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FEDERAL COMMUNICATIONS COMMISSION

REMITTANCE ADVICE

PAGE NO. 1 OF 1

1305

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(2) PAYER NAME (if paying by credit card, enter name exactly as it appears on your card)
Fisher Wayland Cooper Leader & Zaragoza L.L.P.

(3) TOTAL AMOUNT PAID (dollars and cents)
$ 425,225.00

(4) STREET ADDRESS LINE NO. 1
c/o Fisher Wayland:BDJ

ORIGINAL

(5) STREET ADDRESS LINE NO. 2
2001 Pennsylvania Avenue, N.W., Suite 400

(6) CITY
Washington

(7) STATE
D.C.

(8) ZIP CODE
20006

(9) DAYTIME TELEPHONE NUMBER (Include area code)
(202) 659-3494

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

APR - 9 1998

IF PAYER NAME THE AND 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)
Pegasus Development Corporation

(12) STREET ADDRESS LINE NO. 1
5 Radnor Corporate Center, Suite 454

95 through 99-SAT-PLA-98

(13) STREET ADDRESS LINE NO. 2
100 Matsonford Road

S2350-S2354

(14) CITY
Radnor

(15) STATE
PA

(16) ZIP CODE
19087

(17) DAYTIME TELEPHONE NUMBER (Include area code)
(610) 341-0766

(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	(20A) PAYMENT TYPE CODE (PTC)	(21A) QUANTITY	(22A) FEE DUE FOR (PTC) IN BLOCK 20A	FCC USE ONLY
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(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
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(19C) FCC CALL SIGN/OTHER ID	(20C) PAYMENT TYPE CODE (PTC)	(21C) QUANTITY	(22C) FEE DUE FOR (PTC) IN BLOCK 20C	FCC USE ONLY
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(19D) FCC CALL SIGN/OTHER ID	(20D) PAYMENT TYPE CODE (PTC)	(21D) QUANTITY	(22D) FEE DUE FOR (PTC) IN BLOCK 20D	FCC USE ONLY
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(23D) FCC CODE 1	(24D) FCC CODE 2

SECTION D - TAXPAYER INFORMATION (REQUIRED)

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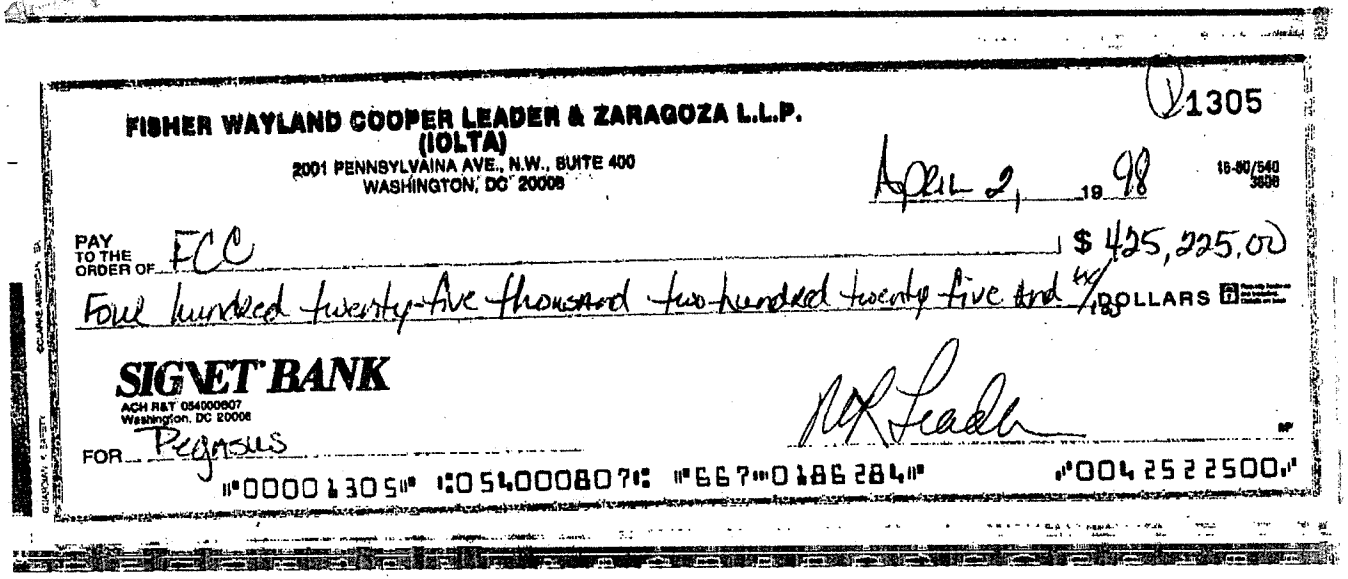

Mellon Bank

FISHER WAYLAND COOPER LEADER & ZARAGOZA L.L.P.
(IOLTA)
2001 PENNSYLVAINA AVE., N.W., SUITE 400
WASHINGTON, DC 20006

1305

April 2, 1998

PAY TO THE ORDER OF FCC

$ 425,225.00

Four hundred twenty-five thousand two hundred twenty five and 00/100 DOLLARS

SIGNET BANK
ACH R&T 054000607
Washington, DC 20006

FOR Pegasus

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85-045-00x
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FISHER WAYLAND COOPER LEADER & ZARAGOZA L.L.P.
2001 PENNSYLVANIA AVENUE, N.W.
SUITE 400
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(202) 775-3543

