atmospheric Loss	-1.0 dB
Receive Antenna Gain	12 dBi
System Noise Temperature	1565 K
Data Rate	112,000 bps
Eb/No	29.2 dB
Bit Error Rate (BER)	1E-05
Required Eb/No	13.5 dB
Implementation Loss	-2.0 dB
Margin	13.7 dB

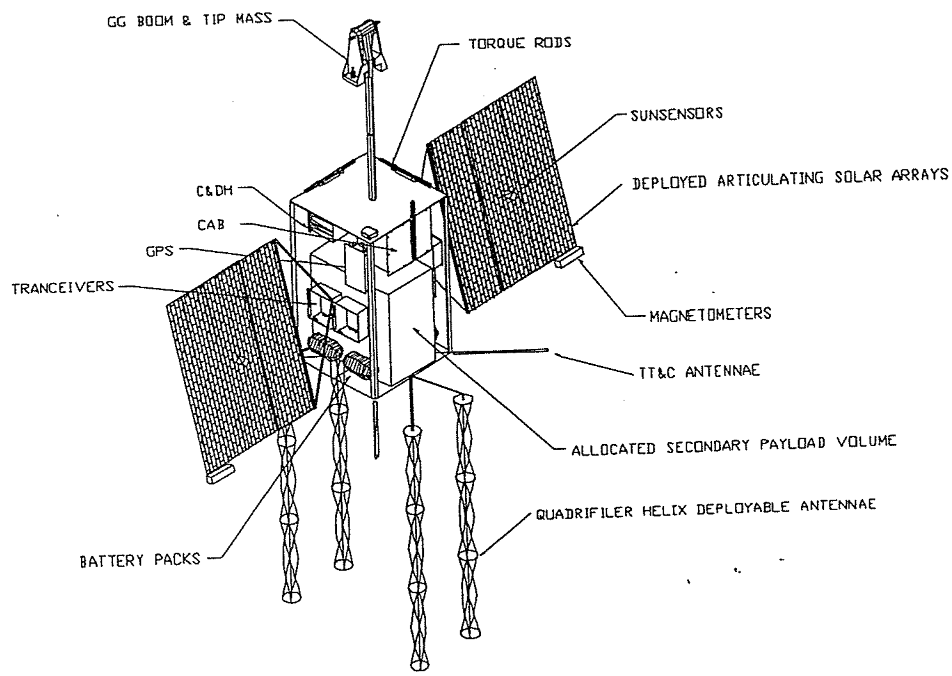
Figure II-13
Service Downlink (137-138 MHz)

Frequency (Typical)	137.528 MHz
Transmitter Power	32 dBW
Transmitter Power	15 dBW
Transmitter Line Loss	-0.2 dB
Transmitter Antenna Gain	3.0 dBi
EIRP	17.8 dBW
EIRP dB(W/m^2/4kHz)	14.85dBW
Slant Range	3194.5 km
Space Loss	-145.2 dB
Polarization Loss	-3.0 dB
Atmospheric Loss	-1.0 dB
Receive Antenna Gain	0.0 dBi
System Noise Temperature	1565 K
Data Rate	9600 bps
Eb/No	23.7 dB
Bit Error Rate (BER)	1E-05
Required Eb/No	13.5 dB
Implementation Loss	-2.0 dB
Margin	13.6 dB
PFD dB (W/m^2/4kHz)	-126.2 dB

4. Mechanical Subsystem

The mechanical configuration of FAISAT in the on-orbit state is illustrated in Figure II-14.

Figure II-14 FAISAT On-Orbit Configuration



(STRUCTURAL SKIN PANELS NOT SHOWN FOR CLARITY)

The configuration of the spacecraft is shown in the deployed state in Figure II-14. The satellite is rectangular in shape with an open architecture of trusses to minimize weight and maximize stiffness. The main body of the spacecraft is 1100 mm long and 600 by 600 mm width and depth, respectively. The solar panels, stowable at launch, are deployable in 3 segments on each side of the spacecraft, providing approximately 2.20 m^2 of total solar array area and a maximum output of 370 watts. The arrays are articulated in one axis for sun tracking, while the spacecraft is stabilized via the gravity gradient boom in pitch and roll and a momentum wheel for yaw axis control, maneuverability, and stability.

Components are mounted on shelves at various heights within the rectangular box-like structure, and as can be seen in Figure II-14, a volume is incorporated to carry secondary payloads for scientific research. The majority of the spacecraft functional and telemetry components are mounted on the structural side panels and the upper and lower end plates. This layout allows for the efficient accommodation of all components critical for the primary function of the spacecraft, while providing a flexible envelope to accommodate secondary payloads of various configurations.

The weight of the spacecraft is approximately 125 kg for the primary spacecraft and an additional 25 kg set aside for secondary payloads. The mass properties breakdown is shown in Figure II-15.

Figure II-15 Mass Properties Breakdown	
Component	**Weight (kg)**
Structure	30.0
C&DH/CAB	15.0
Communications Payload	12
Power System Batteries Solar Panels with Mechanisms	 15.0 14.0
Attitude Control System G.G. Boom GPS Magnetometers and Magnetic Torquers Momentum Wheel	 4.0 2.0 2.0 1.0
Orbital Maintenance System	15.0
Cabling and Misc. Hardware	15.0
Secondary Payload	25.0
Total Weight	**150.0**

5. Thermal Subsystem

The thermal environment of the spacecraft will be controlled via passive design techniques, including thermal blankets, radiators for rejecting heat, controlling conductive thermal interfaces, and judicious use of reflective coatings to improve the thermal system performance in the sun and in eclipse periods. The spacecraft thermal subsystem has been designed to establish a thermal environment within the main body of the spacecraft to a range of +10°C to +40°C. Externally mounted devices, such as the 3 axis magnetometer and solar panels have been designed to handle an extended range of temperatures of approximately -60° to +80°C to accommodate their isolation from the rest of the spacecraft. A separate compartment in the spacecraft will be used to house the batteries which will be thermally isolated from the rest of the spacecraft and will be biased cold through the use of radiator panels to effectively control their operation to a narrower range (0°C to +20°C) to optimize their performance. Small electrical resistance heaters will be used to augment control of the battery's temperatures during minimal use periods.

6. Electrical Power System

The electrical power system consists of solar panels, rechargeable batteries, and charge and power regulators. The solar panels are comprised of silicon solar cells arranged in multiple parallel and serial strings to generate sufficient voltages and currents to power the spacecraft and recharge the batteries. A 2.2 m^2 deployable and steerable array was chosen as the most efficient and cost effective option for providing the required power.

To support the spacecraft during eclipse and peak power demands (multiple transmitters operating simultaneously), two 25V NiH_2 6.0 Ahr batteries will be employed. By controlling the depth of discharge, NiH_2 battery technology has been shown to easily meet the 7 year lifetime requirement. To further improve their performance, the batteries will be mounted in the lower portion of the spacecraft to isolate them physically and thermally from the rest of the dissipating elements to provide greater control of the battery thermal heat environment.

The charge and power regulators will be housed in the Catch All Box (CAB), which will provide DC/DC charge regulation, power conditioning, and shunt dissipation when required. Separate isolated converters and EMI filters will be used to provide redundant and conditioned power to each of the electrical devices within the spacecraft. Safeguards will be incorporated in hardware and software to protect against single event upsets, short circuits, and latchups, and to prevent against cascading type failures.

The power budget for the FAISAT constellation spacecraft is shown in Figure II-16a and shows nominal average power being used by the spacecraft as 140 watts with an additional 20 watts being used by the secondary payload.

The solar array calculation is shown in Figure II-16b detailing the maximum eclipse and end-of-life requirements.

Figure II-16a FAISAT Power Budget

Component	Orbit Average Power (watts)
Receivers	40.0
Transmitters	40.0
C&DH	20.0
ACS	15.0
Power Distribution	15.0
Housekeeping, Make-up Heaters, Sun Tracking and Misc.	10.0
Secondary Payload	20.0
Total	**160**

Figure II-16b Solar Array Breakdown	
Component	**Power (watts)**
Solar Array Power (full sun)	370.0
Shadow (33%)	-123.3
Angle of Incidence Effects	-18.5
BOL	228.2
Degradation over 7 years @ 23%	-52.5
EOL	175.7
Required Power	160.0
Margin	10%

7. Attitude Control and Orbital Maintenance Subsystems

The FAISAT attitude control system (ACS) utilizes gravity gradient stabilization with magnetic torquers and a yaw momentum wheel for control of the spacecraft. The ACS elements are shown in Figure II-17. The gravity gradient technique results in a satellite that requires no moving parts other than a single momentum wheel (MW) after initial extension of the gravity gradient boom. The momentum wheel is designed to provide torque about the yaw (nadir) axis to assist in pointing of the deployable solar arrays toward the sun in one of the two axes needed for optimal solar array performance. The other axis needed is an axis passing through the body of the satellite and the solar array panels mid-plane line. This axis will be controlled by a solar array drive motor (SADM). The primary sensing elements of the ACS will be an attitude-determining GPS system (GPSADS) consisting of four (4) receiving antennae and a four (4) channel GPS receiver housed in a single unit, and a sun sensor (SS) to determine the sun's position about the yaw axis and solar array drive axis. The separation between the outer-most GPS antennae will be a minimum of 0.3 meters in order to achieve attitude knowledge to 0.1°.

