

SAT-LDA-19991119-00112

52382

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FEDERAL COMMUNICATIONS COMMISSION
REMITTANCE ADVICE

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SPECIAL USE
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FCC/WEL PAGE NO. NOV 19 1999

SECTION A - PAYER INFORMATION

(2) PAYER NAME (If paying by credit card, enter name exactly as it appears on your card) PanAmSat Corporation		(3) TOTAL AMOUNT PAID (dollars and cents) \$ 89,460.00
(4) STREET ADDRESS LINE NO. 1 One Pickwick Plaza		
(5) STREET ADDRESS LINE NO. 2		
(6) CITY Greenwich	(7) STATE CT	(8) ZIP CODE 06830
(9) DAYTIME TELEPHONE NUMBER (include area code) (203) 622-6664	(10) COUNTRY CODE (if not in U.S.A.)	

COPY

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)		
(12) STREET ADDRESS LINE NO. 1		
(13) STREET ADDRESS LINE NO. 2		
(14) CITY	(15) STATE	(16) ZIP CODE
(17) DAYTIME TELEPHONE NUMBER (include area code)	(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

(19A) FCC CALL SIGN/OTHER ID PAS-24	(20A) PAYMENT TYPE CODE (PTC) B N Y	(21A) QUANTITY 1	(22A) FEE DUE FOR (PTC) IN BLOCK 20A \$ 89,460.00	FCC USE ONLY
(23A) FCC CODE 1	(24A) FCC CODE 2			
(19B) FCC CALL SIGN/OTHER ID	(20B) PAYMENT TYPE CODE (PTC)	(21B) QUANTITY	(22B) FEE DUE FOR (PTC) IN BLOCK 20B	FCC USE ONLY
(23B) FCC CODE 1	(24B) FCC CODE 2			
(19C) FCC CALL SIGN/OTHER ID	(20C) PAYMENT TYPE CODE (PTC)	(21C) QUANTITY	(22C) FEE DUE FOR (PTC) IN BLOCK 20C	FCC USE ONLY
(23C) FCC CODE 1	(24C) FCC CODE 2			
(19D) FCC CALL SIGN/OTHER ID	(20D) PAYMENT TYPE CODE (PTC)	(21D) QUANTITY	(22D) FEE DUE FOR (PTC) IN BLOCK 20D	FCC USE ONLY
(23D) FCC CODE 1	(24D) FCC CODE 2			

SECTION D - TAXPAYER INFORMATION (REQUIRED)

(25) PAYER TIN 0613698100	(26) COMPLETE THIS BLOCK ONLY IF APPLICANT NAME IS DIFFERENT FROM PAYER NAME (N/A) APPLICANT TIN
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SECTION E - CERTIFICATION

(27) CERTIFICATION STATEMENT
I, _____, Certify under penalty of perjury that the foregoing and supporting information
(PRINT NAME)
are true and correct to the best of my knowledge, information and belief. SIGNATURE _____

SECTION F - CREDIT CARD PAYMENT INFORMATION

(28) MASTERCARD	MASTERCARD/VISA ACCOUNT NUMBER	EXPIRATION DATE
<input type="checkbox"/>		MONTH YEAR
VISA	if hereby authorizes the FCC to charge any VISA or MASTERCARD for the service(s)/authorization(s) herein described.	AUTHORIZED SIGNATURE
<input type="checkbox"/>		DATE

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

In the Matter of the Application of)
)
PANAMSAT LICENSEE CORP.) File No.
)
For Authority To Launch and Operate)
A Replacement C/Ku-band Hybrid)
Fixed-Satellite Service Space Station)

APPLICATION FOR AUTHORITY TO LAUNCH AND OPERATE A REPLACEMENT
C/KU-BAND HYBRID FIXED-SATELLITE SERVICE SPACE STATION

James W. Cuminale
Executive Vice President &
General Counsel
PANAMSAT LICENSEE CORP.
One Pickwick Plaza
Greenwich, Connecticut 06830
(203) 622-6664

Of Counsel:

Joseph A. Godles, Esq.
Goldberg, Godles, Wiener & Wright
1229 19th Street, N.W.
Washington, D.C. 20036
(202) 429-4900

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FEDERAL COMMUNICATIONS COMMISSION
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In the Matter of the Application of)
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For Authority To Launch and Operate)
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Fixed-Satellite Service Space Station)

**APPLICATION FOR AUTHORITY TO LAUNCH AND OPERATE A REPLACEMENT
C/KU-band HYBRID FIXED-SATELLITE SERVICE SPACE STATION**

PanAmSat Licensee Corp. ("PanAmSat") hereby requests authority to launch and operate a replacement C/Ku-band hybrid space station in the fixed-satellite service ("FSS"), to be known as PAS-24, to replace PanAmSat's PAS-6 satellite. PanAmSat proposes to locate PAS-24 at 68.5° E.L., which is the orbital location that is assigned to PAS-6.

Significantly, because PAS-24 will be providing service from the orbital location previously assigned to PAS-6, PanAmSat is not herein seeking the assignment of an additional orbital location, nor will grant of PanAmSat's Application increase congestion in the satellite arc. In accordance with the Commission's policies and rules, PanAmSat respectfully requests that its application for a replacement satellite be processed outside of the context of a processing round.¹

INTRODUCTION

PanAmSat operates a global network of nineteen commercial communications satellites. Using these satellites, PanAmSat and its predecessors have provided a wide variety of reliable satellite services for many years. PanAmSat's satellites provide the means for commercial television and radio distribution, teleconferencing, video backhaul, high speed image transmission, and private data networks, among other services. Countless end users across the world rely on these services every day.

¹ See, e.g., In the matter of Loral SpaceCom Corp., 13 FCC Rcd. 16438 (1998); In the Matter of GE American Communications, 10 FCC Rcd 13775, 13776 (1995).

In support of this Application, PanAmSat submits the following information:

Item A. Name, Address, and Telephone Number of Applicant

PanAmSat Licensee Corp.
One Pickwick Plaza
Greenwich, CT 06830
(203) 622-6664

Item B. General Technical Information and System Description

See attached Engineering Statement.

Item C. Correspondence

Inquiries or correspondence with respect to this application should be sent to the following person at the above address and telephone number:

James W. Cuminale
Executive Vice President & General Counsel

With a copy to:

Joseph A. Godles, Esq.
Goldberg, Godles, Wiener & Wright
1229 19th Street, N.W.
Washington, D.C. 20036
(202) 429-4900

Item D. Milestones

See Exhibit 1.

Item E. Financial Qualifications

Exhibit 2 and the attached full financial showing demonstrate that PanAmSat has the current financial ability to meet the estimated costs of constructing PAS-24, launching the satellite, and operating it for one year.

Item F. Legal Qualifications

The portions of the application appearing on FCC Form 312 establish PanAmSat's legal qualifications, which are a matter of public record. See also Hughes Communications, Inc. et al., 12 FCC Rcd. 7534 (1997).

Item G. Type of Operations

PanAmSat proposes to market all of the transponders on PAS-24 on a non-common carrier basis, pursuant to the Commission's decisions in Domestic Fixed-Satellite Transponder Sales, 90 F.C.C.2d 1238 (1982), and Martin Marietta Communications Systems, Inc., 60 R.R.2d 779 (1986). PanAmSat will retain the flexibility to market transponders to common carriers and resellers. Thus, although common carrier services may be offered using its transponders, they will not be offered by PanAmSat.

Item H. Public Interest Considerations

Grant of this Application is consistent with the Commission's objective of facilitating continuity of service for both operators and their customers. The Commission already has determined that it is in the public interest for PanAmSat to operate PAS-6,² and grant of this Application will enable PanAmSat to continue providing service at 68.5° E.L. by replacing PAS-6, which has experienced a failure of its primary spacecraft control processor, with PAS-24.

WAIVERS/CERTIFICATIONS

PanAmSat 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 launch and operating authority in accordance with this Application. All statements made in the attached exhibits are a material part hereof, and are incorporated herein as if set out in full in this Application.

² Alpha Lyracom, d/b/a PAN AMERICAN SATELLITE, 8 FCC Rcd. 376 (1992), modified DA 95-1682 (rel. Jul. 31, 1995).

The undersigned certifies individually and for PanAmSat that the statements made in this Application are true, complete, and correct to the best of his knowledge and belief, and are made in good faith.

The undersigned also certifies that neither PanAmSat nor any 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 1988, 21 U.S.C. § 853a.

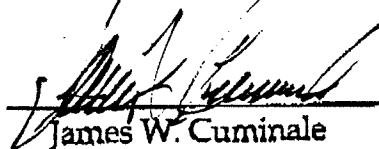
CONCLUSION

For the foregoing reasons, PanAmSat respectfully requests that the Commission grant this Application.

Respectfully submitted,

PANAMSAT LICENSEE CORP.

By: _____



James W. Cuminale
Executive Vice President &
General Counsel

Of Counsel:

Joseph A. Godles, Esq.
Goldberg, Godles, Wiener & Wright
1229 19th Street, N.W.
Washington, D.C. 20036

November 18, 1999

EXHIBIT 1

PAS-24 MILESTONES

<u>EVENT</u>	<u>COMPLETION DATE</u>
Spacecraft RFP issued	Completed
Spacecraft contractor selected	Completed
Spacecraft contract executed	Completed
Launch services contract executed	December 1999
Spacecraft launched	4Q 2000
Spacecraft in service	1Q 2001

EXHIBIT 2

PAS-24 CAPITAL REQUIREMENTS

REQUIREMENT

ESTIMATED COST

Construction, launch, insurance
premium, first year expenses

\$206 million

Item B. General Technical Information

Satellite Operational Characteristics

a. Frequency Plan

The PAS-24 satellite has been designed to replace the existing PAS-6 satellite presently at the 68.5°EL orbital location. The satellite will be constructed to operate in both the C- and Ku-frequency bands. The radio frequency and polarization plans are described in Figures 1a and 1b and Tables 1a and 1b.

The Ku-Band payload consists of 24 active transponders, each with a bandwidth of 36 MHz. The C-Band payload consists of 24 transponders with bandwidths of 54MHz and 27MHz. The satellite will employ full frequency reuse through dual linear polarization and geographic isolation.

In addition to the communications channel frequencies, two Ku-Band command uplinks (see Table 7), two Ku-Band telemetry downlinks (see Table 8), and two Ku-Band beacon downlink frequencies are planned. During transfer orbit, command signals will be received through an omni-directional antenna at the lower band-edge of the Ku-Band receive frequencies. When the satellite is at its final orbit position, the primary command uplink will be received at the higher edge of the standard Ku-Band frequencies. This will occur through the

Ku-Band communications reflector, with the omnidirectional antenna available as a backup. The command uplink will use government-approved command encryption. The two Ku-Band telemetry frequencies will allow simultaneous transmission of two separate or redundant telemetry data streams. The Ku-Band downlink beacon signals will be continuously transmitted by the satellite and used by earth station operators as a calibrated reference to compensate for rain attenuation and to adjust antenna pointing.

The satellite communication subsystem will include appropriate filtering at the inputs and outputs of the satellite to minimize internal interchannel interference, noise effects outside the satellite frequency band, and out-of-band spurious transmissions.

Figure 1. C-Band Frequency Plan

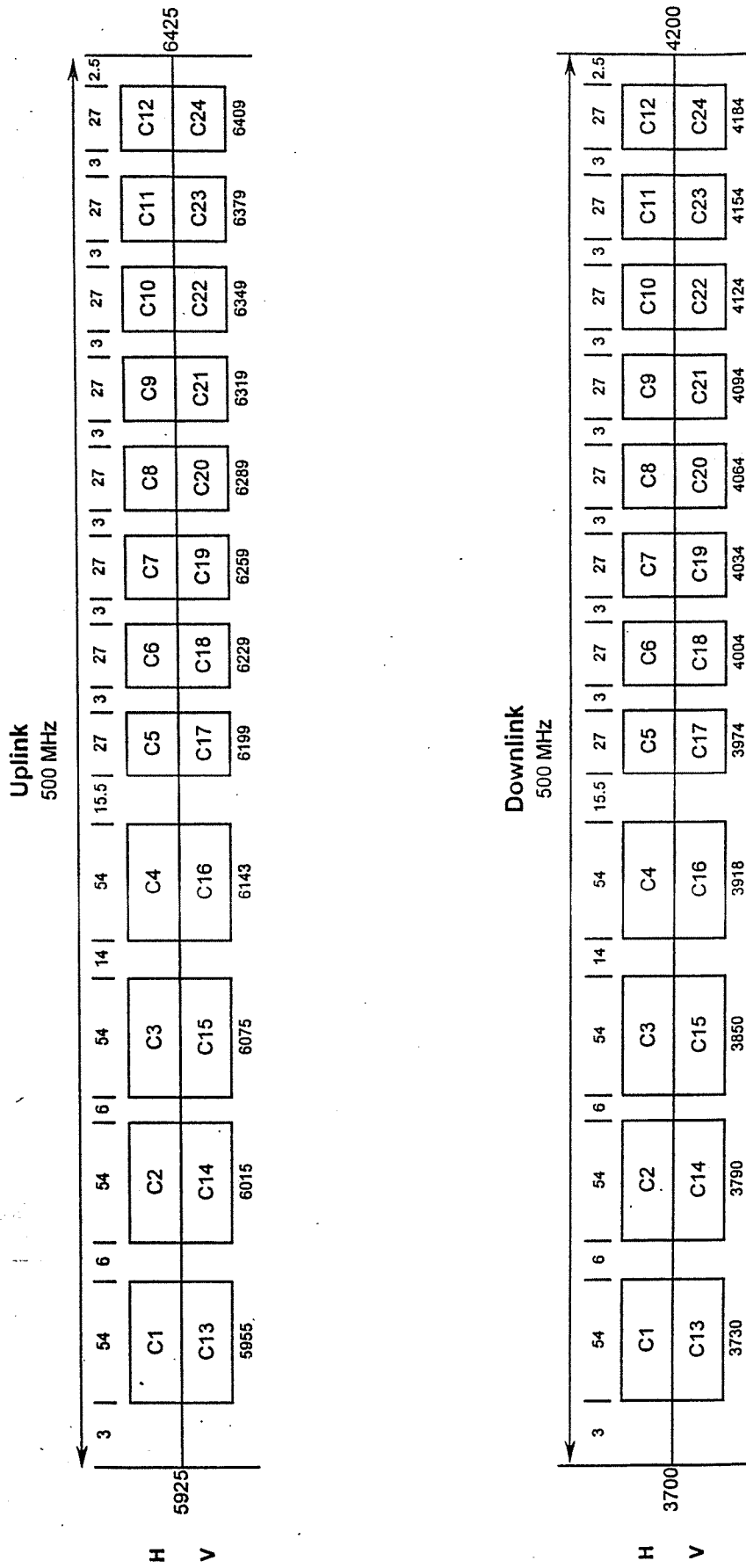


Figure 2. Ku-Band Frequency Plan

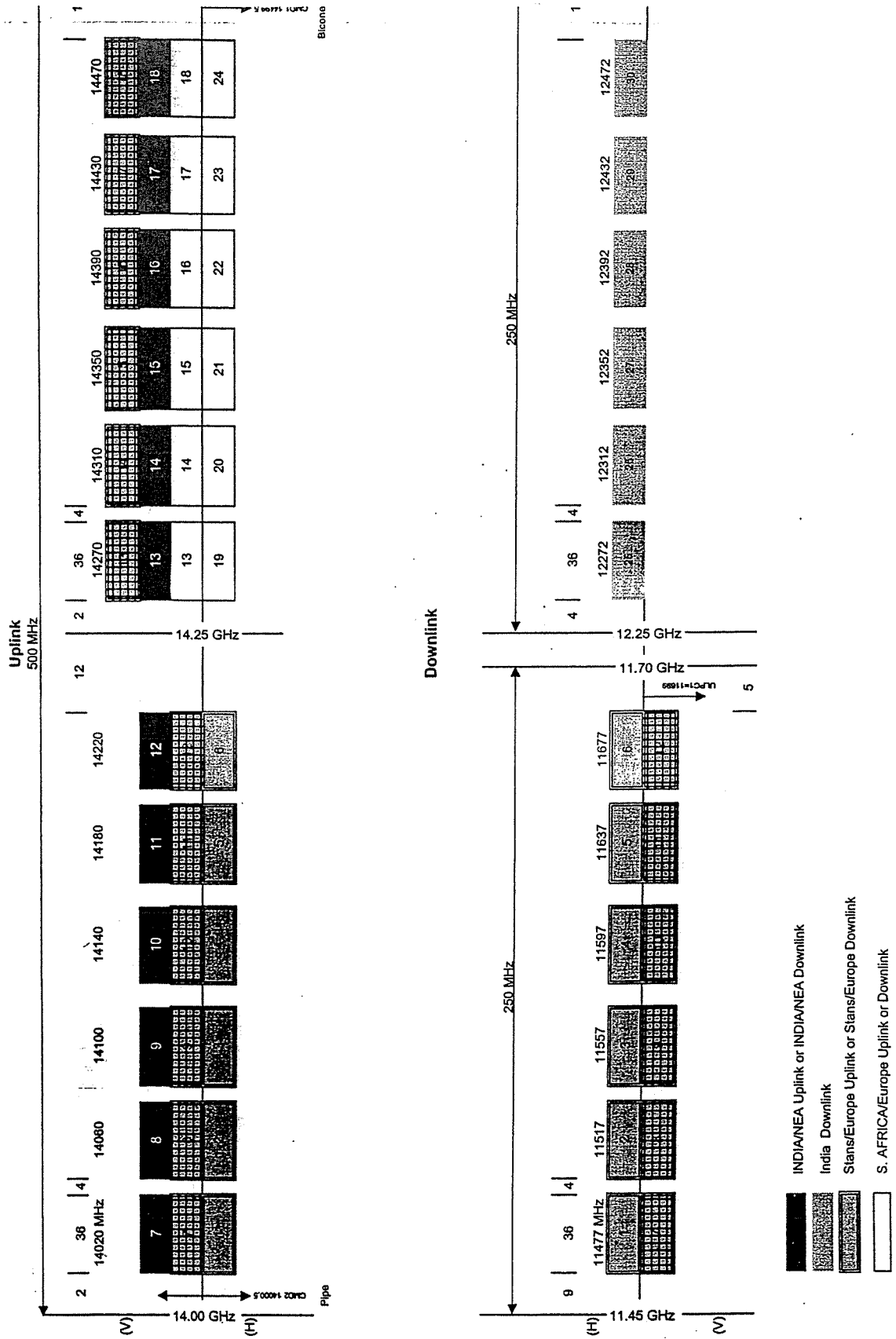


Table 1a. C-Band Frequency Assignments

<u>Transponder</u>	<u>Uplink Pol</u>	<u>Uplink Frequency (MHz)</u>	<u>Downlink Pol</u>	<u>Downlink Frequency (MHz)</u>	<u>Channel Bandwidth (MHz)</u>
1	H	5955	V	3730	36
2	H	6015	V	3790	36
3	H	6075	V	3850	36
4	H	6143	V	3918	36
5	H	6199	V	3974	36
6	H	6229	V	4004	36
7	H	6259	V	4034	36
8	H	6289	V	4064	36
9	H	6319	V	4094	36
10	H	6349	V	4124	36
11	H	6379	V	4154	36
12	H	6409	V	4184	36
13	V	5955	H	3730	36
14	V	6015	H	3790	36
15	V	6075	H	3850	36
16	V	6143	H	3918	36
17	V	6199	H	3974	36
18	V	6229	H	4004	36
19	V	6259	H	4034	36
20	V	6289	H	4064	36
21	V	6319	H	4094	36
22	V	6349	H	4124	36
23	V	6379	H	4154	36
24	V	6409	H	4184	36