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(202) 296-6518

INTERNET
bjacobs@fwclz com

April 3, 1998

VIA COURIER DELIVERY TO MELLON BANK

Magalie Roman Salas
Secretary
Federal Communications Commission
1919 M Street, N.W., Room 222
Washington, D.C. 20554

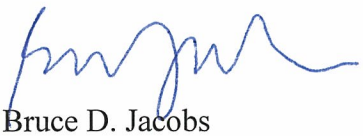
Re: Application of Pegasus Development Corporation
For Authority to Launch and Operate a Communications
Satellite System in the Ka band

Dear Ms. Salas:

Pegasus Development Corporation ("Pegasus"), by its counsel, hereby refiles its above-referenced application, originally submitted on December 22, 1997, along with the filing fee of $425,225 for this application. The Pegasus application was returned by letter from Claudette E. Pride, Chief, Fee Section, Fee Control No. 9712248210223001 (January 13, 1998). On March 17, 1998, the Commission granted Pegasus' request for reinstatement of its application *nunc pro tunc*, as well as Pegasus' request for waiver of the Commission's geostationary fee payment requirement and deferral of its fee payment. *See* Letter from Thomas M. Holleran, Acting Associate Managing Director for Operations, Office of Managing Director, to Bruce D. Jacobs, (March 17, 1998). (This letter is attached.) These grants were conditioned on Pegasus making its fee payment of $425,225 within 20 days of the date of the Commission's letter. The attached filing satisfies the Commission's requirement.

If you have any questions, please contact the undersigned.

Very truly yours,



Bruce D. Jacobs

Enclosures

cc: Kathleen A. Campbell (w/out enclosures)
Fern J. Jarmulnek (w/out enclosures)
James B. Mullins (w/out enclosures)
Claudette E. Pride (w/out enclosures)

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

In the Matter of

Pegasus Development Corporation File No.

Application for Authority to Launch and
Operate a Communications Satellite
System

APPLICATION

Pegasus Development Corporation
5 Radnor Corporate Center
Suite 454
100 Matsonford Road
Radnor, PA 19087

David D. Oxenford
Bruce D. Jacobs
Stephen J. Berman
Fisher Wayland Cooper Leader
& Zaragoza L.L.P.
2001 Pennsylvania Avenue, N.W.
Suite 400
Washington, D.C. 20006
(202) 659-3494

December 22, 1997

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

In re Application of	)	
	)	
PEGASUS DEVELOPMENT CORPORATION	)	File No.
	)	
Application for Authority to Launch and Operate a Communications Satellite System in the Ka Band	)	

APPLICATION

Pegasus Development Corporation ("Pegasus") hereby applies for authority, pursuant to Sections 308 and 309 of the Communications Act of 1934, as amended, and Section 25.114 of the Commission's Rules, to launch and operate a communications satellite system in the Ka Band.[1/]

1.0. INTRODUCTION

Pegasus' parent company, Pegasus Communications Corporation ("Pegasus Communications") is a growing communications company that has achieved success in a variety of media industries. Pegasus Communications owns and operates five broadcast television stations and operates three other stations under local marketing agreements. Pegasus Communications is the largest independent provider of DIRECTV®, with the exclusive right to distribute DIRECTV® programming services to approximately 2.3

1/ *See* Public Notice, Report No. SPB-106 (October 15, 1997).

million U.S. television households in rural areas of twenty-seven states. In addition, Pegasus Communications also provides cable service to approximately 42,000 subscribers in New England and Puerto Rico.

For purposes of this application, Pegasus proposes to launch and operate the Pegasus I Satellite System ("Pegasus I") in the Fixed Satellite Service ("FSS") using Ka-band spectrum. The global system consists of: a constellation of ten geostationary orbit ("GSO") satellites (two satellites at each of five orbit locations); satellite and network control facilities; and customer equipment. The system has the capability to provide a broad range of multimedia services, consisting primarily of wide-band, high-speed data transmissions. The overall operational concept for Pegasus I is illustrated in Figure 1-1. Figure 1-1 shows the ability of Pegasus I subscribers to communicate either with other Pegasus I subscribers or, through a gateway interface, with subscribers to other broadband networks.

2.0. SYSTEM DESCRIPTION

2.1 GENERAL OVERVIEW OF SYSTEM

2.1.1 SATELLITE DESCRIPTION

Each of the ten Pegasus I satellites contains an IF switch matrix for routing signals between the 30 uplink and 30 downlink beams illuminating the service area, defined as the field-of-view for a 20 degree minimum elevation angle, including beams north and south of the equator. No on-board demodulation is required. East-west intersatellite links are proposed in the 50 to 70 GHz millimeter wave band. TT&C during launch and pre-operation will be provided in the Ku Band. On-station, operational TT&C will be provided in the Ka Band.