The sun sensor will be located on a deployed solar array panel on one side of the satellite, as close as practical to the panel axis anterline. Backup sensors will be a single three (3) axis magnetometer and a redundant sun sensor located on the deployed solar array panel on the opposite side of the satellite.

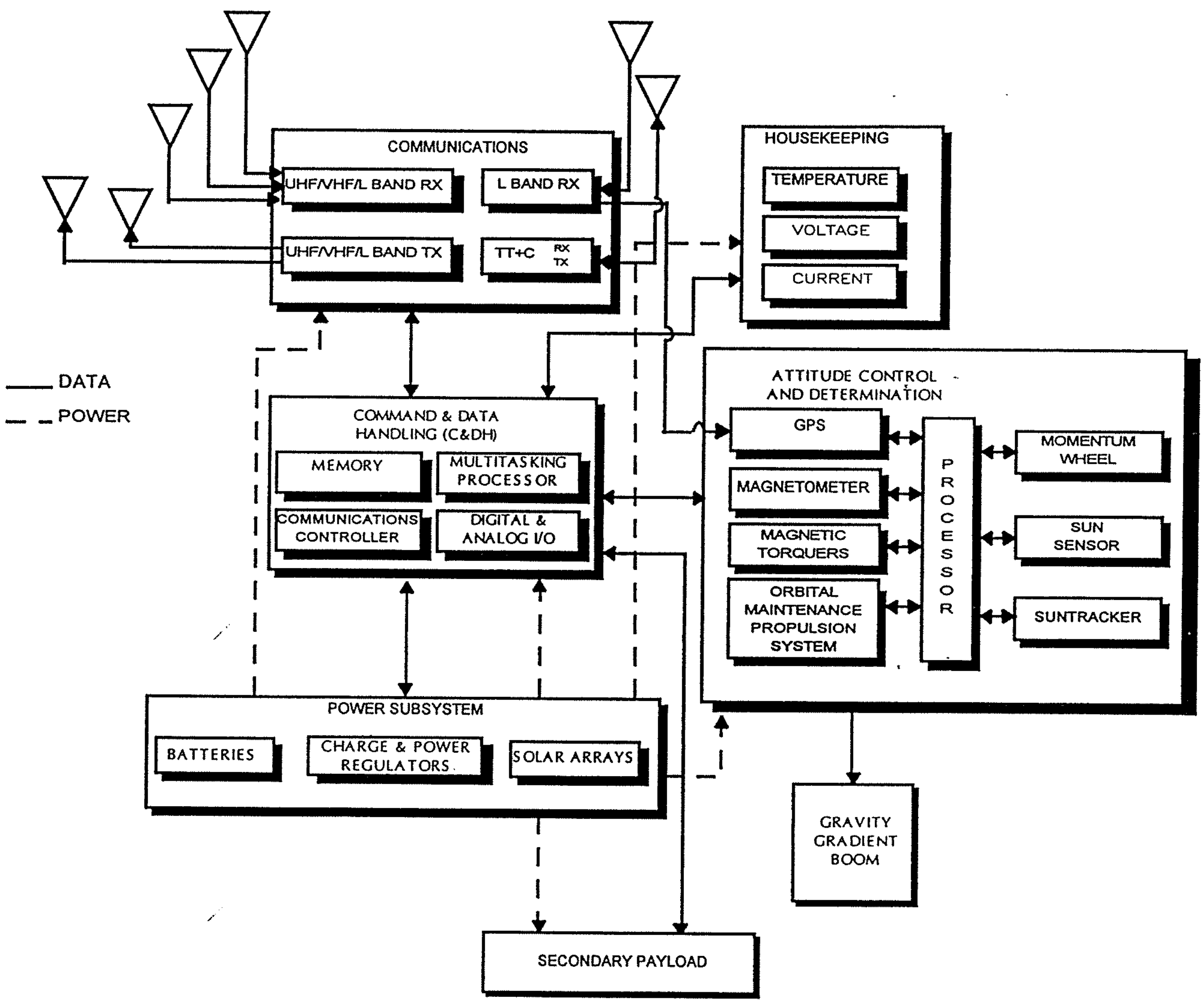
spacecraft orbits over the satellite lifetime, and to re-position the spacecraft in the event of a failed satellite within a plane.

To maximize the secondary payload carrying capability of the FAISAT satellites, plasma thrusters are being considered to provide additional mass and volume. Since the cold gas propulsion system represents approximately 10% of the total launch weight, significant savings can be realized for equivalent performance. Low thrust level plasma thrusters are available today for small spacecraft that require only 100 to 150 watts of power when operating, at low duty cycles, and which are well within the power capabilities of the FAISAT spacecraft.

8. Command and Data Handling System (C&DH)

The command and data handling system computer employed on the FAISAT constellation satellites is an advanced version of the RAD 6000 computer system utilized in the FAISAT-2v mission. The central element of the system is a single board RAD 6000 radiation hardened RISC processor produced by Lockheed Martin. The unit is shown in Figure II-18. Separate areas of on-orbit non-reprogrammable and reprogrammable memory will be used to store boot code and uploadable code for on-orbit operations. From 128 MB to 1 GB of RAM will be available for data storage. Internal spacecraft communications will be performed via LAN type high speed serial data links. Separate microprocessors are contained in each subsystem and element including the radios. The ACS system and the power regulators will be responsible for local data handling thereby reducing the computational burden on the main processor.

Figure II-18 RAD 6000 Illustration



The C&DH main responsibility is to maintain the health and safety of the spacecraft which includes performing ACS functions for stabilization and sun tracking, maintaining the state of charge of the batteries, controlling data flow into and out of the receivers and transmitters, and housekeeping. High speed serial links will be used to communicate to each of the remote devices. In the case of the radio link, advanced forward error correction techniques will be employed to improve the overall quality of the received and transmitted signal and the resultant bit error rate (BER). To provide onboard housekeeping, relay control, and external device configuration, a total of 96 digital and 96 analog I/O channels are available which can be routinely examined from onboard storage locations and changes effected either automatically by the C&DH or remotely via command from the ground.

9. Reliability and Operational Life

The FAISAT spacecraft have been designed as a high reliability single string system with a design life of 7 years. Certain critical spacecraft systems will be functionally redundant. In certain instances, such as in the battery system where too extreme of a weight penalty would be required to be fully redundant, the loss of one battery may cause the spacecraft to curtail certain operations during periods of maximum eclipse, to avoid sacrificing battery lifetime by exceeding the design depth of discharge of the battery. However, the use of NiH_2 technology has been proven to be extremely reliable in space and should not be of concern with respect to other subsystems in the spacecraft.

The electronic components selected for use on the spacecraft have been selected to NASA and military standards with respect to the space environment, including temperature ranges, hermiticity, material selection and compatibility, testing, and radiation tolerance. Almost all components within the spacecraft are at least MIL-883/B or equivalent and have been selected to be latchup immune with a minimum of 15 krad total dose hardness. In devices where these components or the data to support them do not exist, additional testing including extended burnin and qualification tests are performed, and where necessary, additional radiation packaging protection is provided.

B. Ground Components

The ground components of the Final Analysis system consist of the NCC and MGS in Lanham, Maryland, the back up MGS in Logan, Utah, and the SGS in Andoya, Norway.

The Final Analysis 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 interactive user will employ a Message Terminal (MT) with an alphanumeric keyboard to create messages and interact with the satellite. This protocol and strategy is also described in the following paragraphs.

1. Network Control Center

The NCC will be located in the Final Analysis corporate headquarters in Lanham, Maryland. The NCC will operate in a receive only mode and operators will command the satellite system via internet or telephone lines to the ground stations. Technical operations and ephemeris determinations will be performed in the NCC. Location and interrogation schedules of RTs and MTs will also be maintained in the NCC.

2. Master Ground Station

Ground control of the satellite will be performed at the MGS located in Lanham, Maryland. 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 requests, system software patches and tests, and spacecraft subsystem monitoring are also conducted. Attitude control software onboard will control the attitude by commanding the reaction wheel or the magnetic torque coils of the satellite, control the yaw position of the satellite, and also 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's 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, a 385-415 MHz band antenna, and a 148-151 MHz antenna which are mounted on a common azimuth/elevation rotator located on top of the Ground Station building. 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 may 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 was constructed under FAISAT-1 experimental license. Construction of the east coast and Andoya ground stations is complete. The required satellite control and networking ground station software has been developed and is currently being used for FAISAT-2v operations.

3. Secondary Ground Station

The SGS in Andoya, Norway has been implemented in the same manner as the Logan ground station. Full client services including e-mail will be available under our commercial license.