Pol = Polarization
V = Vertical Polarization
H = Horizontal Polarization

Table 1b. Ku-Band Frequency Assignments

<u>Transponder</u>	<u>Uplink Pol</u>	<u>Uplink Frequency (MHz)</u>	<u>Downlink Pol</u>	<u>Downlink Frequency (MHz)</u>	<u>Channel Bandwidth (MHz)</u>
1	H	14020	H	11477	36
2	H	14060	H	11517	36
3	H	14100	H	11557	36
4	H	14140	H	11597	36
5	H	14180	H	11637	36
6	H	14220	H	11677	36
7	V	14020	H	11477	36
8	V	14060	H	11517	36
9	V	14100	H	11557	36
10	V	14140	V	11597	36
11	V	14180	V	11637	36
12	V	14220	V	11677	36
13	V	14270	V	12522	36
14	V	14310	V	12562	36
15	V	14350	V	12602	36
16	V	14390	V	12642	36
17	V	14430	V	12682	36
18	V	14470	V	12722	36
19	H	14270	H	12522	36
20	H	14310	H	12562	36
21	H	14350	H	12602	36
22	H	14390	H	12642	36
23	H	14430	H	12682	36
24	H	14470	H	12722	36
25	H	14270	H	12272	36
26	H	14310	H	12312	36
27	H	14350	H	12352	36
28	H	14390	H	12392	36
29	H	14430	H	12432	36
30	H	14470	H	12472	36

Pol = Polarization
V = Vertical Polarization
H = Horizontal Polarization

b. Emission Designators

Commands to the satellite from the TT&C station will be angle-modulated with a large deviation on the uplink carrier. The satellite will be equipped with government-approved command encryption equipment in order to secure command transmissions. Telemetry data from the satellite will be angle-modulated on the downlink carrier. The emission designators for the communications, TT&C, and downlink beacon signals are as follows:

Table 2. Emissions Designators

<u>Signal</u>	<u>Emission Designator</u>
Command	300KF9DXX
Telemetry/Ranging	120KF9DXX
Downlink Beacon	25KONON
Single carrier TV	32M0F3FNN
High Speed Data	25M7G1WDN
Digital (T1) data	1M17G1WDF
Digital (inroute) data	307KG1WDW
Digital voice	24K3G1WDF
Digital (outroute) data	1M23G1WDF
Digital (64 kbps) data	48K6G1WDF
FM Audio (Narrow-Band)	50K0F3EJF
FM Audio (Wide-Band)	150KF3EJF

c. Communications Coverage

The PAS-24 receive/transmit patterns are depicted in Figures 3 through 9. These figures show downlink coverages over North East Asia, India, The Middle East, The Stans (former Soviet republics ending in Stan, i.e., Kazakstan, Uzbekastan, etc.), and Europe/Southern Africa at Ku-Band and worldwide (land mass) at C-Band. Switching at Ku-Band is provided allowing various channels in each beam to be used when required.