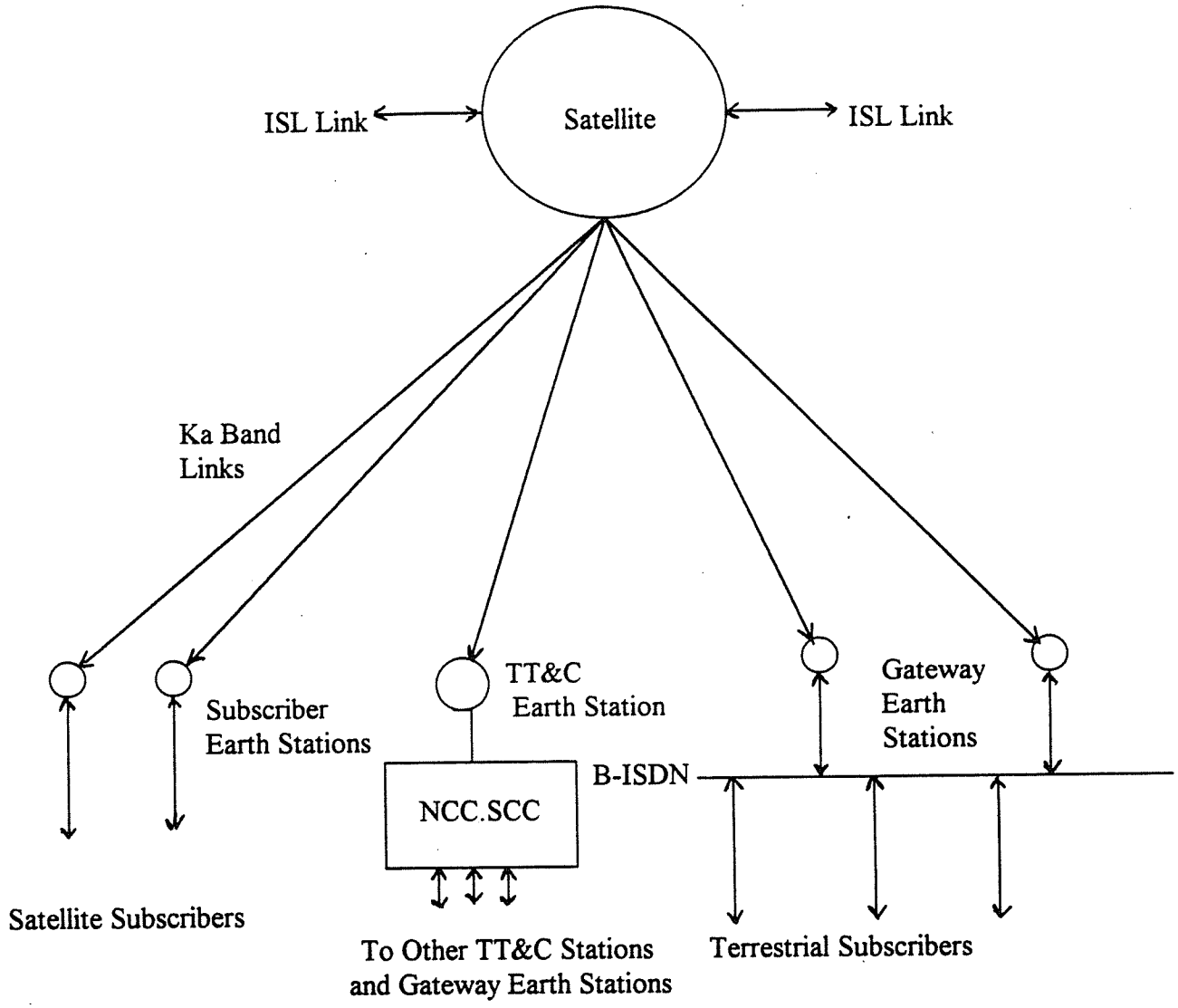


Figure 1-1. Operational Concept

With further development, ATM technology, on-board demodulation and phased array technology may become possible. If this technology is available at the time of licensing, Pegasus may amend its application, if necessary. No significant changes to the satellite capacity or radiation characteristics will result from such modification, however.

Pegasus I will operate in the Ka-Band frequencies that are the subject of the Public Notice with respect to GSO systems. Actual use will depend on what spectrum can be coordinated. Section 2.5.1, below, describes one likely frequency plan.

The satellite concept is depicted in Figure 2-1. Each uplink beam contains a High Band and Low Band segment, each amplified by an LNB, with further amplification, frequency conversion, and filtering provided by a matrix of TDM/FDM channel units. Signals at three different burst rates enter the IF switch matrix where individual transmission bursts are routed to the correct downlink beam. Signals exiting the IF switch matrix destined for individual downlink beams are amplified by downlink TDM/FDM channel units and then by high efficiency, linearized TWTAs.

2.1.2 GROUND SEGMENT

The Pegasus I ground segment consists of a Network Control Center ("NCC") for controlling the communications network and a Satellite Control Center ("SCC") for controlling the launching and operation of satellites and associated TT&C facilities. A NCC/SCC and TT&C terminal will be located within CONUS and a TT&C earth station located in ITU Regions 1 and 3 and interconnected to the NCC/SCC via satellite or terrestrial communications facilities. This ground segment is required for the control of the space segment.