The NCC will maintain an accurate database of information on the RT ID codes and receiver assigned frequencies. The locations of the RT installations, including latitude, longitude, altitude, and any elevation obstructions will be maintained to support the planning function for data collection.

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 400 MHz band, a transmitter in the 148-150 MHz band, an antenna, a power supply, a controlling chip, and a sensor interface. User interface is provided by an RS-232 port which allows flexibility in monitoring data from many different packages.

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 148.0 - 149.9 MHz in 2.5 kHz step size and is controlled by the Final Analysis STAR System. The transmitter is modulated in 9.6 kbps GMSK. The message length for the RT will be variable, up to 540 bytes in length.

In order to collect data from the RTs the satellite transmits a RT beacon which requests each individual RT to transmit to the satellite. The polling strategy is initiated utilizing STARS and scanning the available frequency spectrum to select a number of clear channels for use by the RT beacon. This scanning activity requires about one second. The RT receives the RT beacon signal with its Identifying Code and the frequency on which to broadcast. The RT time of transmission is set by its queue position with each position delaying the requested time of transmit by the RT satellite beacon by a delta time, depending on the common message length of the RT responses.

5. Message Terminals

MTs are considered "active" transceivers. These units consist of a receiver at 400 MHz range, a transmitter at 148-150 MHz range, an antenna, power supply, and a display / keyboard for a user interface. The MT uses similar hardware components as the RT, thereby reducing costs and providing commonality.

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 a fixed frequency for all satellites. If a satellite is available, the satellite responds to the MT and provides a frequency assignment via a priority RT request. The MT then transmits its message on the assigned 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. The satellite transmits the message to the nearest gateway and converts it into the internet or delivers the message to a RT/MT user via the FAISAT e-mail system.

III. Interference and Frequency Sharing Analysis

A. 148-150.05 MHz Uplink Band

1. 148-149.9 MHz Band

The spectrum made available to System 2 in the 148-149.9 MHz band is discussed in the *Report and Order* at ¶ 32. 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. Final Analysis proposes using 148-148.25 MHz, 148.75 - 148.855 MHz, 148.955 - 149.585 MHz, 149.635 - 149.81 MHz for global service uplink and 148.855 - 148.905 MHz within CONUS and globally for service links if System 3 does not use the band for feeder links. If S80 does not use the band 148.905 - 148.955 MHz for feeder links, this band may be used by System 2 for service uplink

(b) Protection of Existing Services

Concerning protection of existing fixed and mobile user services, protection will be accomplished by adhering to Footnotes US 323 and Footnote 608, 608a, 608b, and 608c.

Final Analysis designed its service uplink communication system to utilize the Scanning Activity Receiver System (STARS) to avoid interference with fixed and mobile users of this band. In operation, the STARS receiver onboard 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. The STARS system is an enhanced version of DCAAS. The active channel avoidance capability of the Final Analysis STARS system will not permit the assignment of these bands for uplink transmissions when in use by other services or systems. Final Analysis has designed its uplink communications system so that it would not interfere with these users by adhering to Footnote US323, as follows: i) the STARS system will not assign an uplink frequency to a RT or MT that is actively being used by fixed or mobile users, ii) the modified Time Division Multiple Access (TDMA) polling scheme will limit transmissions to no more than 17% of the time during any 15 minute period and will limit the uplink message size such that a single transmission will not exceed 450 miliseconds, and iii) software in the RTs and MTs will not allow immediate, consecutive transmissions on a single frequency.

(1) Sharing with VITA

Final Analysis will not operate in the VITA band 149.81 - 149.9 MHz.

(2) Sharing with System 1 and ORBCOMM

In the bands shared with System 1 and ORBCOMM, the STARS system will prevent assignment of spectrum in use by other NVNG systems.

(3) Sharing with System 3 and S80

System 2 overlaps its service uplink operation with System 3 and S80 in the bands 148 - 148.25 MHz, 148.75 - 148.905 MHz. The two edge bands 148.0 - 148.25 MHz and 148.75 - 148.855 will not cause harmful interference to CDMA operations. System 3 indicated that it will not perform feeder link operations within CONUS. Therefore, the use of the band 148.855 - 148.905 MHz within CONUS should not cause any harmful interference to System 3 feeder uplink operations. The band 148.905 - 148.955 MHz has been set aside for S80 feeder uplink operations. CONUS service uplink operation in this band should be feasible. If so, then System 2 could perform continuous STARS service uplink operations from 148.75 to 149.585 MHz.

2. 149.9 - 150.05 MHz Uplink Band

System 2 utilizes the 150 - 150.05 MHz band for its feeder uplink operations. This is a portion of the 149.9 - 150.05 MHz Transit band which was allocated to NVNG-MSS on a co-primary basis by the FCC in 1993. Final Analysis will time share the use of this band with the Russian Meteor system which uses the band for downlink, whereas Final Analysis will use the band for uplink services. Interference avoidance with the Meteor shall be effected by one or more of the following methods: 1) maintaining a coordination distance from navigable waterways; 2) limiting minimum elevation angle with azimuth toward navigable waterways; or

3) using frequency avoidance techniques to avoid transmission on the same frequency when a RNSS satellite is in view of a Final Analysis ground station. Final Analysis will further reduce interference by using LHCP on its feeder uplinks.

3. 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 transmitted by the satellite (Section 25.142 (a) (3)). The Final Analysis system processes every uplink transmission system and it only retransmits through noise free data. All signal paths through the satellite require that the received signal be demodulated on board, stored, retrieved and remodulated prior to being re-transmitted. Therefore, it is impossible for the FAISAT system satellites to retransmit signals from outside the Final Analysis system.

B. 400.15-401 MHz Downlink Band

1. Sharing with VITA

The spectrum made available to System 2 in the 400 MHz band is identified in the *Report and Order* at ¶ 33. Specifically, this band is shared with VITA and France's S80- system as described in the following paragraphs. System 2 will share the 400.505 to 400.5517 with the VITA satellite authorized in the first round. Should VITA receive authorization for operations in the 400.5983-400.645 band, Final Analysis, as the operator of System 2, will timeshare the band with VITA. Final Analysis has already coordinated operations of VITA's first satellite, VITSAT-1r. This experience places Final Analysis in a good position to use this experience to successfully coordinate with the second VITA satellite.

2. Sharing with S80

The FCC has already coordinated the band 400.5517-400.593 with S80. However, as suggested by the *Report and Order*, Final Analysis hereby requests the Commission to seek coordination with Final Analysis in that band and if the request is successful, Final Analysis will operate in that band according to the terms of the coordination.

C. 137 - 138 MHz Downlink Band Spectrum Assignments

The spectrum available to System 2 in the 137-138 MHz band is set forth in the *Report and Order* at ¶ 34 *et seq.* Final Analysis will primarily use the 137-138 MHz band for feeder downlinks. As stated before, due to the significant resources extended to R&D, Final Analysis has developed state-of- the-art frequency agile, multiple baud rate flight transceivers. These "software" radios combined with a powerful RISC 6000 radiation hardened on-board computer provide service and feeder link operations at rates of up to 307 kbps. However, the limit of spectrum currently available for System 2 does not allow Final Analysis to realize its full constellation capabilities. The highest data rate that System 2 can perform is approximately 110 kbps in the 137.825-138 MHz portion of the 137-138 MHz band. Additional spectrum allocations to the Little LEO services will permit Final Analysis to fully utilize its built-in system capabilities to serve segments of the market for medium to large data transfer which cannot be serviced with the currently available spectrum.

1. Sharing with NOAA

System 2 will time-share with NOAA the NOAA bands 137.025-137.175 MHz and 137.825-138 MHz on a secondary basis. It is our understanding that NOAA intends to implement a three satellite MetSat system in these bands between 2003 and 2006 and migrate these operations accordingly. In addition, Eumetsat may implement a system using these bands as early as 2003. It is also Final Analysis's understanding that the Russian Meteor system will transition to the NOAA bands in the medium term. As additional MetSat systems become operational in the NOAA bands, the time available to System 2 will decrease.

Final Analysis will transition the majority of its feeder link operations for the NOAA bands to the NOAA channels, as NOAA migrates to the NOAA bands with the installation in orbit of the Metsat constellation in the 2003 to 2006 period.

System 2 will time-share with NOAA channels 137.333-137.367 MHz, 137.475-137.525 MHz, 137.595-137.645 MHz and 137.753-137.787 MHz on a secondary basis for feeder link services until 2000 and on a co-primary basis thereafter. During the 2006 and 2009 time period it is expected that NOAA will vacate the two NOAA channels, 137.485-137.515 MHz and 137.605-137.635 MHz which are called the APT channels. NOAA has expressed a continuing need for transmission of data in the NOAA TIP channels 137.333-137.367 MHz and 137.753-137.787 MHz, until the year 2012. System 2 will have time-shared use of the four NOAA channels until between 2006 and 2009. Time-sharing with the two NOAA TIP channels will continue until approximately 2012. Thereafter time-sharing between System 2 and the NOAA channels will not be required and System 2 will operate in these channels along with other primary allocated services.