Figure 3. C-Band Global (Landmass) Coverage

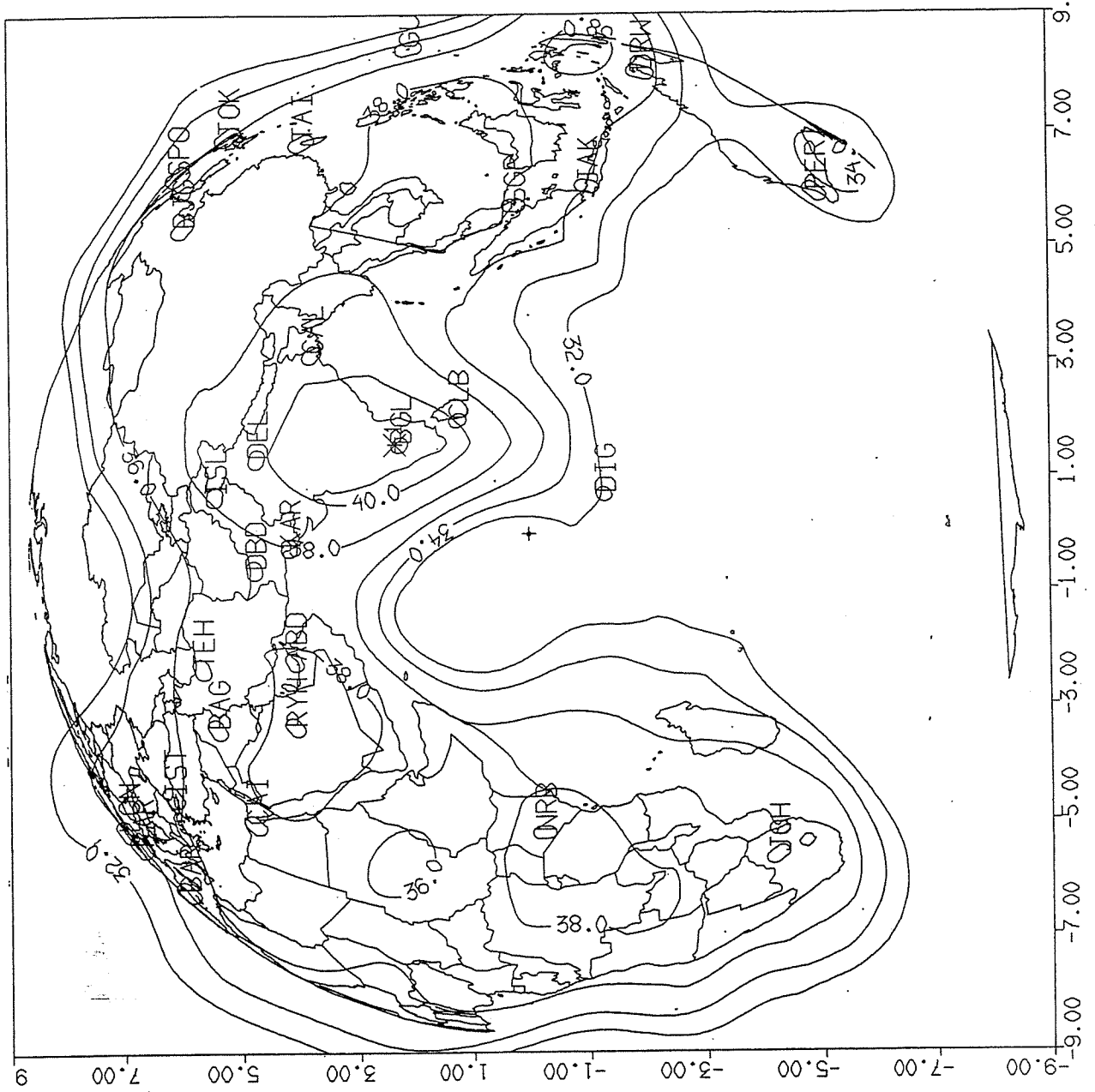


Figure 4. Ku-Band Stans/Europe Downlink Coverage

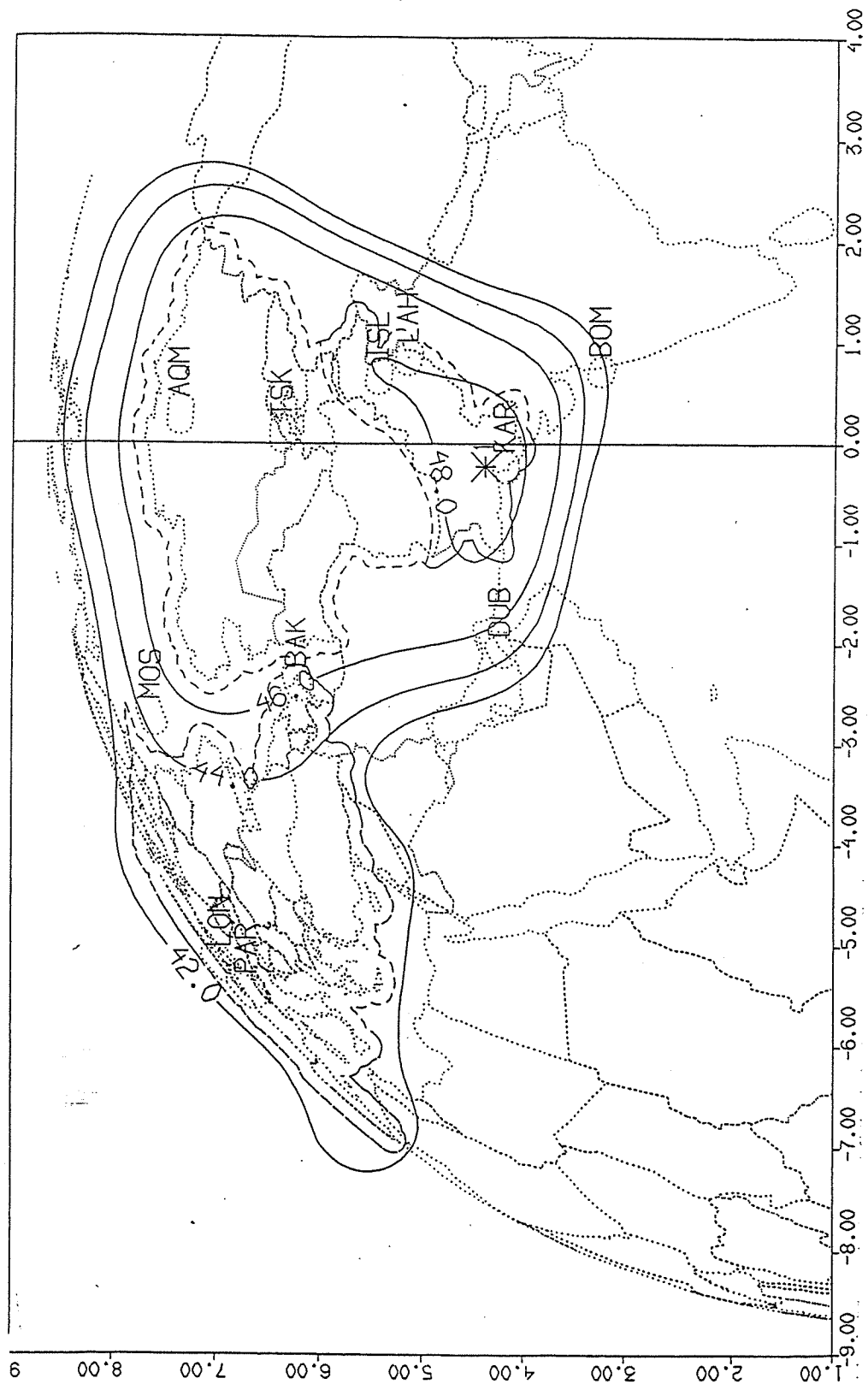


Figure 5. Ku-Band India/North East Asia Downlink Coverage

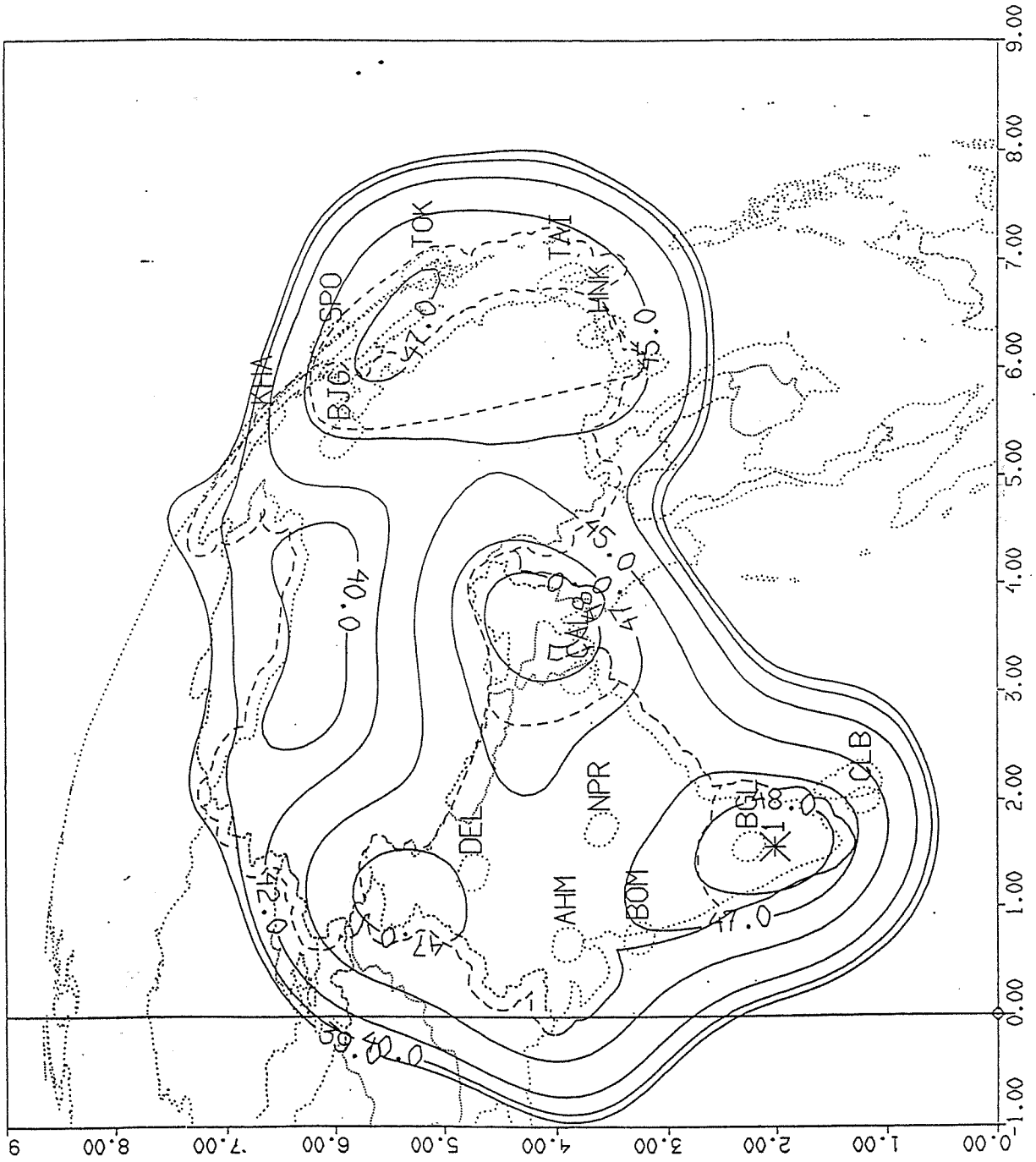


Figure 6. Ku-Band Southern Africa/Europe Downlink Coverage

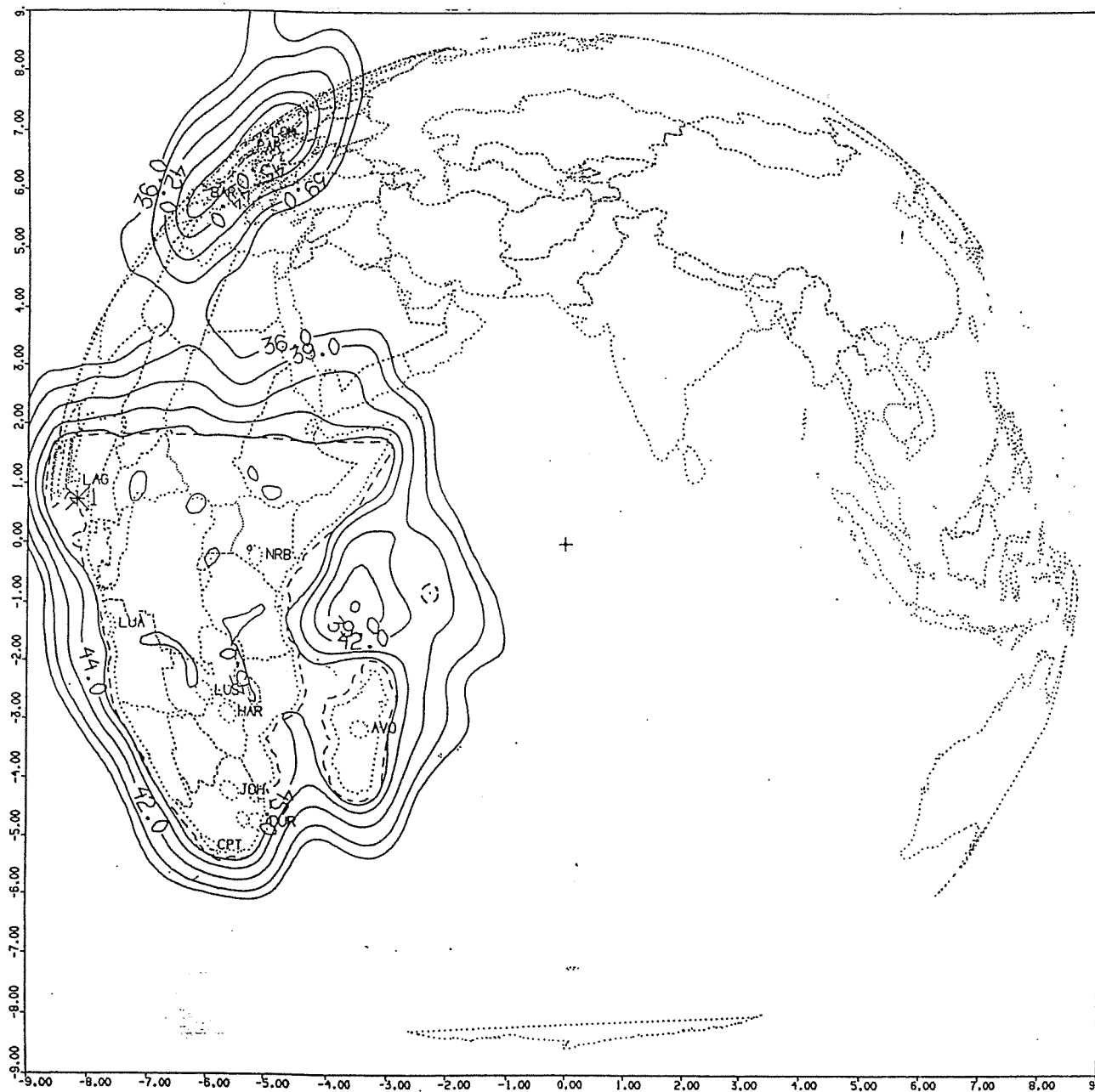


Figure 7. Ku-Band India Downlink Coverage

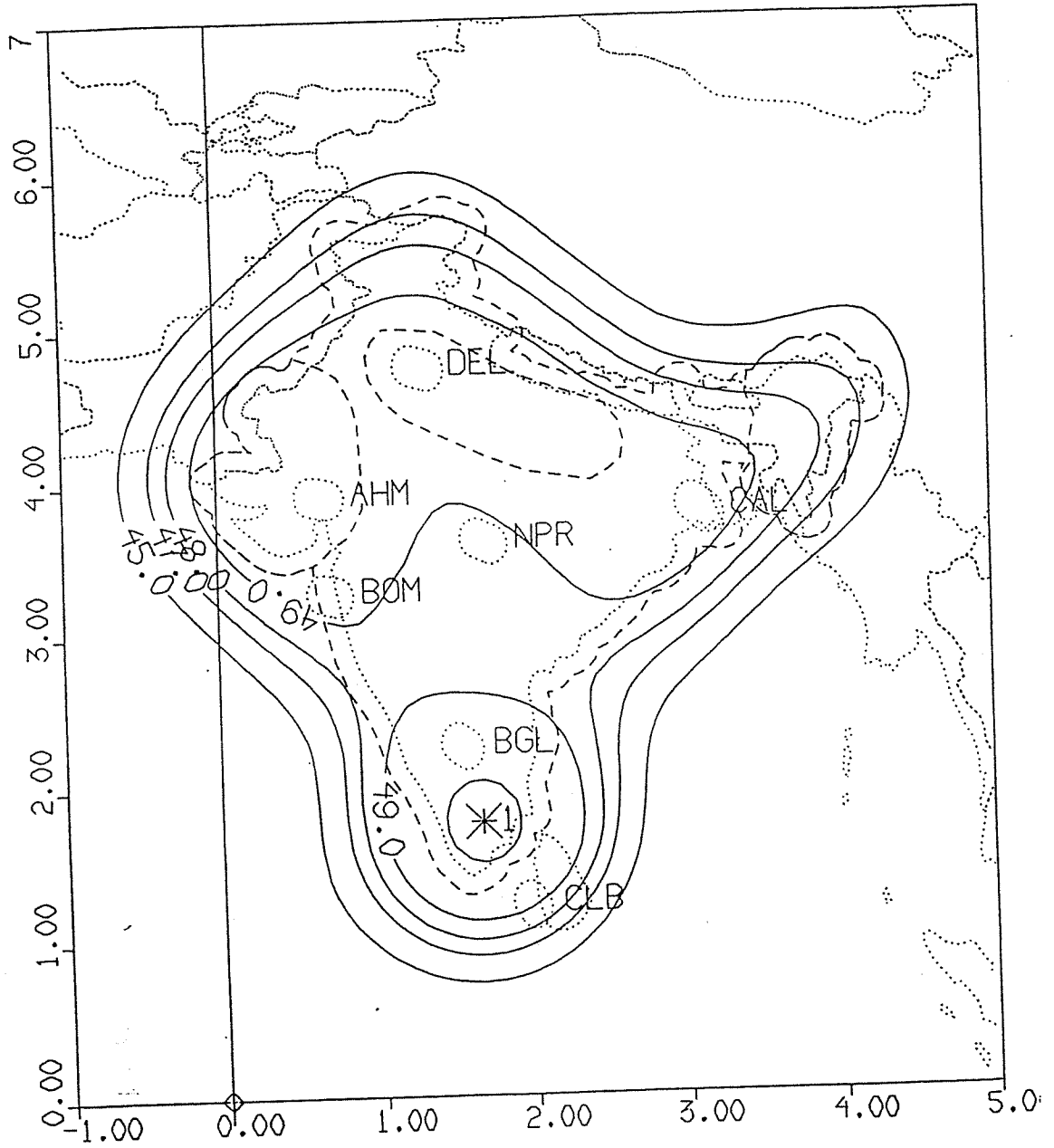


Figure 8. Ku-Band Europe/Middle East Coverage

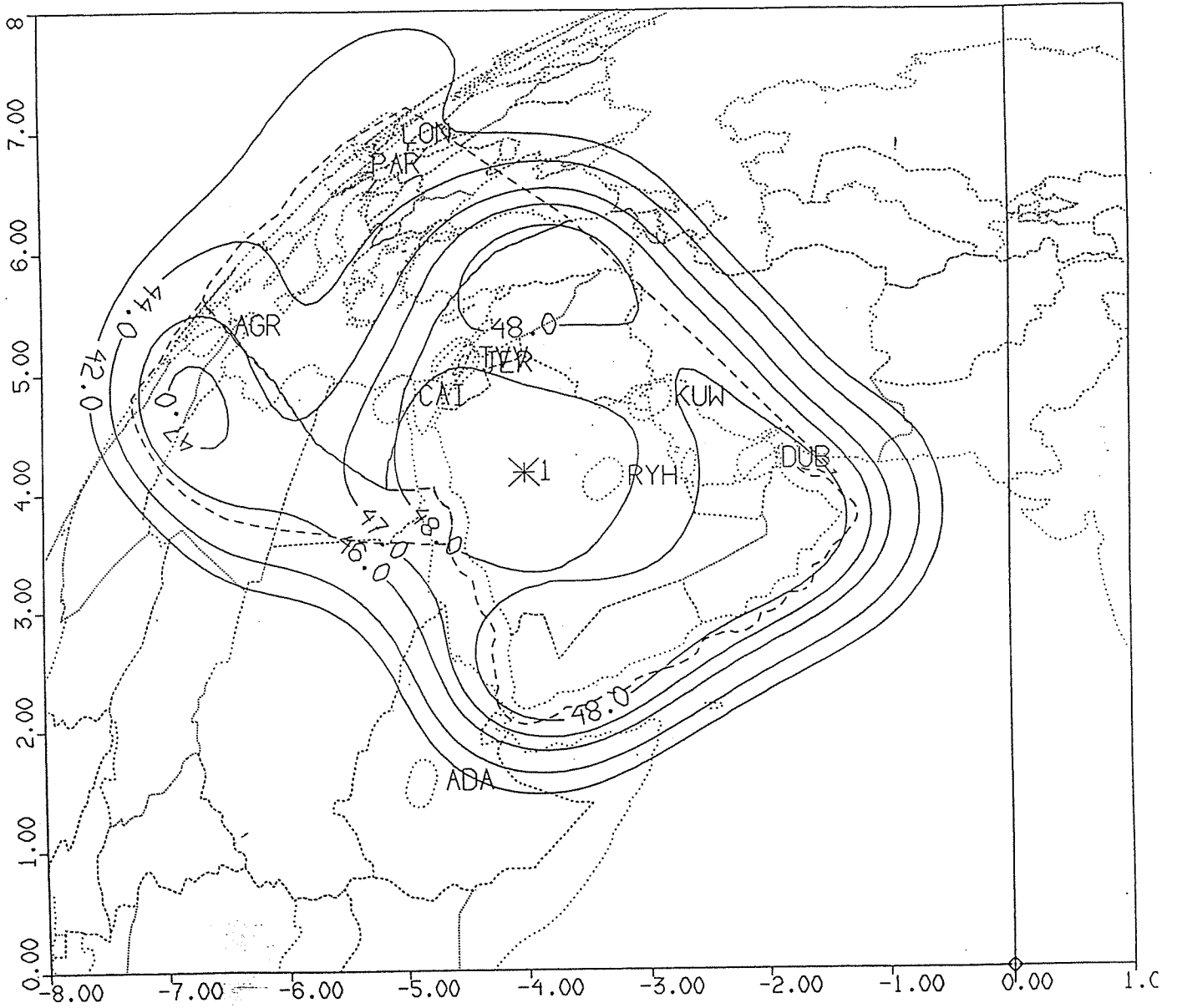
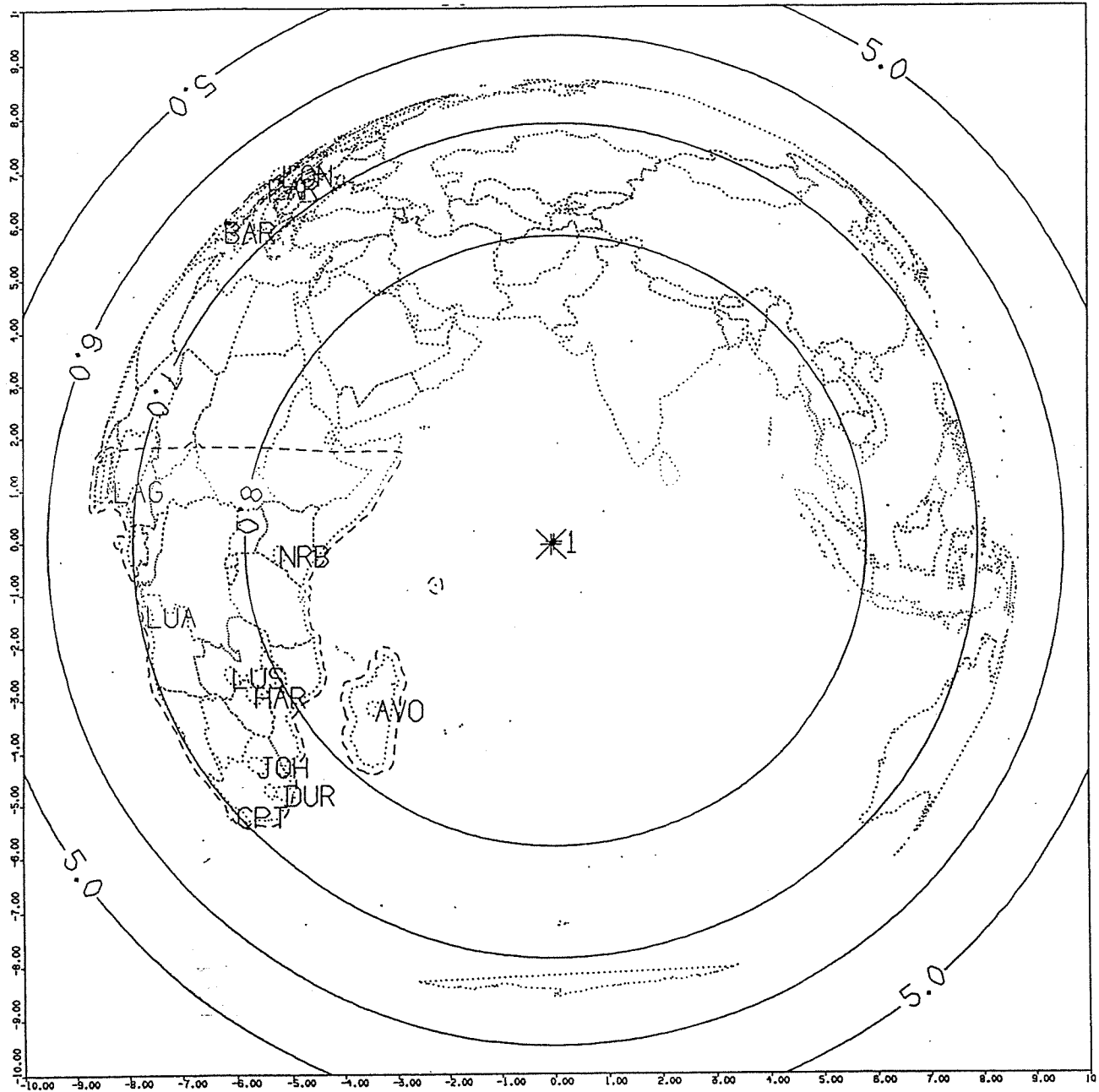


Figure 9. Ku-Band Global Telemetry/Beacon Coverage



d. Power Flux Density Level

The power flux density limits for space stations are specified in Section 25.208 of the FCC Rules. Using the contours in Figures 3 through 8 it will be shown that the PAS-24 satellite will meet the Commission's regulations.

For the C-Band Global beam (54MHz):

Maximum EIRP in Global Beam (dBW)	39.9
Path Loss to Global Beam boresite (dB)	-196.0
Gain of 1m ² Antenna (dB)	42.8
Bandwidth of Digital TV Carrier (dB)	-77.3
Conversion to 4kHz (dB)	36.0

Maximum Power Flux Density (dBW/m ² /4kHz)	-154.6

For the C-Band Global beam (27MHz):

Maximum EIRP in Global Beam (dBW)	39.9
Path Loss to Global Beam boresite (dB)	-196.0
Gain of 1m ² Antenna (dB)	42.8
Bandwidth of Digital TV Carrier (dB)	-74.3
Conversion to 4kHz (dB)	36.0

Maximum Power Flux Density (dBW/m ² /4kHz)	-151.6

For the Ku-Band Europe/Middle East (EME) beam:

Maximum EIRP in EME Beam (dBW)	49.5
Path Loss to EME Beam boresite (dB)	-205.0
Gain of 1m ² Antenna (dB)	42.8
Bandwidth of Digital TV Carrier (dB)	-75.6
Conversion to 4kHz (dB)	36.0

Maximum Power Flux Density (dBW/m ² /4kHz)	-152.3

For the Ku-Band Europe/Stans (EST) beams:

Maximum EIRP in EST Beam (dBW)	48.7
Path Loss to EST Beam boresite (dB)	-205.0
Gain of 1m ² Antenna (dB)	42.8
Bandwidth of Digital TV Carrier (dB)	-75.6
Conversion to 4kHz (dB)	36.0

Maximum Power Flux Density (dBW/m ² /4kHz)	-153.1

For the Ku-Band India (IND) beam:

Maximum EIRP in IND Beam (dBW)	51.3
Path Loss to IND Beam boresite (dB)	-205.0
Gain of 1m ² Antenna (dB)	42.8
Bandwidth of Digital TV Carrier (dB)	-75.6
Conversion to 4kHz (dB)	36.0

Maximum Power Flux Density (dBW/m ² /4kHz)	-149.7

For the Ku-Band Europe/Africa (KEA) beam:

Maximum EIRP in KEA Beam (dBW)	47.2
Path Loss to KEA Beam boresite (dB)	-205.0
Gain of 1m ² Antenna (dB)	42.8
Bandwidth of Digital TV Carrier (dB)	-75.6
Conversion to 4kHz (dB)	36.0

Maximum Power Flux Density (dBW/m ² /4kHz)	-154.6

For the Ku-Band India/NE Asia (INA) beam:

Maximum EIRP in INA Beam (dBW)	48.7
Path Loss to INA Beam boresite (dB)	-205.0
Gain of 1m ² Antenna (dB)	42.8
Bandwidth of Digital TV Carrier (dB)	-75.6
Conversion to 4kHz (dB)	36.0

Maximum Power Flux Density (dBW/m ² /4kHz)	-153.1

As can be seen from the results of the calculations none of PAS-24 beams exceed the flux density limitations employed by the Commission and ITU.

2. Satellite characteristics

The major characteristics of the spacecraft are shown below in Table 3. The estimated weight and power budgets, listed in Tables 4 and 5, are based on a mission life of 15 years and assume sufficient redundancy to allow for random failures.

Table 3. Spacecraft Characteristics

General

spacecraft bus	Hughes, HS-601HP Block 1
stabilization transfer orbit on station	GWANC/spin stabilization 3 axis body stabilized
mission life	15 years (estimated)
eclipse capability (48 transponders)	100 percent
stationkeeping north-south east-west	$\pm 0.05^\circ$ $\pm 0.05^\circ$
antenna pointing	roll pitch yaw
Normal mode	0.12, 0.11, 0.74
Maneuver Mode	0.22, 0.20, 0.33

Communications

frequency	
receive	14000 to 14500 MHz 5925 to 6425 MHz
transmit	11450 to 12750 MHz 3700 to 4200 MHz
number of transponders	C-Band - 24 Ku-Band - 24
transponder bandwidth - Ku-Band	36 MHz
transponder bandwidth - C-Band	54 MHz, 27 MHz

Table 3. (cont'd.)

polarization Ku-Band	
ME/Europe Receive	Vertical linear
ME/Europe Transmit	Vertical linear
Stans/Europe Receive	Horizontal linear
Stans/Europe Transmit	Horizontal linear
RSA/Europe Receive	Horizontal/Vertical
RSA/Europe Transmit	Horizontal/Vertical
India/NEA Transmit	Vertical linear
India/NEA Receive	Vertical linear
India Transmit	Horizontal linear
polarization C-Band	
Hemi Receive	Vertical linear
Hemi Transmit	Vertical linear
transponder gain Ku-Band	105.5 dB at 3dB att.
transponder gain C-Band	106.1 dB at 3dB att.
receive saturation - Ku-Band	-71 to -91 dBW/m ² at 0 dB/K G/T adjustable in 1 dB steps
receive saturation - C-Band	-81 to -101 dBW/m ² at 0 dB/K G/T adjustable in 1 dB steps
transmitter RF power	100W Ku-Band 55 W C-Band
transmitter redundancy	32 for 24 (C-Band) 32 for 24 (Ku-Band)
emission limitations (percentage of authorized bandwidth)	
50 to 100%	>20 dB attenuation in any 4kHz
100 to 250%	>40 dB attenuation in any 4kHz
greater than 250%	>50 dB attenuation in any 4kHz

Table 3. (cont'd.)

Tracking, Telemetry And Command

Frequency

Command	14499.5MHz transfer orbit 14000.5 MHz on station
Telemetry	12747.5MHz and 12748.5MHz.