The ground segment also consists of subscriber earth stations installed on or near

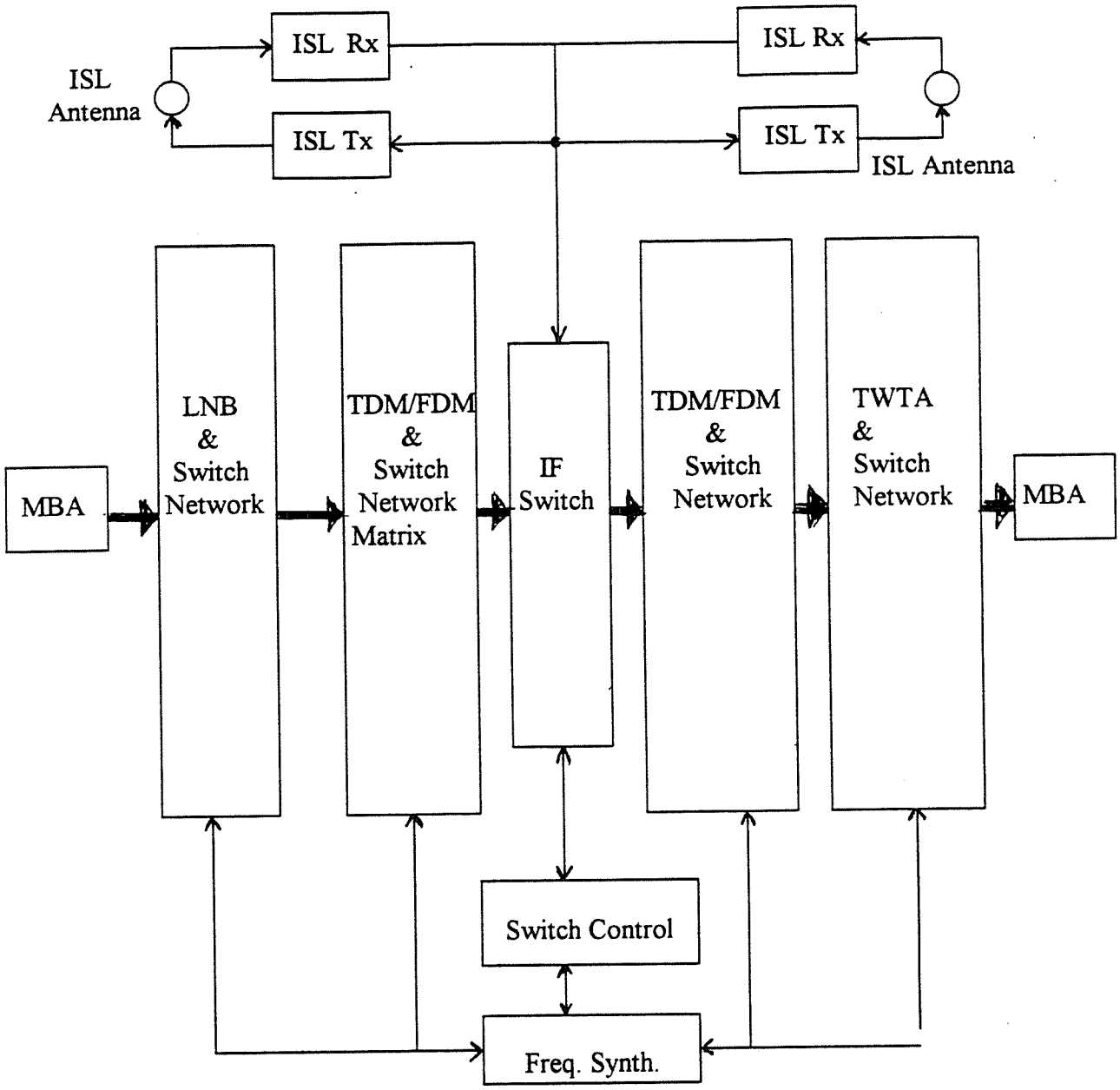


Figure 2-1. Satellite Communications Concept

residences or office and factory buildings, and larger, more sophisticated gateway earth stations providing interconnection, network, trunking and other services. These ground facilities are expected to be owned and operated by service providers.

Subscriber earth station antennas are expected to range from 0.5 to 3.0 meters, with smaller antennas used by private or small-business subscribers and larger antennas used by larger business and government subscribers requiring higher-quality service. Larger antennas also will be used in subtropical and tropical rainy areas. Gateway earth station antennas are expected to be at least 1.0 meter, and as large as 3.0 meters in subtropical or tropical areas. Gateway earth stations provide network services to associated subscribers, such as signaling, routing, authentication, and billing, and may provide interconnection to terrestrial wireless or fiber system subscribers, including protocol conversion. Gateway earth stations are also expected to allow the introduction of network services such as the Internet and provide trunking services between terrestrial systems of various kinds.

2.2. ORBITAL CHARACTERISTICS

2.2.1 OPERATING REGIONS

Pegasus proposes to operate a global network serving four important regional areas:

1) North America, including the 50 states, Puerto Rico, the U.S. Virgin Islands, Canada and Mexico. For interconnectivity, it is desirable to illuminate portions of Central and South America;

2) South and Central America; for interconnectivity it is desirable to illuminate portions of North America;

3) Europe, the Middle East, and Africa; and

4) Asia.

With coverage limited to minimum elevation angles of 20 degrees due to Ka-Band rain attenuation, the range of orbital arcs within which a Pegasus I satellite may operate is limited. The five orbital locations will be occupied by an initial system of ten satellites. The presence of two satellites at each orbital location will permit Pegasus to double system capacity via orthogonal polarization and possibly extend existing coverage areas.

2.2.2. REQUESTED ORBITAL STATIONS

As stated above, the Pegasus I system is comprised of five orbital stations. These orbital stations are 93° and 103° W.L., primarily for North America and the Caribbean region, 69° W.L. for Central and South America, 26.2° E.L. for Europe, Africa, and the Mediterranean area, and 99° E.L. for Asia. Each orbital station enables service both north and south of the equator, using two co-located satellites.