As suggested by the *Report and Order*, Final Analysis will protect NOAA's APT & TIP channels based on an elevation angle of 5°. Furthermore, with regard to the NOAA bands 137.025-137.175 MHz and 137.825.825-138 MHz, the Report and Order suggests non-interference to NOAA satellites based on an elevation angle of 0°. Final Analysis strongly believes a 5° elevation angle is adequate. However, to demonstrate our compliance with the Report and Order we will accept a 0° elevation angle.

We will accomplish timesharing with NOAA in the following way. Currently we obtain from NORAD electronically the two-line element of the FAISAT-2v[31]. We obtain the NOAA satellite's two line elements from NORAD also. We currently use an SGP4 propagator (which

[31]Final Analysis will develop a strategy with NORAD to prevent "spoofing," most probably by initialing calls itself.

is also used by the U.S. military and NORAD) for tracking our FAISAT-2v satellite and for the orbital parameters and tracks of the NOAA satellites. We have essentially already constructed the timesharing algorithms for determining the outage of the FAISAT satellites when in view of the various NOAA satellites. We are doing these things today, and we will be able to do them in the future without difficulty. Should NORAD in the future change its outage algorithm from SPG4 to a different propagator, our ground control applications software can be refitted with whatever propagator NORAD chooses. In addition with regard to the 72-hour reset requirement, Final Analysis's comments to the NPRM state that our satellite has several layers of protection that would detect a failed-on condition well in advance of 72 hours.

2. Sharing with Meteor

As suggested by the *Report and Order*, Final Analysis will timeshare the 137.367-137.4125 MHz band with the Russian Meteor system. The exact elevation angle and other necessary data will only be known after coordination with Meteor. However, Final Analysis will follow the same steps to accomplish timesharing as described in the section on timesharing with NOAA.

3. Sharing with System 3

The *Report and Order* states that the System 3 operation in this band shall be consistent with the coordination agreements GE Starsys entered into with NOAA, ORBCOMM and the S80 system. In discussions with GE Starsys, Final Analysis has been informed that no agreement has been completed regarding co-operation between NOAA and Starsys. In addition, Starsys indicated the only formal agreement in place is with ORBCOMM.

During the first round negotiated rulemaking, ORBCOMM, Starsys and VITA entered into a sharing plan which concluded that additional systems could be accommodated in this band. Subsequently, ORBCOMM and Starsys agreed on certain technical issues regarding interference of ORBCOMM into the Starsys antenna main beam for feeder downlinks.[32] As shown in the letter to the Chief of the International Bureau, ORBCOMM agreed to reduce the service transmission downlink to 11.5 and 12.5 dBW EIRP when ORBCOMM satellites were in the main beam of the Starsys ground antenna.[33] This was necessary because Starsys was operating feeder downlinks.

With regard to the use of this band by System 3, E-Sat has consistently stated that they will use this band primarily for service downlink operations and that any feeder operations would be performed outside of CONUS.

Since the primary focus of the sharing arrangement between Starsys and ORBCOMM was related to ground station antenna main beam interference and since there is no similar issue with respect to service downlink operations of System 3 during CONUS operations, Final Analysis believes that no reduction in transmission power is required by System 2.

Regarding System 3 allowable downlink transmission power, we believe the limits agreed to by Starsys in their coordination discussions with NOAA will be applied to System 3 coordination with all operators in this band including System 2.

4. Sharing with ORBCOMM

Since Final Analysis does not share the same downlink transmission channel with ORBCOMM in this band, no timesharing is required. However, because several of our channels are contiguous, Final Analysis will coordinate frequency issues with respect to interference with ORBCOMM.

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[32] *See* Letter from Stephen D. Baruch, Counsel for STARSYS Global Positioning, Inc. and Stephen L. Goodman, Counsel for Orbital Communications Corp., to Donald Gips, Chief, International Bureau, FCC, *Re: ORBCOMM's Pending Modification Request, File No. 5-SAT-ML-96*, dated June 20, 1996.

[33] *See id.*

5. Sharing with System 1

The System 1 frequency use in the 137-138 band does not require timesharing with System 2 since there is no transmission channel overlap. As with ORBCOMM, frequency avoidance will be coordinated with System 1 as required by System 1 and 2 operations in contiguous channels. Furthermore, the *Report and Order* requires that System 1's use of this channel be restricted to feeder downlinks. Therefore it is anticipated that minimal, if any, coordination will be required between System 1 and System 2.

D. First Priority on After-Acquired Downlink Spectrum

The *Report and Order* recognizes that additional spectrum may be duly allocated worldwide to the NVNG MSS service by the ITU at WRC-97 or a subsequent World Radio communication Conference, and subsequently by the Commission domestically in the United States (the "Future Spectrum").[34] The *Report and Order* also grants System 2 a first priority to apply for "Supplemental Spectrum" defined as the first 210 kHz of Future Spectrum plus spectrum sufficient to account for Doppler frequency shift in the Future Spectrum in order to fully implement its Little LEO system.[35] Final Analysis will exercise this first priority with respect to commercially, useable spectrum in order to fulfill its service downlink requirement.

Final Analysis presumes that the Commission will vigorously seek and support the acquisition of additional spectrum and will assign the Supplemental Spectrum to Final Analysis on an expedited basis outside of a new processing round.

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[34] *Id.* at ¶ 36. The *Report and Order* acknowledges that the spectrum assigned to System 2 in the 400-401 MHz band, at best, can only accommodate 2 or 3 channels (depending on the future outcome of coordination with S80 of France).

[35] *Id.* at ¶ 36-37; 47 C.F.R. § 25.142(e). Final Analysis acknowledges that the amount of Supplemental Spectrum may be reduced to an amount equivalent to 150 kHz of Future Spectrum plus spectrum sufficient to account for Doppler frequency shift in the Future Spectrum, for so long as System 2 is permitted by the Government of France to operate in the 400.5517-400.5983 MHz band coordinated with French system S80-1. *Report and Order* at ¶ 36.

IV. PLAN FOR IMPLEMENTATION OF FAISAT CONSTELLATION

The construction and launch of the FAISAT constellation will be according to the following timetable:

Satellite Number	Begin Construction	Finish Construction	Launch
FAISAT-1A - 2	1998	1999	2000
FAISAT 3 - 8	1999	2001	2001
FAISAT 9 - 14	2000	2002	2002
FAISAT 14 - 38	2001	2003	2003

V. LEGAL QUALIFICATIONS OF FINAL ANALYSIS

As demonstrated in the FCC Form 430 and Exhibits submitted in Section VI of its Original Application, Final Analysis Communication Services, Inc. is legally qualified to hold a Commission license. Final Analysis is a wholly owned subsidiary of Final Analysis Inc., a Maryland corporation. Final Analysis hereby submits a revised FCC Form 430 and revised Exhibits thereto to update certain legal qualification information which has changed since it filed its original FCC Form 430 information in Section VI of its Original Application.

VI. FINANCIAL QUALIFICATIONS OF FINAL ANALYSIS

Final Analysis is financially qualified pursuant to Section 25.142(a)(4) of the Commission's rules, 47 C.F.R. § 25.142(a)(4), and the test adopted by the Commission in the *Report and Order*.[36] Specifically, Final Analysis has the finances necessary to "proceed expeditiously with the construction, launch and operation for one year of the first two space stations of its proposed system immediately upon grant of the requested authorization." *Id.*

In its Original Application, Final Analysis estimated that its total costs for the construction, launch, and operation of its first two satellites for one year were $6,216,565. By its amendment filed on August 19, 1996, Final Analysis reported that due to the actions taken to commence satellite and ground station construction, Final Analysis had already satisfied a significant amount of the construction costs previously outlined in its Original Amendment. Therefore, the remaining costs for the construction, launch and operation of its first two satellites for one year totals $855,000. *See* Final Analysis Communication Services, Inc., File No. 75-SAT-AMEND-96, filed on August 19, 1996. Final Analysis incorporates that amendment by reference herein.

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[36] *See Report and Order* at ¶¶ 18-20.

Final Analysis has funds available well in excess of the cost that is required for the construction, launch and first-year operation of the first two satellites in its system as reflected in its August 19, 1996 amendment. As demonstrated in the attached audited financial statement prepared by the independent auditors Ernst & Young[37] for the year ended December 31, 1996, Final Analysis and its parent have invested in excess of $29 million in its NVNG MSS business, which includes but is not limited to: research and development performed by the company; construction and launch of FAI's first experimental satellite FAISAT-1; construction and launch of FAI's second experimental satellite FAISAT-2v; the establishment and operation of three ground stations in Logan, Utah; Andoya, Norway; and the master ground station at Lanham, Maryland; and the purchase of the main components of the first two satellites for its commercial constellation.