Polarization

command	
transfer orbit	horizontal, linear
on station	horizontal, linear
on station backup	RHCP
telemetry	
transfer orbit	horizontal, linear
on station	horizontal, linear
on station backup	RHCP

bandwidth

command	2.5 MHz
telemetry	120 kHz

telemetry eirp

transfer orbit	0.0 dBW minimum
on station	4.0 dBW minimum

command threshold (flux density)

transfer orbit	-80.0 dBW/m ²
on station	-95.0 dBW/m ²

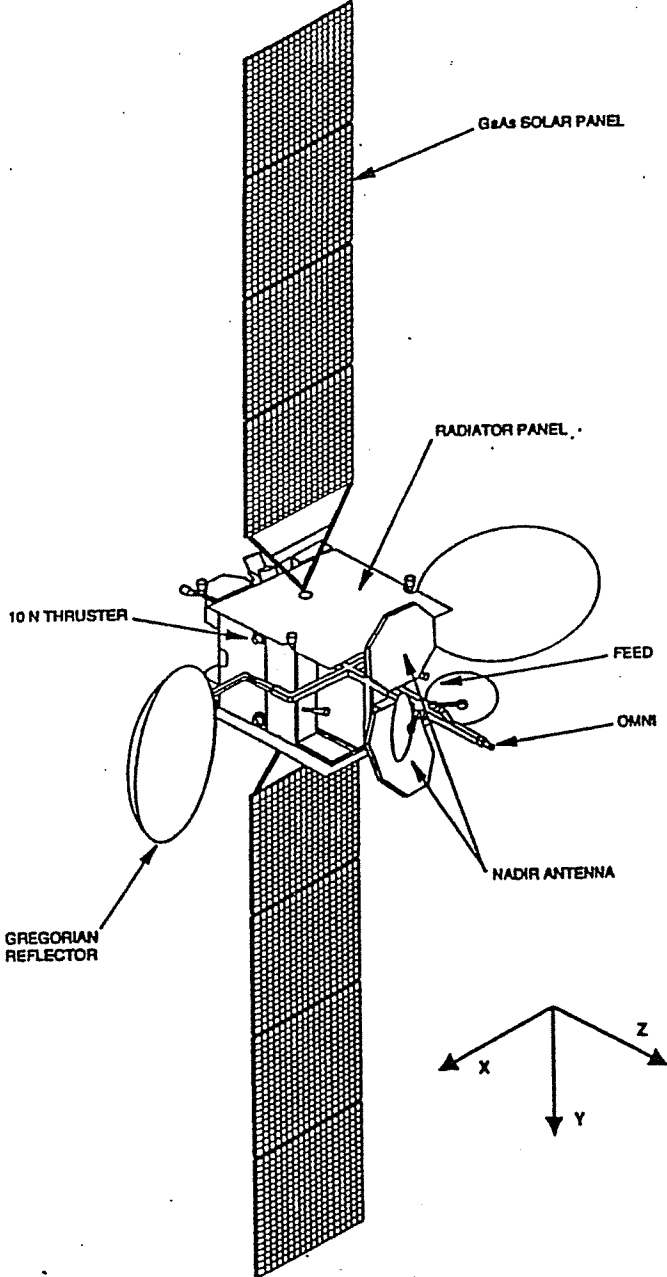
Table 4. Weight Budget

Category	Weight, kgs.
communications subsystem weight	1,000
bus weight	<u>1,300</u>
estimated spacecraft dry weight	2,300
fuel, expendables	<u>1,400</u>
total launch weight	3,700

Table 5. Power Budget

Category	Power, watts
communications subsystem power	9,720
bus power	<u>1,200</u>
total power requirement	10,920
beginning-of-life array capability	<u>11,980</u>
beginning-of-life margin	1,060
end-of-life array capability(15 years)	<u>10,995</u>
end-of-life margin	75

Figure 9. On Orbit Configuration



c. Thermal Control

Thermal control is accomplished with heaters and heat pipes, heat rejection surfaces are the north and south facing radiators, using quartz mirrors, and a radiator area extended with the use of deployable radiators. Battery temperatures are maintained within limits by using direct radiating surfaces plus heaters.

d. Power

Satellite power will be provided by a solar array of fused silica-covered gallium arsenide solar cells that convert solar energy to the required electrical power. The solar wings are deployed after the satellite attains synchronous orbit. Nickel-Hydrogen batteries provide sufficient electrical power during eclipse to operate the full communications and housekeeping loads. The electrical power subsystem has been designed so that no single failure in the subsystem will cause a spacecraft failure. Sufficient power will be available at the end of the satellite's life to support all 48 active transponder channels and the housekeeping loads.

e. Attitude Control

The Attitude Control Subsystem (ACS) maintains the spacecraft attitude during the transfer orbit, initial acquisition period, and geostationary operations. The ACS employs sun and earth sensors to perform all attitude determination functions. Control of attitude and

spacecraft orbit is accomplished by using reaction wheels and by pulsed or continuous firing of selected thrusters by the ACS during ground controlled maneuvers.

f. Propulsion

The spacecraft will use both a liquid bipropellant and a Xenon Ion Propulsion System (XIPS). The liquid bipropellant system is based on proven technology from earlier PanAmSat programs. XIPS technology has been incorporated into the PAS-5 satellite, Galaxy VIII(I), Galaxy-11 and PAS-9.

g. Communication Payload

(i) Antenna Subsystem

The PAS-24 satellite antenna subsystem contains two east-west reflectors and two nadir reflectors. Each reflector is fed by two feed horns which are frequency diplexed to allow each horn to be used for transmit and receive functions. Relative to the desired polarization, the cross-polarization component of the receive and transmit signals will be at least 30 dB over the required coverage regions.

(ii) Communications Subsystem

The communications subsystem consists of three types of communications repeaters:

- (1) a C-Band repeater employing 55 watt TWTAs, and
- (2) a Ku-Band repeater employing 100 watt TWTAs,

Subsystem components are selected to optimize performance in conjunction with ground terminals on customer premises.

A block diagram of the communication subsystem is provided in Figures 10 and 11

Figure 10 - Ku-Band Subsystem Block Diagram

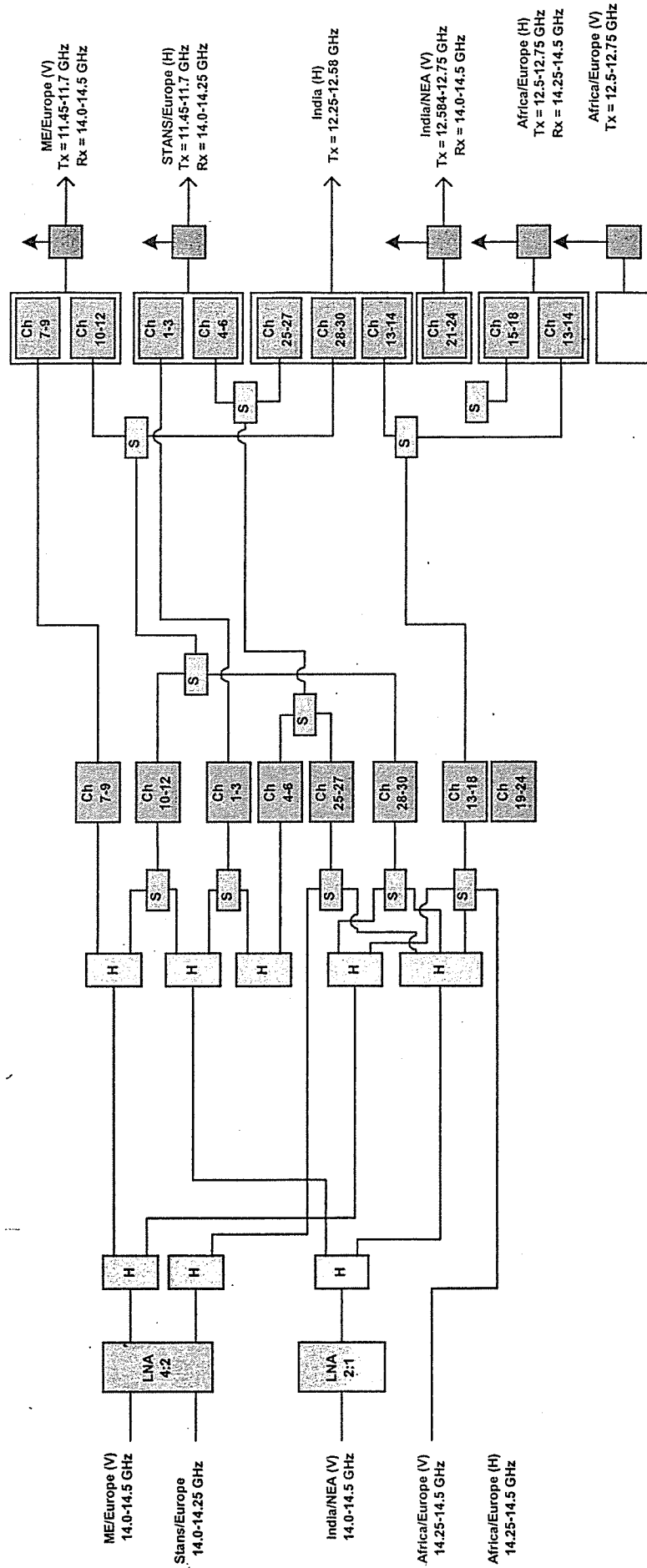
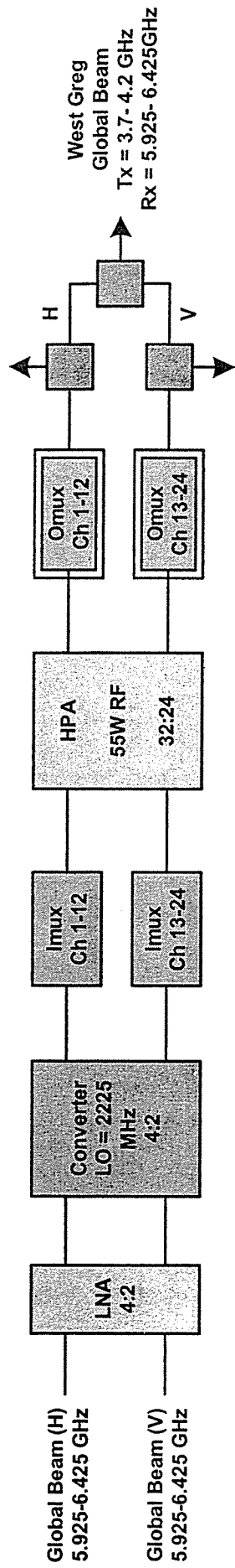


Figure 11 - C-Band Subsystem Block Diagram



Redundant wideband receivers will be connected directly to the receive antenna. Each wideband receiver has been designed to have high sensitivity (good noise performance) and low crosstalk coefficients (good linearity characteristics). The high sensitivity is required for detection and amplification of extremely low-level signals received by the satellite from the earth station transmitters. The low crosstalk coefficients are necessary since many separate signals pass through the wide-Band receivers prior to channelization by the narrow bandpass filters. A highly linear receiver is necessary in order to minimize coupling of interference among these signals in the receiver.

The wide-Band receiver will consist of a low noise amplifier followed by a downconverter that will translate the input frequencies to the satellite transmit frequencies without frequency inversion. Variations in net translation frequency over one day will not exceed a total of one part in 10^6 ; including eclipse effects. Following the downconverter will be a medium-level amplifier that will amplify the translated signals sufficiently to drive the channel amplifier in each transponder.

Following the input filters is a bank of redundancy switches and combining hardware which form the channel amplifier redundancy combining network. Next, the commandable step attenuators provide ground commandable attenuation of up to 16.0 dB in 2 dB increments. Finally, the HPAs output the signals to a redundancy combining network followed by the output multiplexer filters.

Spurious emissions that are beyond the usable bandwidth of each transponder and within the C- and Ku- transmission bands are attenuated by a combination of input and output multiplexer filters. Out-of-band emissions beyond the C- and Ku transmission bands, including harmonics, are attenuated by a combination of the output multiplexer filter and low pass filtering.

h. Satellite Useful Lifetime

The design lifetime of the PAS-24 satellite in orbit (other than with respect to stationkeeping) is 15 years. This has been determined by a conservative evaluation of the effect of the synchronous orbit environment on the solar array, the effect of the charge-discharge cycling on the life of the battery, and the wearout of the amplifiers. The mass allocation of propellant for spacecraft stationkeeping is 15 years. To enhance the probability of survival, spacecraft equipment will be redundant wherever possible. Materials and processes will be selected so that aging or wearing effects will not adversely affect spacecraft performance over the estimated life. The following paragraphs discuss dominant lifetime factors.

(i) Fuel

A conservative mission analysis indicates a 15 year lifetime. The mission has not yet been optimized since the exact sequence of maneuvers will be determined after the actual selection of the launch

vehicle. Any remaining spacecraft weight margin can be converted to fuel life.

(ii) Battery

Life testing to date indicates that a longevity of 15 years can be achieved. In order to ensure this longevity, the spacecraft design incorporates the following required provisions: C/20 charge rate at end of life, thermal control during all phases, and proper selection of cell components.

(iii) Solar Array

Predictions concerning the useful life of the solar array are backed by decades of Hughes experience in predicting and measuring in-orbit solar panel performance. These predictions are based on conservative assumptions concerning the radiation environment.

(iv) Electronics

All critical electronics units and components are redundant. There is a 4 for 2 receiver redundancy employed for each communications payload and at least 16 for 12 redundancy rings employed for the power amplifier chains. For other electronic units a minimum of two-for-one redundancy is employed. The electrical design follows well-established criteria regarding parts selection, testing and design, among others.

(v) Non-Electronic

Full redundancy has been employed for non-electronic components wherever possible.

i. Satellite Stationkeeping

Inclination of the satellite orbit will be maintained to ± 0.05 degrees or less, and the satellite will be maintained to within ± 0.05 degrees of the nominal longitude position. Attitude of the satellite will be maintained to an accuracy consistent with the achievement of the specified communications performance, after taking into account all error sources (e.g., attitude perturbations, thermal distortions, misalignments, orbital tolerances, and thruster perturbations).

In addition to the propellant required for operational attitude and orbital control, extra propellant will be incorporated to provide correction of the initial orbit, initial attitude acquisition, and one orbital repositioning maneuver at a drift rate of 1 degree per day. Sufficient propellant will be included in the satellite to permit a 15-year operational life.

j. Telemetry, Command and Ranging ("TC&R")

The telemetry, command and ranging ("TC&R") subsystem will perform the monitoring and command functions necessary for spacecraft control.

(i) Telemetry

The telemetry system will have two identical links consisting of two encoders that modulate either of two transmitters via a cross-strap switch. Data pertaining to unit status, spacecraft attitude, and spacecraft performance will be transmitted continuously for spacecraft management and control. The telemetry transmitter will also serve as the downlink transmitter for ranging tones and command verification. The primary telemetry data mode will be PCM. For normal on-station operation, the telemetry transmitters will be routed to the transmit feeds of the communications antenna.

In transfer orbit, each telemetry transmitter will drive the omni antenna to provide adequate telemetry coverage. Selection of this high level mode, which may also be used for emergency backup on station, will be by ground command.

(ii) Command

The command system will control spacecraft operation through all phases of the mission by receiving and decoding commands to the spacecraft. Additionally, it will serve as the uplink receiver for ranging signals. The command signals will be fed through a filter diplexer into a redundant pair of command receivers. The composite signal of the receivers' total output will drive a pair of redundant decoders. The decoders will provide command outputs for all satellite

functions. The omni antenna will be used in transfer orbit for command and ranging and the reflector antenna will be used on-station.

(iii) TC&R Performance Characteristics

A telemetry and command summary is given in Table 6. The satellite system requires a command receiver input nominal power of -135 dBW for command execution. With a nominal ground station EIRP of 89.97 dBW, the command threshold requirements are met with margin. See Table 7 for the command link budget. The telemetry link budget for all operations is given in Table 8.

Table 6. TT&C- System Parameters

Parameter	Spacecraft Antenna		
	Omni	Horn	Fwd Pipe
Command frequency	14499.5 MHz	14499.5 MHz	14000.5 MHz
Earth station command EIRP (typical)	89.97 dBW	89.97 dBW	89.97 dBW
Command carrier modulation	FM	FM	FM
Telemetry frequency	12747.5, 12748.5 MHz	12747.5, 12748.5 MHz	12747.5, 12748.5 MHz
Telemetry modulation	PM	PM	PM
Telemetry EIRP (max)	0.0 dBW	4.0 dBW	0.0 dBW
On-station ranging accuracy	±24 m	±24 m	±24 m

Table 7. Command RF Link Budget

Parameter	Transfer Orbit	On-Station	Fwd Pipe
Ground station, EIRP, dBW	89.97	89.97	89.97
Polarization loss, dB	-0.1	-0.1	-0.1
Path loss, dB/m ²	-162.7	-162.7	-162.7
Incident power, dBW/m ²	-72.83	-72.83	-72.83
Isotropic area, dB-m ²	-44.4	-44.4	-44.4
Antenna gain, 20% on omni, dBi	-0.5	22.35	-1.2
RF losses to tracking command receiver, dB	-5.55	-10.26	-5.77
Receiver input power, dBW	-123.28	-105.14	-124.2
Receiver command threshold, dBW	-130	-130	-130
Margin, command threshold, dB	6.72	24.86	5.8

Table 8. Telemetry Link Budget (On-Station)

Parameter	Value
TM EIRP, min.Perth, Australia	4.0 dBW
Path loss	-162.7 dB/m ²
Isotropic area	-42.6 dBm ²
Atmospheric absorption (clear sky)	-0.2 dB
TT&C- station G/T	38.3 dB/K
Link C/T	-155.9 dBW/K
Link C/N ₀	65.57 dB-Hz
Subcarrier modulation index	-5.0 dB
Subcarrier C/N ₀	60.57 dB-Hz
Implementation Loss	-2.5 dB
Telemetry Eb/N ₀ (bit rate = 4 kbps)	36.0 dB
Eb/N ₀ required for 10 ⁻⁶ BER	11.0 dB
Margin	11.07 dB

k. System Reliability

(1) Satellite

The satellite will be designed for an operational and mission life of 15 years. Mission lifetime is determined primarily by the amount of stationkeeping propellant that can be loaded into the tanks within the allowable launch weight and by the wearout of the TWTAs. To ensure highly reliable performance, TWTA redundancy rings of at least 16 for 12 are provided.

Life and reliability will be maximized by using proven reliability concepts in equipment design. All subsystems and units have a minimum design life of 15 years; standby redundancy is used in the attitude control subsystem and in the communications receivers, and active redundancy is used in the power subsystem. All avoidable single-point failure modes will be eliminated. All components and subsystems will be flight-qualified, and all components will be derated in accordance with design guidelines.

(2) Eclipse Conditions

Eclipse conditions occur when a satellite passes through the earth's shadow. Satellite outages during eclipse conditions are avoided by providing each satellite with sufficient on-board battery capacity to power all required spacecraft and communications payload

functions. The battery capacity will be more than adequate to power all amplifiers during eclipses throughout the mission life.

(3) Sun Outages

During predictable twice-yearly periods of approximately eight days, the sun briefly transits the field of view of an earth station pointing at a geostationary satellite. The rise in thermal noise in the earth station receivers caused by the sun's radiation disrupts satellite reception (i.e., causes sun outage). Such disruption of satellite reception is predictable and is well understood by satellite users.

Item E. Performance Requirements and Operational Characteristics

PAS-24 is to be a general purpose communications satellite and has been designed to support all of the various services offered within PanAmSat's satellite system. Depending upon the needs of the users, the transponders on PAS-24 can accommodate television, radio, voice, or data communications. Typical types of communications services to be offered include:

1. Frequency modulated television (FM-TV).
2. High speed digital data.
3. Digital single channel per carrier (SCPC) data channels carrying wide-Band T1 data (1.544 Mbps).
4. Digital SCPC with data channels carrying 56 Kbps data.

5. Frequency Modulated Audio SCPC (FM Audio SCPC).
6. Compressed Digital Video

The characteristics and associated link analyses for representative C- and Ku-Band services are presented in Appendix A. The link budgets demonstrate that PAS-24 will allow all potential services to meet their respective performance objectives while maintaining sufficient link margin.

Item F. Adjacent Satellite Interference Analysis

The interference levels generated between PAS-24 and adjacent satellite systems have been preliminarily evaluated using PanAmSat's computer programs. A discussion of the interference potential is presented in Appendix B.

Our preliminary analysis demonstrates that PAS-24 will not generate any more interference than other satellite systems previously approved by the Commission. In addition, the sensitivity of PAS-24 to adjacent satellite interference is substantially equivalent to that of previously approved satellite systems. In cases where an incompatibility between specific service types of PAS-24 and the adjacent satellite I-706 appear, such incompatibility is not due to the PAS-24 design, but rather is a fundamental characteristic of the close spacing environment under which PAS-24 will operate. Such interference situations will be avoided or minimized through normal coordination arrangements made between PanAmSat and its in-orbit neighbors.