2.2.3 ALTERNATIVE ORBITAL STATIONS

Pegasus is aware that Ka-Band orbital locations may be in short supply and consequently pledges to work diligently with the Commission and its fellow applicants to resolve all orbital issues or conflicts. Ka-Band orbital slots are subject to coordination with other U.S. systems and with the Ka-Band systems of other administrations, and consequently the ITU record, which Pegasus has examined, may not be adequate or up to date regarding announced systems. Consequently, Pegasus is willing to consider alternatives. The range of acceptable longitudes is restricted at Ka Band because of the elevation angle (20 degrees) believed to be necessary for acceptable Ka-Band service. The following is the suggested range of orbital arcs that might prove acceptable to applicants serving the respective regions:

1) North America. The arc plus and minus ten degrees from 93° and 103° W.L. degrees provides acceptable service to CONUS. Orbital stations outside this arc, apparently available at 69° W.L., 121° W.L., and 129° W.L., are less desirable because of rain attenuation effects.

2) Central and South America. The arc from 90° W.L. to approximately 25° W.L. provides acceptable service to this area. This includes possible alternative orbital locations at 63° W.L., 59° W.L., 55° W.L., 51° W.L., 45° W.L., 43° W.L. and 34.5° W.L.

3) Europe and Africa. The arc from 10° W.L. to 40 ° E.L. provides acceptable service to this area. This includes a possible alternative orbital location at 2° E.L.

4) Asia. The arc from 90° E.L. to 140° E.L. provides acceptable service to much of this area. This includes possible alternative orbital locations at 72.7° E.L., 139° E.L., 155° E.L. and 160° E.L.

2.2.4. STATION KEEPING AND LOCATION REQUIREMENTS

Pegasus intends to maintain its satellites on-station with an accuracy of 0.03 degrees north-south and east-west. North-south, i.e., inclination correction, is required over the entire operating life of each satellite because subscriber earth station antennas are fixed and re-pointing requires revisiting each site by a local technician.

2.3. SPACE SEGMENT DESCRIPTION

The Pegasus I satellites are based on state-of-the-art space technology. The use of IF switching results in a space system having high flexibility in data rate and beam-to-beam routing. The multiple beam antenna may be composed of fixed horns with multiple feeds. There may be a need, however, to move satellites from orbit station to orbit station, requiring some flexibility for re-pointing the beams. At a minimum, this flexibility can be accomplished through the use of several antennas. Alternatively, separate transmit and receive multiple beam phased arrays with independent steering may be available. Pegasus I spacecraft require a high power bus and accurate attitude control

and station keeping; these requirements are well within the present capability of the satellite manufacturing industry.

It may become possible to build Pegasus I using ATM-like switching technology, with on-board processing (demodulation, decoding, demultiplexing and the inverse). This satellite will not exceed the radiation characteristics described herein, and will have the same capacity and link performance cited herein. The use of on-board processing will reduce the required earth station HPA power and satellite power densities.

ISLs are planned for the millimeter wave band, 50 to 70 GHz. Commercially-proven optical ISLs also may be used.

2.3.1. COMMUNICATIONS SYSTEM DESIGN

The satellite communications systems are based on the latest miniature microwave integrated circuit ("MMIC") technology, designed to conserve mass and power and to achieve high performance. MMICs are mandatory for LNBs and TDM/FDM channel units because the large number of antenna beams (30) requires the use of repetitive, light- weight, low power subsystems and components. Multiple IF switches also are used in order to provide routing flexibility. Multiple beam reflector antennas provide high efficiency, good crosspol performance, and good co-channel beam isolation. Several antenna assemblies are anticipated in order to achieve beam pointing flexibility. The power amplifiers are expected to be linearized, high efficiency, variable power TWTAs with the high efficiency achieved at the operating point. ATPC, activated via the signaling channel, is provided by the downlink TDM/FDM channel units.

2.3.2. TT&C SUBSYSTEM

The TT&C subsystem will operate in the Ku Band during launch, using omnidirectional satellite antennas, and in the Ka Band during normal operation, with omnidirectional command antennas and a horn telemetry antenna. In certain operational situations where satellite attitude control has been lost, it may be necessary to use the Ku-Band telemetry as part of the restoral operations. TT&C also provides for tracking and ranging.

Command receivers, decoders, and decryptors are fully redundant via cross-strapping. Telemetry encoders, transmitters, and beacons are hot-switched redundant. Functionality will not be lost due to any single failure. A summary of launch and on-orbit TT&C performance is given in Section 2.5.4.3.

2.3.3. ELECTRICAL POWER SUBSYSTEM

Pegasus expects to base its electrical power subsystem on a single high voltage regulated bus with direct energy transfer. Primary power is provided by two deployed gallium arsenide solar arrays steered around a single axis. A silicon solar array is considered an alternative. Power control units and DC/DC converters support local equipment. Excess energy is stored in charge-controlled nickel-hydrogen batteries for use during eclipse and peak load conditions. The required power and energy storage are well within the range of capabilities in the commercial space industry.

2.3.4. THERMAL SUBSYSTEM

Pegasus I included a passive thermal subsystem, using thermal finishes, blankets, and heat pipes augmented with temperature-controlled heaters. These devices minimize temperature excursions and maintain satellite equipment at proper operating

temperatures. Special heaters can maintain minimum operating temperatures for critical equipment. Heat pipes likely will be used to distribute dissipated payload heat and to limit maximum equipment temperatures. In addition, the telemetry subsystem provides fault detection alarms in the event of improper temperature operation and monitors temperature-critical subsystems. The satellite contains three separate thermally-isolated areas (areas having minimal mutual heat transfer) -- the main satellite body, the battery area, and the solar arrays.