In addition to the $29 million invested as of December 31, 1996, as of October 1997, Final Analysis also has received in excess of $3 million from investors, an amount well in excess of the $855,000 needed for the remaining costs to construct, launch and operate its first two satellites for one year. *See* attached audit statement at Note 10. This amount has been and is being applied to the financial requirements for Final Analysis's commercial constellation. Moreover, as reported in our August 1996 amendment, Polyot has committed to launch Final Analysis's entire satellite constellation at no cost to Final Analysis as part of an agreement between Final Analysis and Polyot in which Polyot will be the national service provider for Final Analysis's communication services in Russia and the CIS countries. As indicated by the attached letter of October 23, 1997, Polyot is aware of Final Analysis's plans for a modified constellation and has reconfirmed its commitment to provide launch services for the modified constellation under the same arrangements as before.

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[37] *See* attached audit statement at Note 1.

VII. TECHNICAL QUALIFICATIONS OF FINAL ANALYSIS

Final Analysis is extremely well qualified technically to develop, construct, launch and operate a non-voice non-geostationary mobile satellite system. As described in its Original Application, Final Analysis was founded to draw upon the expertise and experience of numerous seasoned aerospace engineers, scientists and market experts to pursue commercial opportunities in the NVNG MSS satellite business. Throughout its corporate history, Final Analysis has been extensively involved in the development and support of sophisticated space technology in support of NASA and other government programs as well as in the application of the same technology to the provision of affordable, practical space solutions for industrial and commercial use.

In fact, of all of the new applicants in the second processing round of NVNG MSS systems, Final Analysis alone has proven its technical qualifications in the actual construction, launch and operation of prototype spacecraft and ground systems. In particular, the successful construction and launch of its two experimental satellites, FAISAT-1 and FAISAT-2v, has proven Final Analysis's ability to master the sophisticated technology required to implement a Little LEO system. FAISAT-2v's "Awareness Program" will enhance global development of Little LEO technology and applications by offering governments around the world six months free access to the satellite and the use of up to ten remote terminals. FAISAT-2v also serves as the platform for the commercial services provided by first round NVNG MSS licensee, Volunteers in Technical Assistance, Inc. These activities have provided invaluable opportunities for Final Analysis to refine its system design in advance of the actual implementation of its commercial constellation. Consequently, among the new second round applicants, Final Analysis is uniquely positioned to enter the market immediately with proven spacecraft and ground system technology.

VIII. ADDITIONAL REPRESENTATIONS OF FINAL ANALYSIS

A. Waiver of Use of Frequencies

Final Analysis 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 authorization in accordance with this application.

B. Regulatory Classification of Service

Consistent with the rules announced in the *Report and Order* at ¶ 135, Final Analysis intends to operate its proposed NVNG MSS system on a non-common carrier basis.

C. Agreement Not to Enter Into Exclusive Arrangements

Final Analysis agrees that neither it, nor any companies controlling or controlled by it, shall acquire or enjoy any exclusive arrangement with any foreign country which is prohibited by Section 25.142(d) of the Rules, 47 C.F.R. § 25.142(d).[38]

IX. PUBLIC INTEREST STATEMENT

Grant of an NVNG MSS license to Final Analysis is in the public interest, convenience and necessity. Authorizing Final Analysis to provide Little LEO services will allow it to speed the competitive delivery of a wide array of mobile satellite based Little LEO services, ranging from personal data messaging to emergency alert services, supervisory control and data acquisition ("SCADA") and advanced tracking services, to global and U.S. consumers.

Licensing Final Analysis promptly will serve the public interest by promoting additional, competitively priced NVNG MSS services. Final Analysis has demonstrated its ability to promptly provide services through its extensive R&D and development programs. Final Analysis is unique among the second round NVNG MSS applicants in that it has: built and launched two

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[38] *See Report and Order* at Appendix B.

satellites; constructed three ground stations; developed an extensive international awareness program; developed prototype remote terminals; acquired most of the components for the construction of its first two satellites; and obtained a commitment for a dedicated launch vehicle to launch the entire constellation. This successful development program, undertaken at Final Analysis's own risk, means that Final Analysis will be able to provide new and competitively priced services very quickly upon grant of a commercial license by the FCC, unlike other applicants that have not undertaken similarly extensive development programs.

Furthermore, Final Analysis's competitive deployment of its Little LEO system will promote the Commission's public interest objective of "foster[ing] the provision of efficient, innovative, and cost-effective NVNG MSS communications services in the United States." *See Report and Order* at ¶ 11. Correspondingly, grant of an NVNG MSS license to Final Analysis will further the Commission's statutory goals of benefitting U.S. consumers through promotion of the wide availability of reasonably priced advanced telecommunications services. *See* 47 U.S.C. § 151.

XI. CONCLUSION

For all of the foregoing reasons, Final Analysis Communication Services, Inc., submits that grant of this application will serve the public interest, convenience and necessity. Accordingly, Final Analysis Communication Services, Inc., respectfully urges the Commission to grant its application as expeditiously as possible.

Respectfully submitted,

FINAL ANALYSIS COMMUNICATION SERVICES, INC.

By: ____________________________

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Dated: October 30, 1997

ATTACHMENTS

FCC FORM 430 AND EXHIBITS

FCC 430

Federal Communications Commission
Washington, DC 20554

Approved by OMB 3060-0105

See reverse for public burden estimate

LICENSEE QUALIFICATION REPORT

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.
9701-E Philadelphia Court
Lanham, Maryland 20706

2. (Area Code) Telephone Number

(301) 459-4100

3. If this report supersedes a previously filed report, specify its date

11/15/94

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 an NVNG MSS license. FACS's corporate parent Final Analysis, Inc. ("FAI") holds experimental satellite authorizations.

	YES	NO
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.*	☐	☒
(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.*	☐	☒
(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.*	☐	☒
(d) Is the Filer, or any person directly or indirectly controlling the Filer, presently a party in any matter referred to in Items 7(b) and 7(c)? *If "YES", attach as Exhibit IV a statement relating the facts.*	☐	☒
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 the Commission? *If "YES", submit as Exhibit V the name of each such licensee and the licensee's relation to the Filer.*	☒	☐

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

	YES	NO
(b) Is Individual or each member of a partnership a citizen of the United States?	☐	☐
(c) Is Individual or any member of a partnership a representative of an alien or of a foreign government?	☐	☐

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 of 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 the Filer's knowledge and belief, and are made in good faith. The undersigned, individually and for the Filer, certifies that neither the applicant nor any other party to the application is subject to a denial of Federal benefits, that includes FCC benefits, pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C. Section 862, because of a conviction for possession or distribution of a controlled substance.

WILLFUL FALSE STATEMENTS MADE ON THIS FORM ARE PUNISHABLE BY FINE AND/OR 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)), AND/OR FORFEITURE (U.S. CODE, TITLE 47, SECTION 503).

Filer (must correspond with that shown in Item 1)	Typed or Printed Name	
Final Analysis Communication Services, Inc.	Nader Modanlo	
Signature	Title	Date
[signature]	President	10/30/97

NOTICE TO INDIVIDUALS REQUIRED BY THE PRIVACY ACT OF 1974 AND THE PAPERWORK REDUCTION ACT OF 1995

The solicitation of personal information requested in this form is to determine if you are qualified to become or remain a licensee in 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 the burden to Federal Communications Commission, Records Management Branch, Washington, DC 20554, Paperwork Reduction Project (3060-0106), or via the Internet to dconway@fcc.gov. DO NOT SEND COMPLETED FORMS TO THIS ADDRESS. **Individuals are not required to respond to a collection of information unless it displays a currently valid OMB control number.**

Final Analysis Inc. ("FAI"), a Maryland corporation which is the corporate parent of the applicant Final Analysis Communication Services, Inc., currently holds Experimental Radio Service authorizations to operate experimental NVNG MSS satellite facilities, ground stations and remote terminals under call signs KS2XCY (experimental NVNG MSS satellite "FAISAT-2v"); KS2XCZ (remote terminals); KS2XDA (Logan, Utah experimental satellite ground station); and WA2XHE (Lanham, Maryland experimental satellite master ground station). The experimental program under FAISAT-2v is currently under way with the successful launch of the satellite as a secondary payload aboard a Cosmos rocket from the Cosmodrome in Plesetsk, Russia on Tuesday, September 23, 1997 at approximately 12:45 p.m. (EST). *See* Final Analysis Inc., Progress Report for Experimental Little LEO Satellite Program -- FAISAT-2v, filed on September 18, 1997.

FAI's previous experimental satellite operations under experimental satellite "FAISAT-1" have been completed and, accordingly, the corresponding experimental authorizations under call signs KE2XGU, KE2XGV, KE2XGW, KE2XGX, KE2XGY, as referenced in the Original Application, have expired.

The names, addresses and citizenship of those stockholders owning of record and or voting 10 percent or more of the voting stock of FACS, and the percentages so held are as follows:

Stockholder Name	**Address**	**Citizenship**	**Ownership Percentage**
Final Analysis Inc.	9701-E Philadelphia Court Lanham, MD 20706	MD Corporation	100 percent

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

Final Analysis Communication Services, Inc.
FCC Form 430
October 30, 1997
Exhibit VII

The names and addresses of the officers and directors of the applicant are:

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

The applicant Final Analysis Communication Services, Inc. ("Final Analysis") is a wholly-owned subsidiary of Final Analysis Inc. ("FAI"), a for-profit Maryland corporation. The stock of Final Analysis is owned directly by FAI, with no intermediate subsidiaries.