Table A2

**Ku-BAND - MEXICO
MCPC
(45 Mbps)**

Transmission Characteristics	
Signal Description	Digital MCPC
Info Rate	45358 kbps
Modulation	QPSK
Code Rate	R7/8
Transponder Characteristics	
Frequency	11.950 GHz
Bandwidth	36.0 MHz
G/T	-6.3 dB/K
Single Carrier Saturated EIRP (EOC)	48.0 dBW
Carrier Output Back Off	0.0 dB
EIRP per Carrier	48.0 dBW
Transmit Earth Station	
Antenna Diameter	6.1 m
Receive Earth Station	
Antenna Diameter	0.75 m
Earth Station G/T	16.2 dB/K
Performance Objectives	
Minimum Required C/N	8.4 dB
Net C/(N+I)	9.3 dB
Excess Link Margin	0.9 dB

Table A.3

**Ku-BAND – SOUTH AMERICA
FM-TV ANALOG VIDEO**

Transmission Characteristics	
Signal Characteristic	TV FM Analog Video
Modulation	NTSC
Video Bandwidth	4.2 MHz
Peak FM Deviation	10.75 MHz
Pre emphasis and weighting	12.8 dB
Transponder Characteristics	
Frequency	11.820 GHz
Bandwidth	36.0 MHz
G/T	-4.3 dB/K
Single Carrier Saturated EIRP (EOC)	50.0 dBW
Carrier Output Back Off	0.0 dB
EIRP per Carrier	50.0 dBW
Transmit Earth Station	
Antenna Diameter	6.1 m
Receive Earth Station	
Antenna Diameter	1.8 m
Earth Station G/T	22.0 dB/K
Performance Objectives	
Minimum Required C/N	10.0 dB
Net C/(N+I)	15.6 dB
SNR	53.7 dB
Excess Link Margin	5.6 dB

Table A.4

**Ku-BAND – SOUTH AMERICA
MCPC
(45 Mbps)**

Transmission Characteristics	
Signal Description	Digital MCPC
Info Rate	45358 kbps
Modulation	QPSK
Code Rate	R7/8
Transponder Characteristics	
Frequency	11.950 GHz
Bandwidth	36.0 MHz
G/T	-4.3 dB/K
Single Carrier Saturated EIRP (EOC)	50.0 dBW
Carrier Output Back Off	0.0 dB
EIRP per Carrier	50.0 dBW
Transmit Earth Station	
Antenna Diameter	6.1 m
Receive Earth Station	
Antenna Diameter	1.2 m
Earth Station G/T	20.1 dB/K
Performance Objectives	
Minimum Required C/N	8.4 dB
Net C/(N+I)	14.1 dB
Excess Link Margin	6.7 dB

Table A.5

**Ku-BAND-SOUTH AMERICA
SCPC
(3.0 Mbps)**

Transmission Characteristics	
Signal Description	Digital SCPC
Info Rate	3000 kbps
Modulation	QPSK
Code Rate	R2/3
Transponder Characteristics	
Frequency	11.820 GHz
Bandwidth	36.0 MHz
G/T	-4.3 dB/K
Satellite Saturated EIRP (EOC)	50.0 dBW
Carrier Output Back Off	-13.2 dB
EIRP per Carrier	36.8 dBW
Transmit Earth Station	
Antenna Diameter	6.1m
Receive Earth Station	
Antenna Diameter	3.7 m
Earth Station G/T	29.3 dB/K
Performance Objectives	
Minimum Required C/N	5.8 dB
Net C/(N+I)	13.1 dB
Excess Link Margin	7.3 dB

Table A.6

**Ku-BAND-SOUTH AMERICA
SCPC
(64 kbps)**

Transmission Characteristics	
Signal Description	Digital SCPC
Info Rate	64 kbps
Modulation	QPSK
Code Rate	R1/2
Transponder Characteristics	
Frequency	11.820 GHz
Bandwidth	36.0 MHz
G/T	-4.3 dB/K
Satellite Saturated EIRP (EOC)	50.0 dBW
Carrier Output Back Off	-32.2 dB
EIRP per Carrier	17.8 dBW
Transmit Earth Station	
Antenna Diameter	6.1 m
Receive Earth Station	
Antenna Diameter	2.4 m
LNA Earth Station G/T	25.6 dB/K
Performance Objectives	
Minimum Required C/N	6.8 dB
Net C/(N+I)	9.2 dB
Excess Link Margin	2.4 dB

Table A.7

**Ku-BAND-SOUTH AMERICA
SCPC
(1.544 Mbps)**

Transmission Characteristics	
Signal Description	Digital SCPC
Info Rate	1544 kbps
Modulation	QPSK
Code Rate	R1/2
Transponder Characteristics	
Frequency	11.820 GHz
Bandwidth	36.0 MHz
G/T	-4.3 dB/K
Satellite Saturated EIRP (EOC)	50.0 dBW
Carrier Output Back Off	-18.5 dB
EIRP per Carrier	31.5 dBW
Transmit Earth Station	
Antenna Diameter	6.1 m
Receive Earth Station	
Antenna Diameter	2.4 m
Earth Station G/T	25.6 dB/K
Performance Objectives	
Minimum Required C/N	6.8 dB
Net C/(N+I)	9.1 dB
Excess Link Margin	2.3 dB

Table A.8

**Ku-Band-SOUTH AMERICA
VSAT
(128kbps)**

Transmission Characteristics	
Signal Description	VSat
Info Rate	128 kbps
Modulation	BPSK
Code Rate	R1/2 (Seq + RS)
Transponder Characteristics	
Frequency	11.820 GHz
Bandwidth	36.0 MHz
G/T	-4.3 dB/K
Satellite Saturated EIRP (EOC)	50.0 dBW
Carrier Output Back Off	-29.3 dB
EIRP per Carrier	20.7 dBW
Transmit Earth Station	
Antenna Diameter	4.6m
Receive Earth Station	
Antenna Diameter	1.8m
Earth Station G/T	22.9 dB/K
Performance Objectives	
Minimum Required C/N	6.0 dB
Net C/(N+I)	8.5 dB
Excess Link Margin	2.5 dB

Table A.9

**Ku-BAND EUROPE
FM-TV ANALOG VIDEO**

Transmission Characteristics	
Signal Characteristic	TV FM Analog Video
Modulation	NTSC
Video Bandwidth	4.2 MHz
Peak FM Deviation	10.75 MHz
Pre emphasis and weighting	12.8 dB
Transponder Characteristics	
Frequency	11.050 GHz
Bandwidth	27.0 MHz
G/T	-4.3 dB/K
Single Carrier Saturated EIRP (EOC)	51.0 dBW
Carrier Output Back Off	0.0 dB
EIRP per Carrier	51.0 dBW
Transmit Earth Station	
Antenna Diameter	4.6 m
Receive Earth Station	
Antenna Diameter	1.8 m
Earth Station G/T	22.7 dB/K
Performance Objectives	
Minimum Required C/N	10.0 dB
Net C/(N+I)	17.1 dB
SNR	53.2 dB
Excess Link Margin	7.1 dB

Table A.10

**Ku-BAND EUROPE
MCPC
(45 Mbps)**

Transmission Characteristics	
Signal Description	Digital MCPC
Info Rate	45358 kbps
Modulation	QPSK
Code Rate	R7/8
Transponder Characteristics	
Frequency	11.050 GHz
Bandwidth	27.0 MHz
G/T	-4.3 dB
Single Carrier Saturated EIRP (EOC)	51.0 dBW
Carrier Output Back Off	0.0 dB
EIRP per Carrier	51.0 dBW
Transmit Earth Station	
Antenna Diameter	4.6 m
Receive Earth Station	
Antenna Diameter	1.2 m
Earth Station G/T	19.1 dB/K
Performance Objectives	
Minimum Required C/N	8.4 dB
Net C/(N+I)	14.5 dB
Excess Link Margin	6.1 dB

Table A.11

Ku-BAND EUROPE
SCPC
(3.0 Mbps)

Transmission Characteristics	
Signal Description	Digital SCPC
Info Rate	3000 kbps
Modulation	QPSK
Code Rate	R2/3
Transponder Characteristics	
Frequency	11.558 GHz
Bandwidth	27.0 MHz
G/T	-4.3 dB
Satellite Saturated EIRP (EOC)	51.0 dBW
Carrier Output Back Off	-17.5 dB
EIRP per Carrier	33.5 dBW
Transmit Earth Station	
Antenna Diameter	4.6m
Receive Earth Station	
Antenna Diameter	2.4 m
Earth Station G/T	25.4 dB/K
Performance Objectives	
Minimum Required C/N	5.8 dB
Net C/(N+I)	9.1 dB
Excess Link Margin	3.3 dB

Table A.12

Ku-BAND EUROPE
SCPC
(64 kbps)

Transmission Characteristics	
Signal Description	Digital SCPC
Info Rate	64 kbps
Modulation	QPSK
Code Rate	R1/2
Transponder Characteristics	
Frequency	11.558 GHz
Bandwidth	27.0 MHz
G/T	-4.3 dB/K
Satellite Saturated EIRP (EOC)	51.0 dBW
Carrier Output Back Off	-33.4 dB
EIRP per Carrier	17.6 dBW
Transmit Earth Station	
Antenna Diameter	4.6 m
Receive Earth Station	
Antenna Diameter	2.4 m
Earth Station G/T	26.2 dB/K
Performance Objectives	
Minimum Required C/N	6.8 dB
Net C/(N+I)	9.2 dB
Excess Link Margin	2.4 dB

Table A.13

Ku-BAND EUROPE
SCPC
(1.544 Mbps)

Transmission Characteristics	
Signal Description	Digital SCPC
Info Rate	1544 kbps
Modulation	QPSK
Code Rate	R1/2
Transponder Characteristics	
Frequency	12.650 GHz
Bandwidth	27.0 MHz
G/T	-4.3 dB
Satellite Saturated EIRP (EOC)	51.0 dBW
Carrier Output Back Off	-20.3 dB
EIRP per Carrier	30.7 dBW
Transmit Earth Station	
Antenna Diameter	4.6 m
Receive Earth Station	
Antenna Diameter	3.7 m
Earth Station G/T	29.1 dB/K
Performance Objectives	
Minimum Required C/N	6.8 dB
Net C/(N+I)	9.1 dB
Excess Link Margin	2.3 dB

Table A.14

**Ku-BAND EUROPE
VSAT
(128kbps)**

Transmission Characteristics	
Signal Description	VSat
Info Rate	128 kbps
Modulation	BPSK
Code Rate	R1/2 (Seq + RS)
Transponder Characteristics	
Frequency	12.650 GHz
Bandwidth	27.0 MHz
G/T	-4.3 dB
Satellite Saturated EIRP (EOC)	51.0 dBW
Carrier Output Back Off	-31.2 dB
EIRP per Carrier	19.8 dBW
Transmit Earth Station	
Antenna Diameter	4.6 m
Receive Earth Station	
Antenna Diameter	2.4 m
Earth Station G/T	25.4 dB/K
Performance Objectives	
Minimum Required C/N	6.0 dB
Net C/(N+I)	8.5 dB
Excess Link Margin	2.5 dB

Appendix B. Adjacent Satellite Interference Analysis

This section presents the results of an analysis performed to determine the levels of interference generated between the PAS-24 satellite and other potentially adjacent satellites. The analysis used the computer program commonly known as the "George Sharp Adjacent Satellite Interference Program" (4/85 version).

The George Sharp program calculates, on a service by service basis, the interference power generated into each listed satellite service by other satellite services. The program then compares the resulting adjacent satellite interference level to an established interference objective for the particular desired service. The interference objectives used in the analysis presented herein are based on the recommendations of the FCC- Advisory Committee on Reduced Spacing.

Separate interference analyses were performed for C-Band (5.925-6.425 GHz, 3.7-4.2 GHz), Ku--Band (11.7-12.2 GHz, 14.0-14.5 GHz), and extended Ku--Band (10.95-11.2 GHz, 14.0-14.5 GHz). All the analyses incorporate a worst-case assumption that the adjacent satellites are separated by two degrees. Spacings greater than two degrees will result in significant reductions in adjacent satellite interference. It is also assumed that all Ku-Band and extended Ku-Band services are co-frequency and co-polarized to each other. This assumption is made due to the nonuniformity of Ku-Band satellite channel plans. In many

cases, there will exist frequency offsets and/or polarization isolation between adjacent Ku-Band satellite services which will substantially reduce interference. In the case of C-Band services, the uniform nature of C-Band channel plans allow actual polarization orientations to be used in the interference analyses. C-Band services are also assumed to be co-frequency with each other.

Each interference analysis consists of three sections. The first section contains this input parameters for the interference analysis program. This section specifies the technical characteristics of the services supported by the potentially interfering satellites. In order to demonstrate two three, and four-degree compatibility, a medium power satellite similar in performance to PAS-24 has been included at orbital locations where such a satellite does not yet exist. This satellite carries the designation TBD. The second section presents a computed thermal noise summary for each of the satellite links specified in the first section. The second section also specifies the carrier-to-intersatellite interference objective for each service type. The third section consists of a matrix which identifies the amounts by which the interference objectives of a particular service are exceeded when the service receives interference from another adjacent service.

The results of the analyses indicate that a significant interference potential (i.e. greater than 2.5dB) only exists where FM television signals interact with narrowband SCPC- (single-channel-per-carrier) signals at two-degree satellite spacing. Such interference is not the result of the PAS-24 satellite's design or of the services it

will carry, but is rather an inherent characteristic of the two-degree spacing environment. Such interference can be readily contained through coordination arrangements made between adjacent satellite operators. Such arrangements can include coordinated assignment of carrier frequencies, segmentation of the operating frequency bands for specific service types, and proper selection of the satellite input attenuation levels. Hughes has already concluded a coordination agreement with the administration of the Argentine republic- regarding the standard Ku-Band payloads on board the SBS-6, Nahuel-C- and Nahuel-D satellites¹.

In summary, the potential operation of the PAS-24 satellite will not create any exceptional or unusual interference problems with neighboring satellites. PanAmSat remains prepared to engage in coordination discussions with the operators of any neighboring satellites in order to develop a mutually satisfactory operating environment.

¹ see Summary Record of the 2nd FSS Coordination Meeting between the Administrations of the United States and the Argentine Republic, 12-15 March, 1996

FULL FINANCIAL SHOWING

RESPONSIBILITIES FOR FINANCIAL STATEMENTS

The following financial statements of Hughes Electronics Corporation (as more fully described in Note 1 to the financial statements) were prepared by management, which is responsible for their integrity and objectivity. The statements have been prepared in conformity with generally accepted accounting principles and, as such, include amounts based on judgments of management.

Management is further responsible for maintaining internal control designed to provide reasonable assurance that the books and records reflect the transactions of the companies and that established policies and procedures are carefully followed. Perhaps the most important feature in internal control is that it is continually reviewed for effectiveness and is augmented by written policies and guidelines, the careful selection and training of qualified personnel and a strong program of internal audit.

Deloitte & Touche LLP, an independent auditing firm, is engaged to audit the financial statements of Hughes Electronics Corporation and issue reports thereon. The audit is conducted in accordance with generally accepted auditing standards that comprehend the consideration of internal control and tests of transactions to the extent necessary to form an inde-

pendent opinion on the financial statements prepared by management. The Independent Auditors' Report appears on the next page.

The Board of Directors, through its Audit Committee, is responsible for assuring that management fulfills its responsibilities in the preparation of the financial statements and engaging the independent auditors. The Audit Committee reviews the scope of the audits and the accounting principles being applied in financial reporting. The independent auditors, representatives of management, and the internal auditors meet regularly (separately and jointly) with the Audit Committee to review the activities of each, to ensure that each is properly discharging its responsibilities and to assess the effectiveness of internal control. It is management's conclusion that internal control at December 31, 1998 provides reasonable assurance that the books and records reflect the transactions of the company and that established policies and procedures are complied with. To ensure complete independence, Deloitte & Touche LLP has full and free access to meet with the Audit Committee, without management representatives present, to discuss the results of the audit, the adequacy of internal control and the quality of financial reporting.



Chairman of the Board
and Chief Executive Officer



President and
Chief Operating Officer



Senior Vice President and
Chief Financial Officer

INDEPENDENT AUDITORS' REPORT

To the Board of Directors of Hughes Electronics Corporation:

We have audited the Balance Sheet of Hughes Electronics Corporation (as more fully described in Note 1 to the financial statements) as of December 31, 1998 and 1997 and the related Statement of Income and Available Separate Consolidated Net Income, Statement of Cash Flows and Statement of Changes in Owner's Equity for each of the three years in the period ended December 31, 1998. These financial statements are the responsibility of Hughes Electronics Corporation's management. Our responsibility is to express an opinion on these financial statements based on our audits.

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 provide a reasonable basis for our opinion.

In our opinion, such financial statements present fairly, in all material respects, the financial position of Hughes Electronics Corporation at December 31, 1998 and 1997 and the results of its operations and its cash flows for each of the three years in the period ended December 31, 1998 in conformity with generally accepted accounting principles.

As discussed in Note 2 to the accompanying financial statements, effective January 1, 1998, Hughes Electronics Corporation changed its method of accounting for costs of start-up activities by adopting American Institute of Certified Public Accountants Statement of Position 98-5, Reporting on the Costs of Start-Up Activities.

Deloitte & Touche LLP

Los Angeles, California

January 20, 1999

(March 1, 1999 as to Note 19)

STATEMENT OF INCOME AND AVAILABLE SEPARATE CONSOLIDATED NET INCOME (CONCLUDED)

	Years Ended December 31,	
	1998	1997
(Dollars in Millions Except Per Share Amounts)		
AVAILABLE SEPARATE CONSOLIDATED NET INCOME		
Average number of shares of General Motors Class H		
Common Stock outstanding (in millions) (Numerator)	105.3	101.5
Class H dividend base (in millions) (Denominator)	399.9	399.9
Available Separate Consolidated Net Income	\$ 71.5	\$ 119.4
EARNINGS ATTRIBUTABLE TO GENERAL MOTORS		
CLASS H COMMON STOCK ON A PER SHARE BASIS		
Income from continuing operations before extraordinary item and cumulative effect of accounting change	\$ 0.70	\$ 1.07
Discontinued operations	-	0.16
Extraordinary item	-	(0.05)
Cumulative effect of accounting change	(0.02)	-
Earnings Attributable to General Motors	\$ 0.68	\$ 1.18
Class H Common Stock		\$ 0.46

Reference should be made to the Notes to Financial Statements.

BALANCE SHEET

(Dollars in Millions)

	December 31,	
	1998	1997
ASSETS		
CURRENT ASSETS		
Cash and cash equivalents	\$ 1,342.1	\$ 2,783.8
Accounts and notes receivable, net of allowances of \$23.9 and \$15.2	922.4	630.0
Contracts in process, less advances and progress payments of \$27.0 and \$50.2	783.5	575.6
Inventories	471.5	486.4
Prepaid expenses and other, including deferred income taxes of \$33.6 and \$93.2	326.9	297.3
Total Current Assets	3,846.4	4,773.1
Satellites, net	3,197.5	2,643.4
Property, net	1,059.2	889.7
Net Investment in Sales-type Leases	173.4	337.6
Intangible Assets, net of accumulated amortization of \$413.2 and \$318.3	3,552.2	2,954.8
Investments and Other Assets	1,606.3	1,132.4
Total Assets	\$ 13,435.0	\$ 12,731.0

Statement continued on the next page.