2.3.5. PROPULSION SYSTEM

The propulsion subsystem may be based on either a monopropellant or bi-propellant hydrazine system (depending on the selection of a spacecraft manufacturer) operated in a blow-down mode with helium as the pressurant. Propellant and pressurant loading is accomplished through independent fill and drain valves. Thruster isolation is provided by a latch valve. Sufficient propellant will be loaded in order to accomplish all necessary attitude and orbital maneuvers over the expected lifetime of each spacecraft, including the final de-orbiting maneuver. High impulse ion thrusters also may be used, depending on the specific experience of the selected spacecraft manufacturer.

2.3.6. ATTITUDE CONTROL SUBSYSTEM

The attitude control system will contain a special, computer-oriented, autonomous system with command over-rides for automatic operation of the attitude control system. The attitude control system is expected to be a three-axis, stabilized momentum bias system using redundant momentum wheels and associated thrusters. Earth and sun sensors and inertial measurement sensors monitor spacecraft attitude in three axes. A star tracker or RF beacon also may be used for more accurate yaw measurements.

2.3.7. STRUCTURE AND MECHANISMS

The structure provides a rigid stable platform for maintaining alignment of precision pointing sensors and antennas. The structure also conducts heat and provides adequate surface areas for heat radiation. Rigid mounting surfaces are provided for solar arrays and antennas. Deployment mechanisms are required for the solar arrays and antennas.

2.3.8. LAUNCH VEHICLES

Pegasus I satellites may be launched by a variety of launch vehicles. Launch vehicles will be selected on the basis of performance and cost.

2.3.9. MASS AND POWER BUDGETS

Estimated spacecraft mass and power are as follows:

TABLE 2-1. Mass Properties of Pegasus I Satellite.

	Mass, Kg
Communications Subsystem	277
Spacecraft, BOL	833
Launch Mass	1,515

TABLE 2-2. Power Properties of Pegasus I Satellite.

	Power, watts
Communications	1,068
Spacecraft Bus	150
Daytime Power, with margin, EOL	1,346
Daytime Power, with margin, BOL	1,548

2.3.10 OVERALL SPACECRAFT DIMENSIONS

The tip-to-tip spacecraft, with deployed solar arrays, is approximately 15 meters.

2.3.11. SYSTEM LIFE AND RELIABILITY

Pegasus I satellites will have a design lifetime of 12 years. The expected orbital

lifetime of these satellites will exceed 12 years, the probability of a satellite remaining fully operational after 12 years is estimated to be 0.8.

2.4. EARTH STATION DESCRIPTIONS

2.4.1. CPE EARTH STATION DESCRIPTION

The CPE earth station, designed for low-cost, high-volume production and ready installation on residences, industrial buildings, or on the ground, makes use of earth station antennas in the range of 0.5 to 3.0 meters, with 0.7 meters being typical. The antennas are fixed in the direction of the satellite and cannot be re-pointed without the services of a local technician. The HPA of each earth station operates with ATPC such that the signal arriving at the satellite is always near its "clear sky" value, controlled by measuring the downlink attenuation but with the supervision of the local gateway earth station.

Generally, each CPE earth station can operate in either the Low Band or High Band on either polarization set and at either the high or low burst rate (unless coordination precludes the use of the Low Band at that site). Business and government users likely will prefer larger antennas in order to achieve greater availability due to rain, dual band operation, dual polarization operation and generally, will require higher capacity earth stations at the higher data rates. Private subscribers may prefer smaller antennas and simpler earth station configurations because of cost considerations. Thus, the Pegasus I design permits operational flexibility and customized service options, thereby encouraging higher system use.

Authentication of each CPE earth station transmission is provided by its associated gateway earth station, which also monitors services and performance over the

signaling channels. Burst timing corrections are provided by the local gateway earth station based on information transmitted from the NCC/SCC.

For a full range of household multimedia services the PC will need to be connected to other household appliances such as the television set, VCR, or CD player.

2.4.2. GATEWAY EARTH STATION DESCRIPTION

Gateway earth stations will have 1.0 meter fixed antennas or larger, in order to improve availability during periods of rain. Gateway earth stations, with full hot-switched redundancy and operated by independent service providers, operate in the same transmission format as CPE earth stations and provide the following network services:

1) Authentication of subscribers and services, other network services, control of CPE earth station performance, billing, etc. for associated CPE earth stations. Each CPE earth station must be controlled by an authorized gateway earth station.

2) Interconnection with the B-ISDN and other broadband terrestrial transmission facilities, enabling communication between Pegasus I subscribers, terrestrial subscribers, and other satellite system subscribers. Gateway earth stations provide protocol conversion, as required.

3) Introduction of special network services, such as Internet.

4) Provision of point-to-point trunking services for isolated fiber and terrestrial wireless systems and other terrestrial or satellite systems.

2.4.3. NCC/SCC AND TT&C EARTH STATION DESCRIPTION

The NCC/SCC are planned for installation within CONUS, along with a TT&C earth station. The NCC controls the Pegasus worldwide network via terrestrial or satellite communication interconnection with all gateway earth stations. The SCC monitors and controls the satellites, supervises launches and corrects attitude and orbit parameters. The NCC/SCC, again via terrestrial or satellite communications facilities, controls the satellites in other ITU regions via TT&C facilities in those regions. A geographically

separate, redundant NCC/SCC is planned for installation within CONUS.