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

Final Analysis Inc.
9701-E Philadelphia Court
Lanham, MD 20706

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

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

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

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

(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

POLYOT LETTER

Конструкторское бюро
ПРОИЗВОДСТВЕННОГО
ОБЪЕДИНЕНИЯ "ПОЛЕТ"
644021, г. Омск-21
Для телеграмм: г. Омск-21 "УТЕС"
Телетайп 116, ж. д. код 2084
Исх. № 04-142/2
"23" октября 1997 г.
На № ______ от ______ 1996 г.

Mr.Nader Modanlo
President-Founder
Final Analysis Inc.
9701-E Philadelphia
Way Lanham,MD 20706-4600

October 23,1997

Dear Mr.Modenlo:

This letter confirms Polyot's commitment to provide space launch vehicles Cosmos for the launch American system FAISAT proposed by Final Analysis Communication Services /Final Analysis/in the scope of our partnership in Little LEO satellite contellation. I under stand that this commitment will be presented to the Federal Com munications Commission /FCC/ as of a demonstration of Final Analy sis's financial qualifications.

Polyot has committed to providing Cosmos launch vehicles for the American system FAISAT no cost to Final Analysis within the scope of the parnership in Little LEO satellite constellation,besides Polyot has rights to sell services of FAISAT system in Russia and CIS countries.

Polyot also is aware that Final Analysis has been required to augment its initial plans for FAISAT constellation to fulfill certain time-sharing and system operating parameters based on a Joint Proposal submitted by FAISAT system applicants to the FCC on September 19,1997, and adopted in the Report and Order issued by FCC in IB Docket No.96-220 on October 15,1997. Polyot has reviewed Final Analysis's plans for FAISAT constellation as augmented and continues to be firmly committed to providing sufficient launch vehicles for the deployment

ERNST & YOUNG AUDIT STATEMENT

of the American FAISAT system in the scope of the partnership. Polyot has already constructed and set aside a sufficient number of launch vehicles on site and has reserved sufficient and dedicated payload capacity on these launch vehicles for deployment of the system FAISAT as augmented.

I also note that the Cosmos rocket is the most reliable launch vehicle in its class with a proven track record of successful launches. Cosmos rocket launches have had a 99.1 success rate with more than 200 successful launches over the most recently reported ten-year period /i.e. 229 out of 231 Cosmos rockets were successfully launched between January 1, 1986 and September 1.1995/. With the recent launch of Final Analysis's FAISAT-2v satellite on September 23,1997, Polyot continues to build on this outstanding launch record.

As shown in my letter to the FCC on August 15,1996, and as renfirmed herein, Polyot has been, is, and will continue to be firmly committed to our partnership in creating Little LEO satellite constellation in its entirety. Accordingly, Polyot looks forward to effecting the launch phase of the FAISAT constellation immediately upon issuance by the FCC of FAISAT system license to Final Analysis.

Sincerely yours,

Dr.Alexander I.Ilyin
Chief Designer
Polyot Design Bureau

Year ended December 31, 1996 and
Period from Inception to December 31, 1996
with Report of Independent Auditors

Final Analysis Communication Services, Inc.
(A Development Stage Enterprise)

Financial Statements

Year ended December 31, 1996 and
Period from Inception to December 31, 1996

Contents

ERNST & YOUNG LLP

Fairfax Square, Tower II
8075 Leesburg Pike
Vienna, Virginia 22182

Phone: 703 903 5000

Report of Independent Auditors

To the Board of Directors,
Final Analysis Communication Services, Inc.

We have audited the accompanying balance sheet of Final Analysis Communication Services, Inc. (a development stage enterprise) as of December 31, 1996, and the related statements of operations, changes in stockholders' equity, and cash flows for the year then ended and for the period from December 31, 1993 (inception) to December 31, 1996. These financial statements are the responsibility of the Company's management. Our responsibility is to express an opinion on these financial statements based on our audit. The financial statements for the period from December 31, 1993 (inception) through December 31, 1994 were audited by other auditors whose report dated March 23, 1995 expressed an unqualified opinion on such statements. The financial statements for the period from December 31, 1993 (inception) through December 31, 1994 includes a net loss of $317,341, as adjusted. Our opinion on the statements of operations, changes in stockholders' equity and cash flows for the period December 31, 1993 (inception) through December 31, 1994, insofar as it relates to amounts for prior periods through December 31, 1994, is based solely on the report of the other auditors.

We conducted our audits 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 assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall financial statement presentation. We believe that our audits and the report of the other auditors provide 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 Communication Services, Inc. at December 31, 1996 and the results of its operation and its cash flows for the year then ended and for the period from December 31, 1993 (inception) to December 31, 1996 in conformity with generally accepted accounting principles.

As further discussed in Note 3, Final Analysis Communication Services, Inc. is in the development stage and has not had revenues from its planned principal operations. The ultimate viability of the Company is dependent on the Company's ability to arrange adequate financing, obtain appropriate authorization to operate a commercial satellite constellation, successfully launch and operate the satellites, and develop a sufficient customer base to generate revenue. These factors raise doubt as to the Company's ability to continue on its own as a going concern. Management's plans as to the matters are also described in Note 3. These financial statements do not include any adjustments that might result from the outcome of this uncertainty.

Ernst + Young LLP

October 29, 1997

Final Analysis Communication Services, Inc.
(A Development Stage Enterprise)

Balance Sheet

	December 31, 1996
Assets	
Current assets:	
Cash and cash equivalents	$ 8,843
Receivable	200,000
Total current assets	208,843
Property and equipment, at cost:	
Mobile satellite system under construction	19,471,538
Computer equipment	12,312
Office furniture and fixtures	4,000
	19,487,850
Less accumulated depreciation	(5,855)
	19,481,995
Total assets	$19,690,838

	December 31, 1996
Liabilities and stockholders' equity	
Current liabilities:	
Due to parent, net	$14,815,778
Current portion of notes payable	100,000
Accrued expenses	1,788
Total current liabilities	14,917,566
Notes payable, less current portion	101,000
Stockholders' equity:	
Class A Voting Common Stock *($0.001 par value, 30 million shares authorized, 5,400,000 shares issued and outstanding at December 31, 1996)*	5,400
Class B Non-voting Common Stock *($0.001 par value, 50 million shares authorized, none issued and outstanding at December 31, 1996)*	–
Non-voting Convertible Preferred Stock	6,508,638
Deficit accumulated during development stage	(1,841,766)
	4,672,272
Total liabilities and stockholders' equity	$19,690,838

See accompanying notes.

Final Analysis Communication Services, Inc.
(A Development Stage Enterprise)

Statements of Operations

	Year ended December 31, 1996	**Period from Inception to December 31, 1996**
General and administrative expenses	$797,733	$1,650,113
Satellite development costs	–	200,000
Depreciation expense	3,034	5,855
Interest income	(9,807)	(15,990)
Interest expense	1,788	1,788
Net loss	$ 792,748	$1,841,766

See accompanying notes.

Final Analysis Communication Services, Inc.
(A Development Stage Enterprise)

Statement of Changes in Stockholders' Equity

Period from Inception to December 31, 1996

	Common Stock			Class A Voting Common Stock		Non-voting Convertible Preferred Stock			
	Number of share	Per share Amount	Amount	Number of shares	Par Value	Number of Shares	Amount	Deficit Accumulated During Development Stage	Total
From December 31, 1993 (inception) to December 31, 1996									
Issued to parent company for no consideration	5,400	$ –	$ –	–	$ –	–	$ –	$ –	$ –
Sales to private investors	620	1,250	775,000	–	–	–	–	–	775,000
Issued for services	90	1,250	112,500	–	–	–	–	–	112,500
Sales to private investors	1,803	1,250-4,000	4,227,500	–	–	–	–	–	4,227,500
Net loss - Period from Inception through December 31, 1995	–	–	–	–	–	–	–	(1,049,018)	(1,049,018)
Balance at December 31, 1995	7,913	–	5,115,000	–	–	–	–	(1,049,018)	4,065,982
Conversion of Common Stock into Class A Voting Common Stock and Non-voting Convertible Preferred Stock	(7,913)	–	(5,115,000)	5,400,000	5,400	2,512,889	5,115,000	–	5,400
Issue of Non-voting Convertible Preferred Stock, net	–	–	–	–	–	284,097	1,393,638	–	1,393,638
Net loss for the year ended December 31, 1996	–	–	–	–	–	–	–	(792,748)	(792,748)
Balance at December 31, 1996	–	$ –	$ –	5,400,000	$5,400	2,796,986	$6,508,638	$(1,841,766)	$4,672,272

See accompanying notes.