BALANCE SHEET (CONCLUDED)

(Dollars in Millions)

	December 31,	
	1998	1997
LIABILITIES AND OWNER'S EQUITY		
CURRENT LIABILITIES		
Accounts payable	\$ 764.1	\$ 472.8
Advances on contracts	291.8	209.8
Deferred revenues	43.8	77.8
Current portion of long-term debt	156.1	-
Accrued liabilities	753.7	689.4
Total Current Liabilities	2,009.5	1,449.8
Long-Term Debt	778.7	637.6
Deferred Gains on Sales and Leasebacks	121.5	191.9
Accrued Operating Leaseback Expense	56.0	100.2
Postretirement Benefits Other Than Pensions	150.7	154.8
Other Liabilities and Deferred Credits	811.1	706.4
Deferred Income Taxes	643.9	570.8
Commitments and Contingencies		
Minority Interests	481.7	607.8
Owner's Equity		
Capital stock and additional paid-in capital	8,146.1	8,322.8
Net income retained for use in the business	257.8	7.1
Subtotal owner's equity	8,403.9	8,329.9
Accumulated other comprehensive income (loss)		
Minimum pension liability adjustment	(37.1)	(34.8)
Accumulated unrealized gains on securities	16.1	21.4
Accumulated foreign currency translation adjustments	(1.0)	(4.8)
Accumulated other comprehensive loss	(22.0)	(18.2)
Total Owner's Equity	8,381.9	8,311.7
Total Liabilities and Owner's Equity	\$ 13,435.0	\$ 12,731.0

Certain 1997 amounts have been reclassified to conform with the 1998 presentation. Reference should be made to the Notes to Financial Statements.

STATEMENT OF CASH FLOWS

Years Ended December 31,

	1998	1997	1996
(Dollars in Millions)			
CASH FLOWS FROM OPERATING ACTIVITIES			
Net Income	\$ 250.7	\$ 449.7	\$ 162.5
Adjustments to reconcile net income to net cash provided by continuing operations			
(Income) Loss from discontinued operations, net of taxes	-	(1.2)	7.4
Gain on sale of discontinued operations, net of taxes	-	(62.8)	-
Extraordinary item, net of taxes	-	20.6	-
Cumulative effect of accounting change, net of taxes	9.2	-	-
Depreciation and amortization	433.8	296.4	194.6
Amortization of GM purchase accounting adjustments	21.0	21.0	21.0
Net gain on sale of investments and businesses sold	(13.7)	(489.7)	(120.3)
Gross profit on sales-type leases	-	(33.6)	(51.8)
Deferred income taxes and other	153.2	285.5	91.9
Change in other operating assets and liabilities			
Accounts and notes receivable	(97.5)	(239.0)	(87.0)
Contracts in process	(230.9)	(174.2)	54.1
Inventories	20.2	(60.7)	(121.5)
Collections of principal on net investment in sales-type leases	40.6	22.0	31.2
Accounts payable	277.3	(184.1)	116.8
Advances on contracts	82.0	(95.6)	97.6
Deferred revenues	(34.0)	(21.2)	80.6
Accrued liabilities	66.8	217.8	22.4
Deferred gains on sales and leasebacks	(36.2)	(42.9)	(41.6)
Other	(67.3)	102.5	(90.5)
Net Cash Provided by Continuing Operations	875.2	10.5	367.4
Net cash used by discontinued operations	-	(15.9)	(8.0)
Net Cash Provided by (Used in) Operating Activities	\$ 875.2	\$ (5.4)	\$ 359.4

Statement continued on the next page.

NOTES TO FINANCIAL STATEMENTS (CONTINUED)

NOTE 7: Income Taxes

The provision for income taxes is based on reported income from continuing operations before income taxes, minority interests, extraordinary item and cumulative effect of accounting change. Deferred income tax assets and liabilities reflect the impact of temporary differences between the amounts of assets and liabilities recognized for financial reporting purposes and such amounts recognized for tax purposes, as measured by applying currently enacted tax laws.

Hughes and former Hughes (prior to December 18, 1997), and their domestic subsidiaries join with General Motors in filing a consolidated U.S. Federal income tax return. The portion of the consolidated income tax liability recorded by Hughes is generally equivalent to the liability it would have incurred on a separate return basis.

Prior to December 18, 1997, certain income tax assets and liabilities were maintained by former Hughes. Income tax expense was allocated to Hughes as if Hughes filed a separate income tax return. In connection with the Hughes Transactions, certain income tax assets and liabilities were contributed to and assumed by Hughes on December 17, 1997 and are included in the accompanying balance sheet.

As part of a debt refinancing program undertaken by PanAmSat in 1997, an extraordinary charge of \$20.6 million (\$34.4 million before taxes) was recorded, related to the excess of the price paid for the debt over its carrying value, net of deferred financing costs.

The aggregate maturities of long-term debt for the five years subsequent to December 31, 1998 are \$156.1 million in 1999, \$200.0 million in 2000 and \$578.7 million thereafter.

Hughes has \$1.0 billion of unused credit available under two unsecured revolving credit facilities, consisting of a \$750.0 million multi-year facility and a \$250.0 million 364-day facility. The multi-year credit facility provides for a commitment of \$750.0 million through December 5, 2002, subject to a facility fee of 0.07% per annum. Borrowings bear interest at a rate which approximates the London Interbank Offered Rate ("LIBOR") plus 0.155%. The 364-day credit facility provides for a commitment of \$250.0 million through December 1, 1999, subject to a facility fee of 0.05% per annum. Borrowings bear interest at a rate which approximates LIBOR plus 0.25%, with an additional 0.125% utilization fee when borrowings exceed 50% of the commitment. No amounts were outstanding under either facility at December 31, 1998. These facilities provide backup capacity for Hughes' \$1.0 billion commercial paper program. No amounts were outstanding under the commercial paper program at December 31, 1998.

PanAmSat maintains a \$500.0 million multi-year revolving credit facility that provides for short-term and long-term borrowings and a \$500.0 million commercial paper program that provides for short-term borrowings. The multi-year revolving credit facility provides for a commitment through December 24, 2002, subject to a facility fee of 0.10% per annum. Borrowings bear interest at a rate which approximates LIBOR plus 0.30%. Borrowings under the credit facility and commercial paper program are limited to \$500.0 million in the aggregate. No amounts were outstanding under either agreement at December 31, 1998.

The income tax provision consisted of the following:

(Dollars in Millions)	1998	1997	1996
U.S. Federal, state and foreign taxes currently (refundable) payable	\$ (177.3)	\$ 24.0	\$ 36.5
U.S. Federal, state and foreign deferred tax liabilities, net	132.6	212.7	68.3
Total income tax (benefit) provision	\$ (44.7)	\$ 236.7	\$ 104.8

Income from continuing operations before income taxes, minority interests, extraordinary item and cumulative effect of accounting change includes the following components:

(Dollars in Millions)	1998	1997	1996
U.S. income	\$ 283.8	\$ 659.4	\$ 218.4
Foreign (loss) income	(93.0)	(41.2)	3.7
Total	\$ 190.8	\$ 618.2	\$ 222.1

The combined income tax provision was different than the amount computed using the U.S. Federal statutory income tax rate for the reasons set forth in the following table:

(Dollars in Millions)	1998	1997	1996
Expected tax at U.S. Federal statutory income tax rate	\$ 66.8	\$ 216.4	\$ 77.7
Research and experimentation tax benefits	(183.6)	(39.3)	-
Foreign sales corporation tax benefit	(30.1)	(25.5)	(24.0)
U.S. state and local income taxes	13.7	24.8	9.4
Purchase accounting adjustments	7.3	7.3	7.3
Losses of equity method investees	36.7	18.7	14.8
Minority interests in losses of partnership	19.3	17.5	17.7
Non-deductible goodwill amortization	20.1	9.7	-
Other	5.1	7.1	1.9
Total income tax (benefit) provision	\$ (44.7)	\$ 236.7	\$ 104.8

NOTES TO FINANCIAL STATEMENTS (CONTINUED)

Temporary differences and carryforwards which gave rise to deferred tax assets and liabilities at December 31 were as follows:

(Dollars in Millions)	1998		1997	
	Deferred Tax Assets	Deferred Tax Liabilities	Deferred Tax Assets	Deferred Tax Liabilities
Profits on long-term contracts	\$ 145.5	\$ 155.5	\$ 156.0	\$ 142.8
Sales and leasebacks	65.4	-	85.8	-
Employee benefit programs	68.3	101.3	64.3	114.0
Postretirement benefits other than pensions	72.3	-	72.9	-
Customer deposits and rebates	52.9	-	61.9	-
State taxes	38.8	-	50.0	-
Gain on PanAmSat merger	-	191.1	-	195.0
Satellite launch insurance costs	-	103.1	-	43.7
Depreciation	-	470.9	-	438.6
Net operating loss and tax credit carryforwards	77.8	-	-	-
Sale of equity interest in DIRECTV	-	47.5	-	48.7
Other	32.8	30.5	63.9	35.4
Subtotal	553.8	1,099.9	554.8	1,018.2
Valuation allowance	(64.2)	-	(14.2)	-
Total deferred taxes	\$ 489.6	\$ 1,099.9	\$ 540.6	\$ 1,018.2

No income tax provision has been made for the portion of undistributed earnings of foreign subsidiaries deemed permanently reinvested that amounted to approximately \$18.5 million and \$18.2 million at December 31, 1998 and 1997, respectively. Repatriation of all accumulated earnings would have resulted in tax liabilities of \$6.4 million in 1998 and \$5.4 million in 1997.

At December 31, 1998, Hughes has \$63.9 million of foreign operating loss carryforwards expiring in varying amounts between 1999 and 2003. A valuation allowance was provided for all of the foreign operating loss carryforwards.

Hughes has an agreement with Raytheon which governs Hughes' rights and obligations with respect to U.S. Federal and state income taxes for all periods prior to the merger of Hughes Defense with Raytheon. Hughes is responsible for any income taxes pertaining to those periods prior to the merger, including any additional income taxes resulting from U.S. Federal and

state tax audits. Hughes is also entitled to any U.S. Federal and state income tax refunds relating to those years.

The U.S. Federal income tax returns of former Hughes have been examined through 1990. All years prior to 1983 are closed. Issues relating to the years 1983 through 1990 are being contested through various stages of administrative appeal. The Internal Revenue Service ("IRS") is currently examining former Hughes' U.S. Federal tax returns for years 1991 through 1994. Management believes that adequate provision has been made for any adjustment which might be assessed for open years.

Hughes reached an agreement with the IRS regarding a claim for refund of U.S. Federal income taxes related to the treatment of research and experimentation costs for the years 1983 through 1995. Hughes recorded a total of \$183.6 million of research and experimentation tax benefits during

1998, a substantial portion of which related to the previously noted agreement with the IRS and covered prior years.

NOTE 8: Retirement Programs and Other Postretirement Benefits

Hughes adopted SFAS No. 132, Employers' Disclosures about Pensions and Other Postretirement Benefits. SFAS No. 132 required changes in disclosure of certain information about pensions and other postretirement benefits. Substantially all of Hughes' employees participate in Hughes' contributory and non-contributory defined benefit retirement plans. Benefits are based on years of service and compensation earned during a specified period of time before retirement. Additionally, an unfunded, nonqualified pension plan covers certain employees. Hughes also maintains a program for eligible retirees to participate in health care and life insurance benefits generally until they reach age 65. Qualified employees who elected to participate in the Hughes contributory defined benefit pension plans may become eligible for these health care and life insurance benefits if they retire from Hughes between the ages of 55 and 65.

Prior to December 18, 1997, the pension-related assets and liabilities and the postretirement benefit plans were maintained by former Hughes for its non-automotive businesses and were not included in the Hughes balance sheet. A portion of former Hughes' net pension expense or income and postretirement benefit cost was allocated to Hughes and is included in the Statement of Income and Available Separate Consolidated Net Income. The net pension expense allocation was \$12.3 million and \$12.2 million for 1997 and 1996, respectively. For 1997 and 1996, the pension expense components including benefits earned during the year, interest accrued on benefits earned in prior years, actual return on assets and net amortization and deferral, were not determined separately for the Hughes participants. The postretirement benefit cost allocated to Hughes was \$11.2 million and \$10.4 million for 1997 and 1996, respectively. For 1997 and 1996, the postretirement benefit cost components, including benefits earned during the year, interest accrued on benefits earned in prior years and net amortization, were not determined separately for the Hughes employees. The 1997 information presented on the next page is based on pro rata allocations from former Hughes for each pension and postretirement benefit component.

NOTES TO FINANCIAL STATEMENTS (CONTINUED)

The components of the pension benefit obligation and the other postretirement benefit obligation are shown below. The net benefit obligation recognized in the balance sheet is shown on the next page:

	Pension Benefits		Other Postretirement Benefits	
	1998	1997	1998	1997
CHANGE IN BENEFIT OBLIGATION				
Net benefit obligation at beginning of year	\$ 1,556.4	\$ 1,490.5	\$ 135.6	\$ 132.3
Service cost	57.5	47.9	3.6	3.6
Interest cost	110.8	110.3	9.3	9.1
Plan participants' contributions	14.1	13.7	-	-
Actuarial loss	66.6	32.4	35.1	4.1
Acquisitions/divestitures	-	(17.6)	-	-
Benefits paid	(151.3)	(120.8)	(12.0)	(13.5)
Net benefit obligation at end of year	1,654.1	1,556.4	171.6	135.6
CHANGE IN PLAN ASSETS				
Fair value of plan assets at beginning of year	1,906.1	1,716.4	-	-
Actual return on plan assets	165.0	302.4	-	-
Employer contributions	20.3	12.0	12.0	13.5
Plan participants' contributions	14.1	13.7	-	-
Acquisitions/divestitures	-	(17.6)	-	-
Benefits paid	(151.3)	(120.8)	(12.0)	(13.5)
Transfers	4.7	-	-	-
Fair value of plan assets at end of year	1,958.9	1,906.1	-	-
Funded status at end of year	304.8	349.7	(171.6)	(135.6)
Unamortized asset at date of adoption	-	(12.8)	-	-
Unamortized amount resulting from changes in plan provisions	4.4	5.1	-	-
Unamortized net amount resulting from changes in plan experience and actuarial assumptions	(80.8)	(122.3)	4.9	(31.0)
Net amount recognized at end of year	\$ 228.4	\$ 219.7	\$ (166.7)	\$ (166.6)

	Pension Benefits		Other Postretirement Benefits	
	1998	1997	1998	1997
Prepaid benefit cost	\$ 248.1	\$ 227.0		
Accrued benefit cost	(89.3)	(83.8)	\$ (166.7)	\$ (166.6)
Intangible asset	7.4	18.0	N/A	N/A
Deferred tax assets	25.1	23.7	N/A	N/A
Accumulated other comprehensive loss	37.1	34.8	N/A	N/A
Net amount recognized at end of year	\$ 228.4	\$ 219.7	\$ (166.7)	\$ (166.6)

Included in the pension plan assets at December 31, 1998 are GM Class H common stock of \$2.3 million, GM \$1 2/3 common stock of \$7.1 million and GMAC bonds of \$3.3 million.

	Pension Benefits		Other Postretirement Benefits	
	1998	1997	1998	1997
Discount rate	6.75%	7.25%	6.50%	6.75%
Expected return on plan assets	9.50%	9.50%	N/A	N/A
Rate of compensation increase	5.00%	5.00%	N/A	N/A

For measurement purposes, a 9.5% annual rate of increase per capita cost of covered health care benefits was assumed for 1999. The rate was assumed to decrease gradually 0.5% per year to 6.0% in 2006.

	Pension Benefits		Other Postretirement Benefits	
	1998	1997	1998	1997
Benefits earned during the year	\$ 57.5	\$ 47.9	\$ 3.6	\$ 3.6
Interest accrued on benefits earned in prior years	110.8	110.3	9.3	9.1
Expected return on assets	(144.5)	(135.7)	-	-
Amortization components				
Unamortized asset at date of adoption	(12.8)	(14.2)	-	-
Unamortized amount resulting from changes in plan provisions	0.7	0.7	-	-
Unamortized net amount resulting from changes in plan experience and actuarial assumptions	4.6	3.3	(0.8)	(1.5)
Net periodic benefit cost	\$ 16.3	\$ 12.3	\$ 12.1	\$ 11.2

NOTES TO FINANCIAL STATEMENTS (CONTINUED)

The projected benefit obligation and accumulated benefit obligation for the pension plans with accumulated benefit obligations in excess of plan assets were \$114.3 and \$89.3, respectively, as of December 31, 1998, and \$93.5 and \$83.8, respectively, as of December 31, 1997. The pension plans with accumulated benefit obligations in excess of plan assets do not have any underlying assets.

Assumed health care cost trend rates have a significant effect on the amounts reported for the health care plan. A one-percentage point change in assumed health care cost trend rates would have the following effects:

(Dollars in Millions)	I - Percentage Point Increase	I - Percentage Point Decrease
Effect on total of service and interest cost components	\$ 1.5	\$ (1.2)
Effect on postretirement benefit obligation	14.0	(12.2)

NOTE 9: Owner's Equity

In connection with the Hughes Transactions, Hughes was recapitalized on December 17, 1997 at which time 1,000 shares of \$1.00 par value common stock, representing all of the authorized and outstanding common stock of Hughes, were issued to GM. Prior to December 17, 1997, the equity of Hughes was comprised of Parent Company's net investment in its telecommunications and space business.

The following represents changes in the components of accumulated other comprehensive income (loss), net of income taxes, as of December 31:

(Dollars in Millions)	1998			1997			1996		
	Pre-tax Amount	Tax (Credit) Expense	Net Amount	Pre-tax Amount	Tax Expense	Net Amount	Pre-tax Amount	Tax Expense	Net Amount
Minimum pension liability adjustments	\$ (3.9)	\$ (1.6)	\$ (2.3)	-	-	-	-	-	-
Foreign currency translation adjustments	6.4	2.6	3.8	\$1.0	\$0.4	\$0.6	\$1.3	\$0.5	\$0.8
Unrealized holding losses	3.0	1.2	1.8	-	-	-	-	-	-
Reclassification adjustment for gains included in net income	(11.8)	(4.7)	(7.1)	-	-	-	-	-	-

Hughes maintains 401(k) plans for qualified employees. A portion of employee contributions are matched by Hughes and amounted to \$30.6 million, \$26.3 million and \$16.7 million in 1998, 1997 and 1996, respectively. Hughes has disclosed in the financial statements certain amounts associated with estimated future postretirement benefits other than pensions and characterized such amounts as "other postretirement benefit obligation."

Notwithstanding the recording of such amounts and the use of these terms, Hughes does not admit or otherwise acknowledge that such amounts or existing postretirement benefit plans of Hughes (other than pensions) represent legally enforceable liabilities of Hughes.

NOTE 10: Incentive Plan

Under the Hughes Electronics Corporation Incentive Plan ("the Plan"), as approved by the GM Board of Directors in 1998, shares, rights or options to acquire up to 35.6 million shares of GM Class H common stock on a cumulative basis were available for grant through December 31, 1998.