2.4.4. EARTH STATION CAPACITY

Each earth station may operate at data rates between 16 KBps up to the maximum burst rate, 53 MBps in the Low Band and 61MBps in the High Band. If needed, multiples of these rates can be provided for gateway earth station trunking services or other services by changing the frequency plan in the satellite beams.

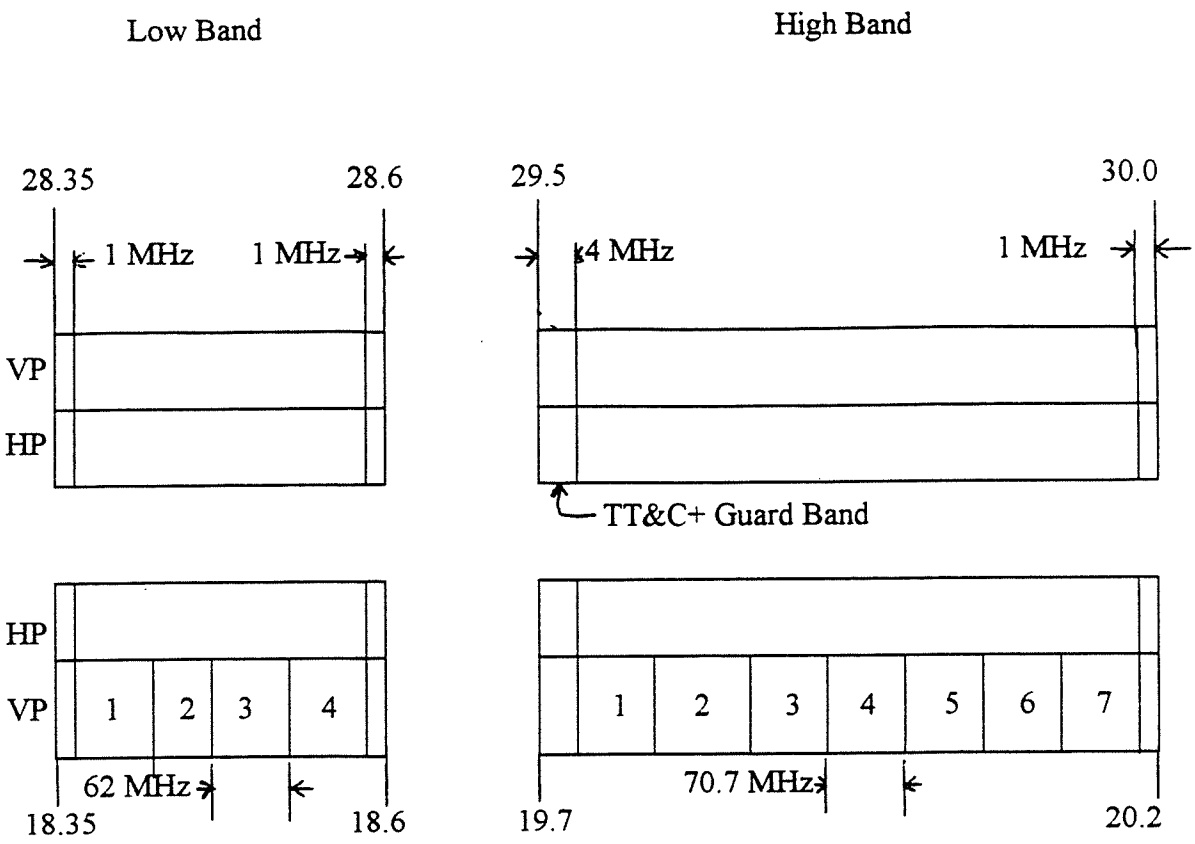
2.4.5. EARTH STATION ANTENNA BEAM PATTERNS

All Ka-Band earth station antennas will meet the requirements specified in 47 C.F.R. § 25.209.

2.5. COMMUNICATIONS SYSTEM DESCRIPTION

2.5.1. SPECTRUM AND POLARIZATION PLAN

The spectrum and polarization plan is depicted in Figure 2-2, illustrating a "High Band" segmented into seven parts, plus guard bands and TT&C, and a "Low Band" segmented into four parts, plus guard bands. The different segmentations, resulting in slightly different antenna self-interference in the two bands, provide approximately the same maximum data rate to subscribers. A segment from each band is assigned to each beam such that an adequate separation exists between two co-channel beams. Orthogonal polarization is used with each band such that transmit and receive signals are orthogonally polarized. While Figure 2-2 indicates equal segmentation, operational requirements may result in more bandwidth for some beams relative to others, in order to adapt to the demand for service over the service area. The bandwidth per beam is controlled by the LNB and TWTA switching.



Frequency in GHz
Not to Scale

Figure 2-2. Spectrum and Polarization Plan

For equal-bandwidth segmentation, the following are the transponder center frequencies.