Final Analysis Communication Services, Inc.
(A Development Stage Enterprise)

Statements of Cash Flows

	Year ended December 31, 1996	Period from Inception to December 31, 1996
Operating activities		
Net loss	$ (792,748)	$(1,841,766)
Adjustments to reconcile net income to net cash used in operating activities:		
Depreciation expense	3,034	5,855
Changes in assets and liabilities:		
Accounts payable and accrued expenses	(88,304)	1,788
Other	5,400	5,400
Net cash used in operating activities	(872,618)	(1,828,723)
Investing activities - increase in mobile satellite system under construction	(1,347,007)	(4,672,072)
Financing activities		
Proceeds from sale of Common Stock, net	–	5,115,000
Proceeds from sale of Non-voting Convertible Preferred Stock, net	1,193,638	1,193,638
Proceeds from issuance of notes	201,000	201,000
Proceeds from 1995 common stock subscription	615,000	–
Net cash provided by financing activities	2,009,638	6,509,638
Net (decrease) increase in cash and cash equivalents	(209,987)	8,843
Cash and cash equivalents at beginning of year	218,830	–
Cash and cash equivalents at end of year	$ 8,843	$ 8,843

(Continued . . .)

Final Analysis Communication Services, Inc.
(A Development Stage Enterprise)

Statements of Cash Flows (Continued)

	Year ended December 31, 1996	**Period from Inception to December 31, 1996**
The Company's financial statements are affected by the following non-cash transactions:		
Issuance of 5,400 shares of Common Stock in 1994 to parent company for no consideration	$ –	$ –
Issuance of 90 shares of Common Stock for services in 1994	$ –	$ 112,500
Increase in the Mobile Satellite System Under Construction and Due to Parent balances	$8,865,647	$14,815,778
Non-voting Convertible Preferred Stock subscription receivable	$ 200,000	$ 200,000
Conversion of 7,913 shares of Common Stock into Non-voting Convertible Preferred Stock and Class A Voting Common Stock	$5,115,000	$ 5,115,000

See accompanying notes.

Notes to Financial Statements

Year ended December 31, 1996

1. Description of Business

Final Analysis Communication Services, Inc. ("FACS" or the "Company"), was incorporated on December 31, 1993 under the laws of the State of Maryland. The Company is a wholly-owned subsidiary of Final Analysis, Inc. ("FAI"). Substantially all transactions in the period from December 31, 1993 (inception) through December 31, 1996 were related party transactions between Final Analysis Communications Services, Inc. and FAI. See Note 8.

FACS was formed to build, launch and operate a worldwide, low earth orbit ("LEO") satellite-based digital telecommunications system that will offer low-cost, high quality two-way data transmission services, such as paging, e-mail, data acquisition, fixed and mobile asset tracking, and position location determination. FACS' target markets include automated meter reading facilities, asset tracking for rail and trucking companies and paging for areas that are underserved or are not served by existing or planned wireline and cellular communications systems. Management estimates the total cost of construction, insurance and launch of the Company's satellite system, including related ground and user segments and pre-operating costs, will be in the range of $150-$250 million, depending on the number of global gateways that are ultimately required.

The Company is in the development stage and has not had revenues from its planned principal operations. Since inception, management has been involved primarily in the development of the Company's satellite system, raising capital, coordinating with a number of strategic partners providing technological support, and seeking licensing from the Federal Communications Commission (FCC).

Since inception, the Company and its parent have incurred costs in excess of $21 million to fund the corporate expenses of FACS, and the construction of its mobile satellite system. This amount does not include approximately $8.0 million (unaudited) spent for research and development on the Company's first satellite by the principal stockholders of FAI, which amount is not included in these financial statements.

2. Summary of Significant Accounting Policies

Cash and cash equivalents

The Company considers all highly liquid investments with original maturities of three months or less when purchased to be cash equivalents.

2. Summary of Significant Accounting Policies (continued)

Property and Equipment

Property and equipment are stated at cost. Depreciation is calculated on the straight-line method over the estimated useful life of the asset.

Property and Equipment

During construction of the mobile satellite system, the Company is capitalizing substantially all construction costs. The Company will depreciate the mobile satellite system over the estimated economic useful lives of the various system components once the satellite system is placed into service. Depreciation of the space segment assets will be over the lesser of seven years or the estimated life of the related asset, and depreciation of the ground segment will be over the lesser of 10 years or the estimated life of the related asset.

The Company's policy is to review its long-lived assets, including its mobile satellite system, for impairment whenever events or changes in circumstances indicate that the carrying amount of an asset may not be recoverable. The Company recognizes an impairment loss when the sum of the expected future cash flows is less than the carrying amount of the asset. Given the inherent technical and commercial risks within the space communications industry, it is reasonably possible that the Company's current estimate that it will recover the carrying amount of its long-lived assets from future operations may change.

Income Taxes

The provision for income taxes is determined based on pretax accounting income utilizing the liability method. Under this method, deferred tax assets and liabilities are determined based on differences between the financial reporting and tax basis of assets and liabilities and are measured using the tax rates and laws expected to be in effect when these differences reverse.

The Company files separate income tax returns and is not a member of consolidated group for income tax purposes.

2. Summary of Significant Accounting Policies (continued)

Income Taxes (continued)

Deferred tax assets as of December 31, 1996 total approximately $340,000 and are comprised principally of the tax effect of net operating loss carryforwards of $186,000 and deferred organizational expenses of $154,000. Because realization of these deferred tax assets in uncertain, a valuation allowance against the entire net deferred tax asset has been provided. The Company's net operating loss carryforwards of approximately $548,000 begin to expire in 2009. During 1996, the Company may have incurred a change in ownership pursuant to Section 382 of the Internal Revenue Code following the issuance of Non-voting Convertible Preferred Stock. As a result, the use of net operating losses may be subject to significant limitations. Subject to these limitations, the net operating loss carryforwards are available to offset taxable income.

Use of Estimates

The preparation of financial statements in conformity with generally accepted accounting principles requires management to make estimates and assumptions that affect the amounts reported in the financial statements and accompanying notes. Actual results could differ from those estimates.

Fair value of Financial Instruments

The Company believes the carrying value of its monetary assets and liabilities, consisting principally of cash and cash equivalents, stock subscription receivable and due to parent approximates the fair value of such assets and liabilities as of December 31, 1996.

3. Going Concern

The ultimate viability of the Company is dependent on the Company's ability to arrange adequate financing, obtain appropriate regulatory approval to operate a commercial satellite constellation, successfully launch and operate the satellite constellation, and develop a sufficient customer base to generate revenue. These factors raise doubt as to the Company's ability on its own to continue as a going concern; however, during 1997, the Company is addressing these issues and has initiated discussions with potential investors to raise funds for use in the construction of the Company's satellite constellation. During 1997, the Company also launched its second satellite (FAISAT-2V), entered into a meter reading demonstration contract with a U.S. utility company and signed a spectrum sharing agreement which will assist the Company's application for a commercial FCC license. Management believes the above actions will mitigate issues regarding going concern.

3. Going Concern (continued)

These financial statements do not contain any adjustments that might result from the outcome of this uncertainty.

4. Receivable

Balance at December 31, 1996 represents the amount due from the sale of Non-voting Convertible Preferred Stock during 1996, paid for in January 1997.

5. Mobile Satellite System Under Construction

The Company has entered into an agreement with its parent company for the construction of a LEO mobile satellite system. Balance comprised of the following as of December 31, 1996:

	Space Segment	Ground Segment	Total
Hardware and engineering costs	$10,261,824	$924,328	$11,186,152
Launch services and certain spacecraft components *(Note 9)*	3,400,000	–	3,400,000
Engineering services	3,200,000	–	3,200,000
	$16,861,824	$924,328	17,786,152
Deferred license costs:			
FCC application fee			247,970
Other deferred license costs			1,437,416
			$ 19,471,538

The balance capitalized as hardware and engineering costs represents primarily FAI labor charges, hardware and consulting fees re-billed by FAI to FACS.

Construction and operation of communications satellites in the United States requires licenses from the Federal Communications Commission ("FCC"). Similar licenses are required from foreign regulatory authorities to the permit the Company's mobile satellite system services to be offered outside the United States. During 1994, the Company paid $247,970 to the Federal Communications Commission as an application fee to become a licensed operator of a LEO

5. Mobile Satellite System Under Construction (continued)

satellite system. The Company expects to receive its license upon demonstration of its financial and technical capabilities to build and operate its planned satellite system. Upon approval, the Company will amortize the FCC license fee and other deferred license costs over the anticipated 10 year life of the license.

Other deferred license costs include legal and other expenses incurred in connection with the company's application for a FCC commercial license, and costs incurred coordinating the company's satellite operations with the International Telecommunications Union.

The mobile satellite system under construction includes assets located in Europe and Asia with a carrying value of approximately $4,900,000.

The carrying value of the Company's mobile satellite system under construction does not include approximately $8.0 million (unaudited) spent for research and development on the Company's first satellite by the principal stockholders of FAI, which amount is not included in these financial statements.