The GM Executive Compensation Committee may grant options and other rights to acquire shares of GM Class H common stock under the provisions of the Plan. The option price is equal to 100% of the fair market value of GM Class H common stock on the date the options are granted. These nonqualified options generally vest over two to four years, expire ten years from date of grant and are subject to earlier termination under certain conditions.

As part of the Hughes Transactions, the outstanding options of former Hughes employees who continued as Hughes employees were converted on December 18, 1997 into options to purchase recapitalized GM Class H common stock. Recognition of compensation expense was not required in connection with the conversion.

Changes in the status of outstanding options were as follows:

GM CLASS H COMMON STOCK	Shares		Weighted-Average Exercise Price
	Under	Option	
Outstanding at December 31, 1997	13,961,615		\$ 29.08
Granted	4,180,525		51.02
Exercised	(1,506,241)		23.22
Terminated	(937,179)		31.79
Outstanding at December 31, 1998	15,698,720		\$ 35.32

The following table summarizes information about the Plan stock options outstanding at December 31, 1998:

Range of Exercise Prices	Options Outstanding			Options Exercisable		
	Number Outstanding	Weighted-Average Remaining Contractual Life (years)	Weighted-Average Exercise Price	Number Exercisable	Weighted-Average Exercise Price	Weighted-Average Exercise Price
\$ 9.86 to \$20.00	833,203	3.7	\$14.70	833,203	\$14.70	\$14.70
20.01 to 30.00	1,056,354	5.9	22.18	1,056,354	22.18	22.18
30.01 to 40.00	9,800,388	8.2	32.08	3,344,007	32.64	32.64
40.01 to 50.00	1,372,700	9.6	43.71	-	-	-
50.01 to 54.79	2,636,075	9.3	54.79	-	-	-
\$ 9.86 to \$54.79	15,698,720	8.1	\$35.32	5,233,564	\$27.67	\$27.67

At December 31, 1998, 5,373,522 shares were available for grant under the Plan subject to GM Executive Compensation Committee approval.

NOTES TO FINANCIAL STATEMENTS (CONTINUED)

On May 5, 1997, PanAmSat adopted a stock option incentive plan with terms similar to the Plan. As of December 31, 1998, PanAmSat had issued 1,493,319 options to purchase its common stock with exercise prices ranging from \$29.00 per share to \$59.75 per share. The options vest ratably over three years and have a remaining life of approximately nine years on the 1998 options and eight and one-half years on the 1997 options. At December 31, 1998, 113,590 options were exercisable. The PanAmSat options have been considered in the following pro forma analysis.

The following table presents pro forma information as if Hughes recorded compensation cost using the fair value of issued options on their grant date:

(Dollars in Millions Except Per Share Amounts)	1998	1997	1996
Reported earnings used for computation of available separate consolidated net income	\$ 271.7	\$ 470.7	\$ 183.5
Assumed stock compensation cost, net of tax	85.0	43.5	8.8
Adjusted earnings used for computation of available separate consolidated net income	\$ 186.7	\$ 427.2	\$ 174.7
Reported earnings per share attributable to GM Class H common stock	\$ 0.68	\$ 1.18	\$ 0.46
Adjusted earnings per share attributable to GM Class H common stock	\$ 0.47	\$ 1.07	\$ 0.44

For stock options granted prior to the Hughes Transactions, the estimated compensation cost was based upon an allocation from former Hughes which was calculated using the Black-Scholes valuation model for estimation of the fair value of its options. The following table presents the estimated weighted-average fair value of options granted and the assumptions used for the 1998 and 1997 calculations (stock volatility has been estimated based upon a three-year average derived from a study of a Hughes determined peer group and may not be indicative of actual volatility for future periods):

	1998	1997
Estimated fair value per option granted	\$ 22.78	\$ 26.90
Average exercise price per option granted	51.02	31.71
Stock volatility	32.8%	32.5%
Average risk-free interest rate	5.63%	5.87%
Average option life in years	6.2	7.0

NOTE 11: Other Income and Expenses

(Dollars in Millions)	1998	1997	1996
Gain on PanAmSat merger		\$ 489.7	
Gain on sale of DIRECTV interest to AT&T			\$ 120.3
Equity losses from unconsolidated affiliates	\$ (128.3)	(72.2)	(42.2)
Other	(24.8)	(26.8)	(9.0)
Total other, net	\$ (153.1)	\$ 390.7	\$ 69.1

Equity losses from unconsolidated affiliates at December 31, 1998, are primarily comprised of losses at DIRECTV Japan, of which Hughes owns 31.6%, and American Mobile Satellite Corporation, of which Hughes owns 20.7%.

NOTE 12: Related-Party Transactions

In the ordinary course of its operations, Hughes provides telecommunications services and sells electronic components to, and purchases sub-components from, related-parties. In addition, prior to December 18, 1997, Hughes received allocations of corporate expenses and interest costs from former Hughes and GM.

The following table summarizes significant related-party transactions:

(Dollars in Millions)	1998	1997	1996
Revenues	\$ 40.5	\$ 45.2	\$ 50.8
Costs and expenses			
Purchases	29.0	275.4	241.5
Allocation of corporate expenses	-	77.5	75.6
Allocated interest	-	55.6	53.2

NOTE 13: Earnings Per Share Attributable to GM Class H Common Stock and Available Separate Consolidated Net Income

Earnings per share attributable to GM Class H common stock is determined based on the relative amounts available for the payment of dividends to holders of GM Class H common stock. Holders of GM Class H common stock have no direct rights in the equity or assets of Hughes, but rather have rights in the equity and assets of GM (which includes 100% of the stock of Hughes).

Amounts available for the payment of dividends on GM Class H common stock are based on the Available Separate Consolidated Net Income ("ASCNI") of Hughes. The ASCNI of Hughes is determined quarterly and is equal to the separate consolidated net income of Hughes, excluding the effects of GM purchase accounting adjustments arising from GM's acquisition

of Hughes (earnings used for computation of ASCNI), multiplied by a fraction, the numerator of which is a number equal to the weighted-average number of shares of GM Class H common stock outstanding during the period and the denominator of which was 399.9 million during 1998, 1997 and 1996. The denominator used in determining the ASCNI of Hughes may be adjusted from time-to-time as deemed appropriate by the GM Board of Directors to reflect subdivisions or combinations of the GM Class H common stock and to reflect certain transfers of capital to or from Hughes. The GM Board's discretion to make such adjustments is limited by criteria set forth in GM's Restated Certificate of Incorporation.

For 1997 and 1996, ASCNI and earnings attributable to GM Class H common stock are presented on a pro forma basis. Prior to the Hughes Transactions, such amounts were calculated based on the financial performance of former Hughes. Since the 1997 and 1996 financial statements relate only to the telecommunications and space business of former Hughes prior to the consummation of the Hughes Transactions, they do not reflect the earnings attributable to the GM Class H common stock on a historical basis. The pro forma presentation is used, therefore, to present the financial results which would have been achieved for 1997 and 1996 relative to the GM Class H common stock had they been calculated based on the performance of the telecommunications and space business of former Hughes.

Earnings per share represent basic earnings per share. The assumed exercise of stock options does not have a dilutive effect since such exercises do not currently result in a change to the GM Class H dividend base (denominator) used in calculating earnings per share. As Hughes has no other common stock equivalents that may impact the calculation, diluted earnings per share are not presented.

Dividends may be paid on the GM Class H common stock only when, as and if declared by GM's Board of Directors in its sole discretion. Dividends may be paid on GM Class H common stock to the extent of the amount initially determined to be available for the payment of dividends on Class H

NOTES TO FINANCIAL STATEMENTS (CONTINUED)

common stock, plus the portion of earnings of GM after the closing of the Hughes Transactions attributed to GM Class H common stock. The GM Board determined that the amount initially available for the payment of dividends on shares of the recapitalized GM Class H common stock was the cumulative amount available for the payment of dividends on GM Class H common stock immediately prior to the closing of the Hughes Transactions, reduced by a pro rata portion of the net reduction in GM's total stockholders' equity resulting from the Hughes Transactions. As of December 31, 1998, the amount available for the payment of dividends on GM Class H common stock was \$3.8 billion. The GM Board does not currently intend to pay cash dividends on the recapitalized GM Class H common stock.

NOTE 14: Acquisitions

In December 1998, Hughes agreed to acquire all of the outstanding capital stock of United States Satellite Broadcasting Company, Inc. ("USSB"). USSB provides DTH premium satellite programming in conjunction with DIRECTV's basic programming service. USSB launched its service in June 1994 and, as of December 31, 1998, had more than two million subscribers nationwide. The acquisition will be accounted for using the purchase method of accounting. The purchase price, consisting of cash and GM Class H common stock, will be determined at closing based upon an agreed-upon formula and will not exceed \$1.6 billion in the aggregate. Subject to certain limitations in the merger agreement, USSB shareholders will be entitled to elect to receive cash or shares of GM Class H common stock. The amount of cash to be paid in the merger cannot be less than 30% or greater than 50% of the aggregate purchase price with the remaining consideration consisting of GM Class H common stock. The merger, which is subject to USSB shareholder approval and the receipt of appropriate regulatory approval, is expected to close in early to mid-1999.

In October 1998, Hughes agreed to acquire, pending regulatory approval

in Mexico, an additional ownership interest in Grupo Galaxy Mexicana, S.A. de C.V. ("GGM"), a Galaxy Latin America, LLC ("GLA") local operating company located in Mexico, from Grupo MVS, S.A. de C.V. ("MVS"). Hughes' equity ownership will represent 49.0% of the voting equity and all of the non-voting equity of GGM. The GGM transaction will be accounted for using the purchase method of accounting. As part of the GGM transaction, in October 1998 Hughes acquired from MVS an additional 10.0% interest in GLA, increasing its ownership interest to 70.0%, as well as an additional 19.8% interest in SurfIn, a company providing financing of subscriber receiver equipment for certain GLA local operating companies located in Latin America and Mexico, increasing its ownership percentage from 39.3% to 59.1%. The GLA and SurfIn transactions were accounted for using the purchase method of accounting. The increased ownership in SurfIn resulted in its consolidation since the date of acquisition. The aggregate purchase price for the transactions was \$197.0 million in cash.

In May 1998, Hughes purchased an additional 9.5% interest in PanAmSat for \$851.4 million in cash, increasing Hughes' ownership interest in PanAmSat from 71.5% to 81.0%.

In December 1997, Hughes repurchased from AT&T a 2.5% equity interest in DIRECTV, ending AT&T's marketing agreement to distribute the DIRECTV direct broadcast satellite television service and DIRECTV™ receiver equipment. The \$161.8 million repurchase resulted in goodwill of approximately \$156.1 million.

In May 1997, Hughes and PanAmSat, a leading provider of international satellite services, merged their respective satellite service operations into a new publicly-held company, which retained the name PanAmSat Corporation. Hughes contributed its Galaxy® satellite services business in exchange for a 71.5% interest in the new company. PanAmSat stockholders received a 28.5% interest in the new company and \$1.5 billion in cash. Such cash consideration and other funds required to consummate the merger were funded by new debt financing totaling \$1,725.0 million provided by

NOTE 15: Derivative Financial Instruments and Risk Management

Hughes, which borrowed such funds from GM.

For accounting purposes, the merger was treated by Hughes as an acquisition of 71.5% of PanAmSat and was accounted for using the purchase method. Accordingly, the purchase price was allocated to the net assets acquired, including intangible assets, based on estimated fair values at the date of acquisition. The purchase price exceeded the fair value of net assets acquired by \$2.4 billion. In addition, the merger was treated as a partial sale of the Galaxy business by Hughes and resulted in a one-time pre-tax gain of \$489.7 million (\$318.3 million after-tax).

As the Hughes 1997 financial statements include only PanAmSat's results of operations since the date of acquisition, the following selected unaudited pro forma information is being provided to present a summary of the combined results of Hughes and PanAmSat as if the acquisition had occurred as of the beginning of the respective periods, giving effect to purchase accounting adjustments. The pro forma data is presented for informational purposes only and may not necessarily reflect the results of operations of Hughes had PanAmSat operated as part of Hughes for the years ended December 31, 1997 and 1996, nor are they necessarily indicative of the results of future operations. The pro forma information excludes the effect of non-recurring charges.

(Dollars in Millions Except Per Share Amounts)	1997	1996
Total revenues	\$ 5,247.9	\$ 4,189.8
Income before extraordinary item	164.1	42.1
Net income	143.5	42.1
Pro forma available separate consolidated net income	41.8	15.5
Pro forma earnings per share attributable to GM		
Class H common stock	\$ 0.41	\$ 0.16

In the normal course of business, Hughes enters into transactions that expose it to risks associated with foreign exchange rates. Hughes utilizes derivative instruments in an effort to mitigate these risks. Hughes' policy does not allow speculation in derivative instruments for profit or execution of derivative instrument contracts for which there are no underlying exposures. Instruments used as hedges must be effective at reducing the risk associated with the exposure being hedged and designated as a hedge at the inception of the contract. Accordingly, changes in market values of hedge instruments are highly correlated with changes in market values of the underlying transactions, both at the inception of the hedge and over the life of the hedge contract.

Hughes primarily uses foreign exchange-forward contracts to hedge firm commitments denominated in foreign currencies. Foreign exchange-forward contracts are legal agreements between two parties to purchase and sell a foreign currency for a price specified at the contract date, with delivery and settlement in the future. The total notional amounts of contracts afforded hedge accounting treatment at December 31, 1998 and 1997 were not significant.

Hughes is exposed to credit risk in the event of non-performance by the counterparties to its foreign exchange-forward contracts. While Hughes believes this risk is remote, credit risk is managed through the periodic monitoring and approval of financially sound counterparties.

In connection with debt refinancing activities by PanAmSat in 1997, PanAmSat entered into certain U.S. Treasury rate lock contracts to reduce its exposure to fluctuations in interest rates. The aggregate notional value of these contracts was \$375.0 million and these contracts were accounted for as hedges. The cost to settle these instruments in 1998 was \$9.1 million and is being amortized to interest expense over the term of the related debt securities.

NOTES TO FINANCIAL STATEMENTS (CONTINUED)

NOTE 16: Discontinued Operations

On December 15, 1997, Hughes sold substantially all of the assets and liabilities of Hughes Avicom International, Inc. ("Hughes Avicom") to Rockwell Collins, Inc. for cash. Hughes Avicom is a supplier of products and services to the commercial airline market. Hughes recorded an after-tax gain of \$62.8 million on the sale. The net operating results of Hughes Avicom have been reported, net of applicable income taxes, as "Income (Loss) from discontinued operations, net of taxes" and the net cash flows as "Net cash used by discontinued operations."

Summarized financial information for Hughes Avicom follows:

(Dollars in Millions)	1997*	1996
Revenues	\$ 102.5	\$ 89.9
Net income (loss)	1.2	(7.4)

*Includes the results of Hughes Avicom through December 15, 1997.

NOTE 17: Segment Reporting

Hughes' segments, which are differentiated by their products and services, include Direct-To-Home Broadcast, Satellite Services, Satellite Systems and Network Systems. Direct-To-Home Broadcast is engaged in acquiring, producing, selling and/or distributing digital programming via satellite to residential and commercial customers. Satellite Services is engaged in the selling, leasing and operating of satellite transponders and providing services for cable television systems, news companies, Internet service providers and private business networks. Satellite Systems designs, manufactures and markets satellites and satellite components. Network Systems products include satellite-based business networks and Internet access service, cellular-based fixed wireless telephone systems and mobile cellular digital packet data systems. Other includes the corporate office and other entities.

(Dollars in Millions)	Direct-To-Home Broadcast	Satellite Services	Satellite Systems	Network Systems	Other	Eliminations	Total
1998							
External Revenues	\$ 1,813.7	\$ 643.8	\$ 2,493.4	\$ 1,000.6	\$ 12.4		\$ 5,963.9
Intersegment Revenues	2.4	123.5	337.7	76.1	0.8	\$ (540.5)	
Total Revenues	\$ 1,816.1	\$ 767.3	\$ 2,831.1	\$ 1,076.7	\$ 13.2	\$ (540.5)	\$ 5,963.9
Operating Profit (1)	\$ (228.1)	\$ 318.3	\$ 246.3	\$ 10.9	\$ (68.2)	\$ (30.1)	\$ 249.1
Depreciation and Amortization (1)	102.3	235.0	49.2	41.7	31.6	(5.0)	454.8
Intangibles, net	-	2,433.5	-	53.6	1,065.1	-	3,552.2
Segment Assets (2)	2,190.4	5,890.5	1,491.2	1,299.0	2,856.8	(292.9)	13,435.0
Capital Expenditures (3)	230.8	921.7	99.7	40.0	3.3	133.0	1,428.5
1997							
External Revenues	\$ 1,276.9	\$ 537.3	\$ 2,290.0	\$ 998.3	\$ 25.8		\$ 5,128.3
Intersegment Revenues	-	92.6	201.9	13.0	2.7	\$ (310.2)	
Total Revenues	\$ 1,276.9	\$ 629.9	\$ 2,491.9	\$ 1,011.3	\$ 28.5	\$ (310.2)	\$ 5,128.3
Operating Profit (1)	\$ (254.6)	\$ 292.9	\$ 226.3	\$ 74.1	\$ (47.9)	\$ (5.4)	\$ 285.4
Depreciation and Amortization (1)	86.1	145.2	39.4	32.0	14.7	-	317.4
Intangibles, net	-	2,498.5	-	-	456.3	-	2,954.8
Segment Assets (2)	1,408.7	5,682.4	1,312.6	1,215.6	3,298.1	(186.4)	12,731.0
Capital Expenditures (3)	105.6	625.7	113.9	43.1	0.4	(62.1)	826.6
1996							
External Revenues	\$ 621.0	\$ 381.7	\$ 1,950.4	\$ 1,049.6	\$ 6.0		\$ 4,008.7
Intersegment Revenues	-	101.1	106.0	20.4	1.7	\$ (229.2)	
Total Revenues	\$ 621.0	\$ 482.8	\$ 2,056.4	\$ 1,070.0	\$ 7.7	\$ (229.2)	\$ 4,008.7
Operating Profit (1)	\$ (319.8)	\$ 239.1	\$ 183.3	\$ 107.7	\$ (13.5)	\$ (7.7)	\$ 189.1
Depreciation and Amortization (1)	67.3	58.5	34.4	28.3	27.1	-	215.6
Intangibles, net	-	72.9	-	-	395.1	-	468.0
Segment Assets (2)	1,023.4	1,275.5	757.8	964.0	457.1	(105.2)	4,372.6
Capital Expenditures (3)	63.5	308.7	87.8	45.3	-	(55.9)	449.4

Certain 1997 and 1996 amounts have been reclassified to conform with the 1998 presentation.

(1) Includes amortization arising from purchase accounting adjustments related to GHI's acquisition of Hughes amounting to \$3.3 million in each of the years for the Satellite Services segment and \$17.7 million in each of the years in Other.

(2) Assets of the Satellite Services segment and Other include the unamortized purchase accounting adjustments associated with GHI's acquisition of Hughes. Satellite Services includes unamortized purchase accounting adjustments of \$66.3 million in 1998, \$69.6 million in 1997 and \$72.9 million in 1996. Other includes unamortized purchase accounting adjustments of \$360.3 million in 1998, \$378.0 million in 1997 and \$395.7 million in 1996.

(3) Includes expenditures related to satellites in segments as follows: \$70.2 million in 1998 for Direct-To-Home Broadcast segment and \$726.3 million, \$606.1 million and \$259.2 million in 1998, 1997 and 1996, respectively, for Satellite Services segment. Satellite Services segment also includes \$155.5 million in 1998 related to the early buy-out of satellite sale-leasebacks.

NOTES TO FINANCIAL STATEMENTS (CONTINUED)

A reconciliation of operating profit to income from continuing operations before income taxes, minority interests, extraordinary items and cumulative effect of accounting change, as shown in the Statement of Income and Available Separate Consolidated Net Income, follows:

	1998	1997	1996
Operating profit	\$ 249.1	\$ 285.4	\$ 189.1
Interest income	112.3	33.1	6.8
Interest expense	(17.5)	(91.0)	(42.9)
Other, net	(153.1)	390.7	69.1
Income from continuing operations before income taxes, minority interests, extraordinary item and cumulative effect of accounting change	\$ 190.8	\$ 618.2	\$ 222.1

The following table presents revenues earned from customers located in different geographic areas. Property and satellites are grouped by their physical location. All satellites are reported as United States assets.

(Dollars in Millions)	1998			1997			1996		
	Total Revenues	Net Property & Satellites	Total Revenues	Net Property & Satellites	Total Revenues	Net Property & Satellites			
NORTH AMERICA									
United States	\$ 3,534.3	\$ 4,206.3	\$ 2,851.1	\$ 3,507.1	\$ 2,613.1	\$ 1,725.1			
Canada and Mexico	136.7	2.0	101.3	-	27.4	-			
Total North America	3,671.0	4,208.3	2,952.4	3,507.1	2,640.5	1,725.1			
EUROPE									
United Kingdom	842.4	14.1	583.3	10.4	336.2	8.0			
Other	275.5	0.6	419.0	0.4	290.0	0.3			
Total Europe	1,117.9	14.7	1,002.3	10.8	626.2	8.3			
LATIN AMERICA									
Brazil	184.9	4.6	131.2	-	48.6	-			
Other	104.2	11.2	90.4	-	23.1	-			
Total Latin America	289.1	15.8	221.6	-	71.7	-			
ASIA									
Japan	185.9	0.6	147.9	0.5	119.7	0.4			
India	83.4	14.7	46.5	12.7	8.0	11.7			
China	63.4	1.7	154.5	1.5	125.2	1.4			
Other	214.7	0.6	477.8	0.5	387.3	0.5			
Total Asia	547.4	17.6	826.7	15.2	640.2	14.0			
Total Middle East	284.3	-	77.7	-	1.2	-			
Total Africa	54.2	0.3	47.6	-	28.9	-			
Total	\$ 5,963.9	\$ 4,256.7	\$ 5,128.3	\$ 3,533.1	\$ 4,008.7	\$ 1,747.4			

NOTE 18: Commitments and Contingencies

In connection with the 1997 spin-off of Hughes Defense and its subsequent merger with Raytheon, a process was agreed to among GM, Hughes and Raytheon for resolving disputes that might arise in connection with post-closing adjustments called for by the terms of the merger agreement. Such adjustments might call for a cash payment between Hughes and Raytheon. A dispute currently exists regarding the post-closing adjustments which Hughes and Raytheon have proposed to one another. In an attempt to resolve the dispute, Hughes gave notice to Raytheon to commence the arbitration process. Raytheon responded by filing an action in Delaware Chancery Court which seeks to enjoin the arbitration as premature. It is possible that the ultimate resolution of the post-closing financial adjustment provision of the merger agreement may result in Hughes making a payment to Raytheon that could be material to Hughes. However, the amount of any payment that either party might be required to make to the other is not determinable at this time. Hughes intends to vigorously pursue resolution of the dispute through the arbitration process, opposing the adjustments Raytheon seeks and seeking the payment from Raytheon that it has proposed.

Hughes has entered into agreements to procure commercial satellite launches, a significant number of which are expected to be used in connection with satellites ordered by outside customers. The agreements provide for launches beginning in 1999 and also contain options for additional launch vehicles. The total amount of the commitments, which is dependent upon the number of options exercised, market conditions and other factors, could exceed \$2.0 billion.

Hughes has a long-term agreement for multiple launch services aboard expendable launch vehicles using the Sea Launch ocean-based commercial launch system. Hughes plans to use options under this agreement to deliver communications satellites in-orbit. Sea Launch is scheduled to

demonstrate the capabilities of its ocean-based commercial launch system with its first launch in March 1999. The first launch will carry a demonstration payload having the same mission and physical characteristics (weight, size, etc.) as an HS 702 commercial communications satellite. If the first launch is not successful or delayed, Hughes could be required by customers to procure other launch vehicles to satisfy its contractual obligations, which may lead to higher operating costs.

DIRECTV has an agreement with General Electric Capital Corporation ("GECC") under which GECC agreed to provide an open-end revolving credit program for consumer purchases of DIRECTV receiver equipment, installations and ancillary items at selected retail establishments. Funding under this program was discontinued effective September 10, 1996. The aggregate outstanding balance under this agreement at December 31, 1998 was approximately \$190.0 million. Hughes has certain rights regarding the administration of the program, and the losses from qualifying accounts under this program accrue to Hughes, subject to certain indemnity obligations of GECC. Hughes has established allowances to provide for expected losses under the program. The allowances are subject to periodic review based on information regarding the status of the program. A complaint and counterclaim have been filed by the parties in the U.S. District Court for the District of Connecticut concerning GECC's performance and DIRECTV's obligation to act as a surety. GECC claims damages from DIRECTV in excess of \$140.0 million. DIRECTV seeks damages from GECC in excess of \$70.0 million. Hughes intends to vigorously contest GECC's allegations and pursue its own contractual rights and remedies. Hughes does not believe that the litigation will have a material adverse impact on Hughes' results of operations or financial position. Discovery is not yet completed in the case and no trial date has been set.

In December 1994, former Hughes entered into an agreement with Computer Sciences Corporation ("CSC") whereby CSC provides a significant amount of data processing services required by the non-automotive

NOTES TO FINANCIAL STATEMENTS (CONTINUED)

businesses of former Hughes. Baseline service payments to CSC are expected to aggregate approximately \$1.5 billion over the term of the eight-year agreement for former Hughes. Based on historical usage, approximately 17% of the costs incurred under the agreement are attributable to Hughes. The contract is cancelable by Hughes with early termination penalties.

At December 31, 1998, minimum future commitments under non-cancelable operating leases having lease terms in excess of one year, exclusive of satellite transponders leaseback payments disclosed in Note 4, are primarily for real property and aggregated \$323.8 million, payable as follows: \$56.6 million in 1999, \$53.3 million in 2000, \$52.3 million in 2001, \$50.3 million in 2002, \$29.4 million in 2003 and \$81.9 million thereafter. Certain of these leases contain escalation clauses and renewal or purchase options. Rental expenses under operating leases were \$62.0 million in 1998, \$72.2 million in 1997 and \$52.7 million in 1996.

In conjunction with its performance on long-term contracts, Hughes is contingently liable under standby letters of credit and bonds in the amount of \$294.3 million at December 31, 1998. In Hughes' past experience, no

material claims have been made against these financial instruments. In addition, Hughes has guaranteed up to \$204.6 million of bank debt, including \$150.0 million related to American Mobile Satellite Corporation, and up to \$22.1 million of capital lease obligations. \$150.0 million of bank debt matures in March 2003; the remaining \$54.6 million of bank debt matures in September 2007. The capital lease obligations are due in variable amounts over the next five years.

In connection with the DTH broadcast businesses, Hughes has commitments related to certain programming agreements which are variable based upon the number of underlying subscribers and market penetration rates. Minimum payments over the terms of applicable contracts are anticipated to be approximately \$700.0 million to \$800.0 million.

Hughes is subject to potential liability under government regulations and various claims and legal actions which are pending or may be asserted against it. The aggregate ultimate liability of Hughes under these claims and actions was not determinable at December 31, 1998. In the opinion of Hughes management, such liability is not expected to have a material adverse effect on Hughes' results of operations or financial position.

NOTES TO FINANCIAL STATEMENTS (CONCLUDED)

NOTE 19: Subsequent Events

Hughes entered into a contract with Asia-Pacific Mobile Telecommunications Satellite Pte. Ltd. ("APMT") effective May 15, 1998, whereby Hughes was to provide to APMT a satellite-based mobile telecommunications system consisting of two satellites, a ground segment, user terminals and associated equipment and software. As part of the contract, Hughes was required to obtain all necessary U.S. Government export licenses for the APMT system by February 15, 1999. On February 24, 1999, the Department of Commerce notified Hughes that it intends to deny the export licenses required by Hughes to fulfill its contractual obligation to APMT. Hughes has until March 16, 1999 to request reconsideration of the decision. As a result of Hughes failing to obtain the export licenses, APMT has the right to terminate the contract. At this time, there are ongoing discussions between Hughes and APMT regarding the contract, and between Hughes and the U.S. Government regarding the export licenses. If the U.S. Government ultimately denies the required export licenses or APMT terminates the contract, Hughes could be required to refund \$450 million to APMT and record a pre-tax charge to earnings of approximately \$100 million in 1999.

On January 22, 1999, Hughes agreed to acquire Primestar, Inc.'s ("Primestar") 2.3 million-subscriber, medium-power DTH business. In a related transaction, Hughes also agreed to acquire the high-power satellite assets and direct broadcast satellite ("DBS") orbital frequencies of Tempo, a wholly-owned subsidiary of TCI Satellite Entertainment, Inc. The acquisitions will be accounted for using the purchase method of accounting. The purchase price for the DTH business will be comprised of \$1.1 billion in cash and 4,871,448 shares of GM Class H common stock, for a total purchase price of \$1,325.0 million. The DTH transaction, pending regulatory and Primestar lender approval, is expected to close in early to mid-1999. The purchase price for the Tempo assets consists of \$500.0

million in cash, \$150.0 million of which is expected to be paid in early to mid-1999 and \$350.0 million which is payable upon Federal Communications Commission approval of the transfer of the DBS orbital frequencies, which is expected in mid to late-1999.

Hughes has maintained a suit against the U.S. Government since September 1973 regarding the Government's infringement and use of a Hughes patent (the "Williams Patent") covering "Velocity Control and Orientation of a Spin Stabilized Body," principally satellites. On April 7, 1998, the U.S. Court of Appeals for the Federal Circuit ("CAFC") reaffirmed earlier decisions in the Williams case and including the award of \$114.0 million in damages. The CAFC ruled that the conclusions previously reached in the Williams case were consistent with the U.S. Supreme Court's findings in the Warner-Jenkinson case. The U.S. Government petitioned the CAFC for a rehearing, was denied the request, and thereafter applied for certiorari to the U.S. Supreme Court.

On March 1, 1999, the U.S. Supreme Court denied the U.S. Government's petition for certiorari. The case will be remanded back to the trial court (Court of Claims) for entry of the final judgment. While no amount has been recorded in the financial statements of Hughes to reflect the \$114.0 million award of the interest accumulating thereon as of December 31, 1998, it is expected that resolution of this matter will result in the recognition of a pre-tax gain of approximately \$150 million during 1999. The GGM transaction (discussed in Note 14) received regulatory approval and closed in February 1999.

TYPE OF SERVICE

20. NATURE OF SERVICE: This filing is for an authorization to provide or use the following type(s) of service(s). Place an "X" in the box(es) next to all that apply.

a. Fixed Satellite c. Radiodetermination Satellite e. Direct to Home Fixed Satellite
 b. Mobile Satellite d. Earth Exploration Satellite f. Digital Audio Radio Service g. Other (please specify)

21. STATUS: Place an "X" in the box next to the applicable status. Mark only one box.

a. Common Carrier b. Non-Common Carrier
 a. Using U.S. licensed satellites b. Using Non-U.S. licensed satellites

22. If earth station applicant, place an "X" in the box(es) next to all that apply.

a. Connected to the Public Switched Network b. Not connected to the Public Switched Network

23. If applicant is providing INTERNATIONAL COMMON CARRIER service, see instructions regarding Sec. 214 filings. Mark only one box. Are these facilities:

a. Connected to the Public Switched Network b. Not connected to the Public Switched Network

24. FREQUENCY BAND(S): Place an "X" in the box(es) next to all applicable frequency band(s).

a. C-Band (4/6 GHz) b. Ku-Band (12/14 GHz) c. Other (Please specify)

TYPE OF STATION

25. CLASS OF STATION: Place an "X" in the box next to the class of station that applies. Mark only one box.

a. Fixed Earth Station b. Temporary-Fixed Earth Station c. 12/14 GHz VSAT Network d. Mobile Earth Station e. Space Station f. Other (Specify)

If space station applicant, go to Question 27.

26. TYPE OF EARTH STATION FACILITY Mark only one box.

a. Transmit/Receive b. Transmit-Only c. Receive-Only

PURPOSE OF MODIFICATION OR AMENDMENT

27. The purpose of this proposed modification or amendment is to: Place an "X" in the box(es) next to all that apply.

<input type="checkbox"/>	a -- authorization to add new emission designator and related service
<input type="checkbox"/>	b -- authorization to change emission designator and related service
<input type="checkbox"/>	c -- authorization to increase EIRP and EIRP density
<input type="checkbox"/>	d -- authorization to replace antenna
<input type="checkbox"/>	e -- authorization to add antenna
<input type="checkbox"/>	f -- authorization to relocate fixed station
<input type="checkbox"/>	g -- authorization to change assigned frequency(ies)
<input type="checkbox"/>	h -- authorization to add Points of Communication (satellites & countries)
<input type="checkbox"/>	i -- authorization to change Points of Communication (satellites & countries)
<input type="checkbox"/>	j -- authorization for facilities for which environmental assessment and radiation hazard reporting is required
<input type="checkbox"/>	k -- Other (Please Specify)

ENVIRONMENTAL POLICY

28. Would a Commission grant of any proposal in this application or amendment have a significant environmental impact as defined by 47 CFR 1.1307? If YES, submit the statement as required by Sections 1.1308 and 1.1311 of the Commission's rules, 47 C.F.R. §§ 1.1308 and 1.1311, as an exhibit to this application.

YES NO

A Radiation Hazard Study must accompany all applications as an exhibit for new transmitting facilities, major modifications, or major amendments. Refer to OET Bulletin 65.

ALIEN OWNERSHIP

29. Is the applicant a foreign government or the representative of any foreign government?	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO
30. Is the applicant an alien or the representative of an alien?	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO
31. Is the applicant a corporation organized under the laws of any foreign government?	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO
32. Is the applicant a corporation of which more than one-fifth of the capital stock is owned of record or voted by aliens or their representatives or by a foreign government or representative thereof or by any corporation organized under the laws of a foreign country?	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO
33. Is the applicant a corporation directly or indirectly controlled by any other corporation of which more than one-fourth of the capital stock is owned of record or voted by aliens, their representatives, or by a foreign government or representative thereof or by any corporation organized under the laws of a foreign country?	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO
34. If any answer to questions 29, 30, 31, 32 and/or 33 is Yes, attach as an exhibit, the identification of the aliens or foreign entities, their nationality, their relationship to the applicant, and the percentage of stock they own or vote.		

BASIC QUALIFICATIONS

35. Does the applicant request any waivers or exemptions from any of the Commission's Rules? If Yes, attach as an exhibit, copies of the requests for waivers or exceptions with supporting documents.	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO
36. Has the applicant or any party to this application had any FCC station authorization or license revoked or had any application for an initial, modification or renewal of FCC station authorization, license, or construction permit denied by the Commission? If Yes, attach as an exhibit, an explanation of the circumstances.	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO
37. Has the applicant, or any party to this application, or any party directly or indirectly controlling the applicant ever been convicted of a felony by any state or federal court? If Yes, attach as an exhibit, an explanation of the circumstances.	<input checked="" type="checkbox"/> YES	<input type="checkbox"/> NO
38. Has any court finally adjudged the applicant, or any person directly or indirectly controlling the applicant, 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 any other means or unfair methods of competition? If Yes, attach as an exhibit, an explanation of the circumstances.	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO
39. Is the applicant, or any person directly or indirectly controlling the applicant, currently a party in any pending matter referred to in the preceding two items? If Yes, attach as an exhibit, an explanation of the circumstances.	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO
40. If the applicant is a corporation and is applying for a space station license, attach as an exhibit 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. Also list the names and addresses of the officers and directors of the Filer.		
41. By checking Yes, the undersigned 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 Act of 1988, 21 U.S.C. Section 862, because of a conviction for possession or distribution of a controlled substance. See 47 CFR 1.2002(b) for the meaning of "party to the application" for these purposes.	<input checked="" type="checkbox"/> YES	<input type="checkbox"/> NO
42a. Does the applicant intend to use a non-U.S. licensed satellite to provide service in the United States? If yes, answer 42b and attach an exhibit providing the information specified in 47 C.F.R. § 25.137, as appropriate. If no, proceed to question 43.	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO
42b. What administration has licensed or is in the process of licensing the space station? If no license will be issued, what administration has coordinated or is in the process of coordinating the space station?		

Hughes Electronics Corporation ("HE") indirectly owns over 80% of the issued and outstanding stock of PanAmSat Licensee Corp. ("PanAmSat"). HE Holdings, Inc. ("HEH"), a wholly-owned subsidiary of HE formerly known as Hughes Aircraft Company, pled guilty to two felony counts in 1990. The full details of this matter are included in a Form 430 for Hughes Communications Galaxy, Inc., dated August 19, 1991.

On June 15, 1992, HEH was found guilty of one felony count with regard to the testing of microelectronics components. The full details of this matter are included in a Form 430 for Hughes Communications Galaxy, Inc., dated August 12, 1992.

The conduct at issue in these two cases has no relevance to the FCC authorizations and applications of PanAmSat. HEH was merged into the Raytheon Company in 1997 and therefore is no longer affiliated with PanAmSat or any party to this application. HE, moreover, had no ownership interest in the PanAmSat system when the conduct occurred at HEH. In addition, conduct in these matters is wholly unrelated to the communications area and does not reflect in any way upon the FCC-related activity of PanAmSat, whose operations were largely independent of HEH during the period when HEH was a subsidiary of HE.

PanAmSat Licensee Corp.

Exhibit 2
FCC Form 312

**Names, addresses, citizenship, and percentage interests of stockholders
owning of record and/or voting 10 % or more of voting stock**

PanAmSat International Systems, Inc. c/o PanAmSat Corporation One Pickwick Plaza Greenwich, CT 06830	USA	100%
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Names and addresses of Officers and Directors of PanAmSat Licensee Corp.

Mr. R. Douglas Kahn
c/o PanAmSat Corporation
One Pickwick Plaza
Greenwich, CT 06830

Mr. Kenneth N. Heintz
c/o PanAmSat Corporation
One Pickwick Plaza
Greenwich, CT 06830

Mr. James W. Cuminale
c/o PanAmSat Corporation
One Pickwick Plaza
Greenwich, CT 06830

Mr. Robert A. Bednarek
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