6. Notes Payable

Unsecured note payable to an investor, guaranteed by the parent company, due January 1998, interest free and convertible into Non-voting Convertible Preferred Stock until due. See note 10.	$101,000
Unsecured note payable to an investor, guaranteed by the parent company, interest payable quarterly at 10% per annum, principal due December 1997, principal convertible into Class B Non-voting Common Stock until due	100,000
	201,000
Less: current portion	(100,000)
	$101,000

7. Related Party Transactions

The Company has entered into an agreement with its parent company for the construction of a LEO mobile satellite system. Such agreement provides for FAI to build commercial satellites for FACS on a "cost plus" (time and material) basis under which FACS will pay FAI for the cost of direct materials and outside services used to design and manufacture the satellite, plus a general and administration charge. FACS will also pay an agreed rate per hour for each FAI labor hour used to design and manufacture the satellite. The Company paid FAI approximately $1,347,000 for the year ended December 31, 1996 for work performed pursuant to the aforementioned agreement (period from inception to December 31, 1996 - $4,672,072).

The Company has a balance payable to FAI of $14,815,778 as of December 31, 1996. The Company has provided FAI with an option to convert such debt into 3,683,000 shares of Class A Voting Common Stock, such conversion calculated with reference to the monthly share price of FACS stock sold during 1995 and 1996.

During the period from December 31, 1993 (inception) to December 31, 1996, FAI provided management services to FACS without charge.

8. Stockholders' Equity

Effective February 2, 1996 the Company's Board of Directors adopted a resolution to establish new classes of shares, and increase the total number of shares of stock which the Company has the authority to issue up to 50 million shares, consisting of 30 million shares designated as Class A Voting Common Stock ("Class A Common Stock"), 10 million shares designated as Class B Non-voting Common Stock ("Class B Common Stock") and 10 million shares designated as Non-voting Preferred Stock ("Convertible Preferred Stock").

Final Analysis Communication Services, Inc.
(A Development Stage Enterprise)

Notes to Financial Statements (continued)

8. Stockholders' Equity (continued)

Non-voting Convertible Preferred Stock

Non-voting Convertible Preferred Stock as of December 31, 1996 is comprised of the following:

Convertible Preferred Stock, $.001 par value, convertible to Class B Non-voting Common Stock:	
Series A Preferred Stock, 1,370,000 shares authorized; 1,370,000 shares issued and outstanding; issue price and liquidation preference value - $1.25 per share	$ 1,712,500
Series B Preferred Stock, 100,000 shares authorized; 71,111 shares issued and outstanding; issue price and liquidation preference value - $2.25 per share	160,000
Series C Preferred Stock, 410,000 shares authorized; 410,000 shares issued and outstanding; issue price and liquidation preference value - $2.50 per share	1,025,000
Series D Preferred Stock, 493,000 shares authorized; 493,000 shares issued and outstanding; issue price and liquidation preference value - $3.00 per share	1,479,000
Series E Preferred Stock, 254,000 shares authorized; 211,000 issued and outstanding; issue price and liquidation preference value - $3.50 per share	738,500
Series F Preferred Stock, 50,000 shares authorized; 50,000 shares issued and outstanding, issue price and liquidation preference value - $4.00 per share	194,712
Series G Preferred Stock, 60,000 shares authorized; 60,000 shares issued and outstanding, issue price and liquidation preference value - $5.00 per share	281,694
Series H Preferred Stock, 131,875 shares authorized; 131,875 shares issued and outstanding, issue price and liquidation preference value - $8.00 per share	917,232
	$ 6,508,638

Shares of Series A through H Preferred Stock are non-voting and pay cumulative dividends at a rate of 10% of the issue price for the fractional portion of each year outstanding. Dividends are payable as and when declared by the Board of Directors. Each share of Series A through H Preferred Stock may be converted at the option of the holder thereof at any time into such number of fully paid and non-assessable shares of Non-voting Class B Common Stock as is determined by dividing the applicable issue price by a conversion price in effect at each time of conversion. Such conversion price is initially equal to the issue price, and is subject to anti-dilution provisions.

8. Stockholders' Equity (continued)

Cumulative dividends in arrears amount to $105,604, $9,867, $63,208, $69,702, $33,028 $12,333, $13,416 and $19,873 for Series A, B, C, D, E , F, G, and H Preferred Stock, respectively.

During February 1996, the Company and FAI agreed to convert 5,400 shares of Common Stock held by FAI into 5,400,000 shares of Class A Voting Common Stock, and the Company and non-affiliated stockholders holding 2,513 shares of Common Stock agreed to convert such shares into 2,512,889 shares of Non-voting Convertible Preferred Stock with an aggregate liquidation value of $5,115,000 upon issue.

Warrants

During 1996, the Board of Directors authorized the issuance of warrants entitling the holders thereof to purchase 939,000 shares of Class B Non-voting Common Stock for prices between $4.00 and $8.00 per share. Of this total, the Company issued one warrant to a strategic partner entitling the holder to purchase 126,500 shares of Class B Non-voting Common Stock at $4.00 per share. Such warrant was issued in connection with the sale of Non-voting Convertible Preferred Stock during 1996 and expires in December 2000.

9. Other information

The Company's parent and Polyot, a Russian space organization, have entered into a long-term partnership pursuant to which Polyot will provide launch services for the Company's entire satellite constellation.

The Company has entered into an agreement to provide a portion of the satellite capacity in FAISAT 2V to a third party, in exchange for an earlier entry into the market under the third party's FCC license.

10. Subsequent Events

In March 1997, the Company borrowed $700,000 under the terms of a promissory note entitling the holder thereof to convert such amount into shares of Non-voting Convertible Preferred Stock at $8.00 per share subject to anti-dilution provisions.

In May 1997, the Company provided an option to one of its lenders to convert an outstanding loan balance of $72,000 into shares of Non-voting Convertible Preferred Stock at a value of $8.00 per share.

In June 1997, the Company's Board of Directors authorized the issuance of additional warrants entitling the holders thereof to purchase 759,000 shares of Class B Non-voting Common Stock at a price of $8.00 per share.

In June 1997, the Company entered into an agreement with a strategic partner pursuant to which the Company agreed to make payments aggregating $1,700,000 in exchange for engineering support and technical assistance provided during 1997 and future years. Such amount is payable in 8 annual installments of $200,000 and one installment of $100,000, commencing in the year after which FAI or FACS first reports net sales of $20,000,000.

In September 1997, the Company successfully launched its second satellite FAISAT-2V.

During October 1997, the holder of the $101,000 note due January 1998 converted such note into shares of Non-voting Convertible Preferred Stock. See note 6.

In the period to October 1997, the Company sold 386,375 shares of Series H Non-voting Convertible Preferred Stock to investors for $8.00 per share generating aggregate proceeds of $3,091,000. In connection with such sales, the Company issued warrants entitling the holders to purchase 90,000 shares of Class B Non-voting Common Stock at par value.

CERTIFICATIONS

CERTIFICATION OF ENGINEER

I, David W. Grimes, Chief Engineer, Final Analysis, by my signature affixed below, hereby certify, pursuant to Section 1.16 of the Commission's rules, 47 C.F.R. Section 1.16, that:

(1) I am the technically qualified person responsible for preparation of the engineering information contained in the foregoing Amendment to Application;

(2) I am familiar with the Commission's rules set forth in Part 25 of Title 47 of the Code of Federal Regulations;

(3) I have either prepared or reviewed the engineering information submitted in this Amendment; and,

(4) I certify under penalty of perjury that the foregoing is true and correct to the best of my knowledge.

David W. Grimes, Chief Engineer
Final Analysis

Executed on October 30, 1997

CERTIFICATION OF APPLICANT

On behalf of Final Analysis Communications Services, Inc., and in accordance with Section 1.2001-1.2003 of the Commission's rules, 47 C.F.R. Sections 1.2001-1.2003, I hereby certify that no party to this application is subject to a denial of Federal benefits that includes FCC benefits pursuant to Section 5301 of the Anti-Drug Abuse Act of 1998. *See* 21 U.S.C. Section 852a. Pursuant to Section 1.16 of the Commission's rules, 47 C.F.R. Section 1.15, I also hereby certify under penalty of perjury that the statements in the foregoing Amendment to Application are true, correct, and complete to the best of my knowledge and are made in good faith.

FINAL ANALYSIS COMMUNICATION SERVICES, INC.

By: ______________________________

Nader Modanlo,
Chairman, President

Executed on October 30, 1997

CERTIFICATE OF SERVICE

I hereby certify that a true and correct copy of the foregoing Amendment to Application was sent by first-class mail, postage prepaid, or by hand delivery this 30th day of October, 1997, to each of the following:

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Federal Communications Commission
1919 M Street, N.W., Room 814
Washington, D.C. 20554

Commissioner James H. Quello*
Federal Communications Commission
1919 M Street, N.W., Room 802
Washington, D.C. 20554

Commissioner Rachelle B. Chong*
Federal Communications Commission
1919 M Street, N.W., Room 844
Washington, D.C. 20554

Commissioner Susan Ness*
Federal Communications Commission
1919 M Street, N.W., Room 832
Washington, D.C. 20554

Mr. Regina Keeney*
Chief, International Bureau
Federal Communications Commission
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