Transponder	Low Band		High Band	
	Downlink MHz	Uplink MHz	Downlink MHz	Uplink MHz
Guard Band	18,350-18351	28,350-28351	19,700-19,704	29,500-29,504
T1	18,382	28382	19,739.4	29,539.4
T2	18,444	28444	19,810.1	29,610.1
T3	18,506	28506	19,880.8	29,680.8
T4	18,568	28568	19,951.5	29,751.5
T5			20,022.2	29,822.2
T6			20,092.9	29,892.9
T7			20,163.6	29,963.6
Guard Band	18,599-18,600	28,599-28,600	20,199-20,200	29,999-30,000

2.5.2. SATELLITE COVERAGE AND ANTENNA BEAM PATTERNS

Coverage of the U.S., including offshore states and territories by the 30 beam antenna, is depicted in Figure 2-3a from the 93° W.L. orbital position and Figure 2-3b from the 103° W.L. orbital position. Tables 2-3a and b list the beam pointing angles relative to the antenna boresight for 93° and 103° W.L. Table 2-4 depicts the segmentation and polarization plan for the individual beams for the 93° W.L. orbital location. The 93° W.L. orbital position also can provide coverage of Canada, Mexico, Central America, the Caribbean area and portions of South America by operating a second satellite with this coverage pattern from the 93° W.L. orbital position. Figures 2-3a and b also depict the 20 degree earth station elevation contour for these orbital positions, illustrating the narrow range of orbital stations capable of serving CONUS. Alaska can be served at a lower elevation angle because typical rain rates in Alaska are lower. Hawaii also is beyond the 20 degree contour. There are regions in Hawaii where rain rates are very high, consequently service to Hawaii from the 93° W.L. orbital slot is not as good as it could be from orbital stations further west. Hawaii is within the 20

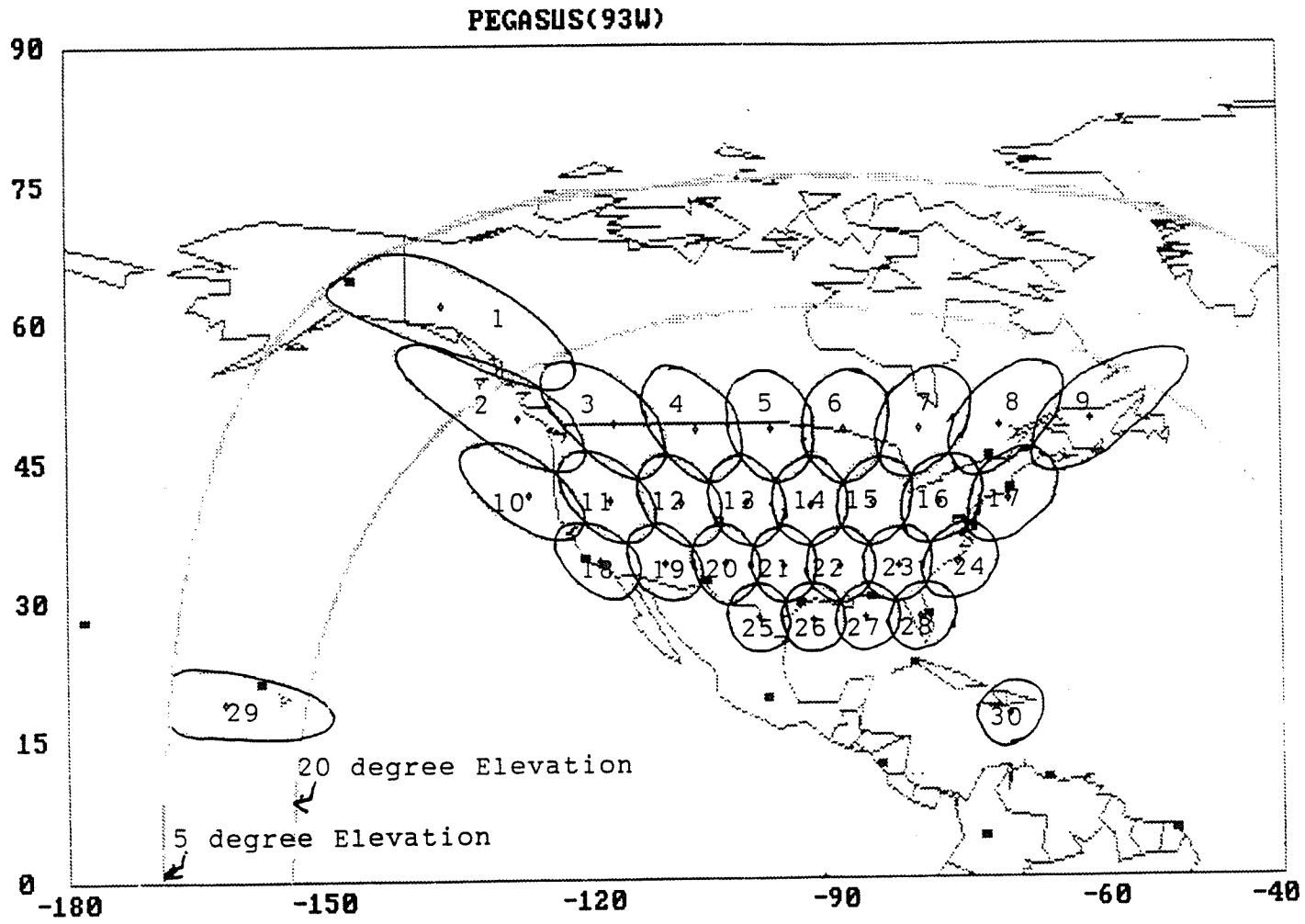


Figure 2-3a. Coverage of U.S. Including Offshore States and Territories for Satellite at 93° W.L.

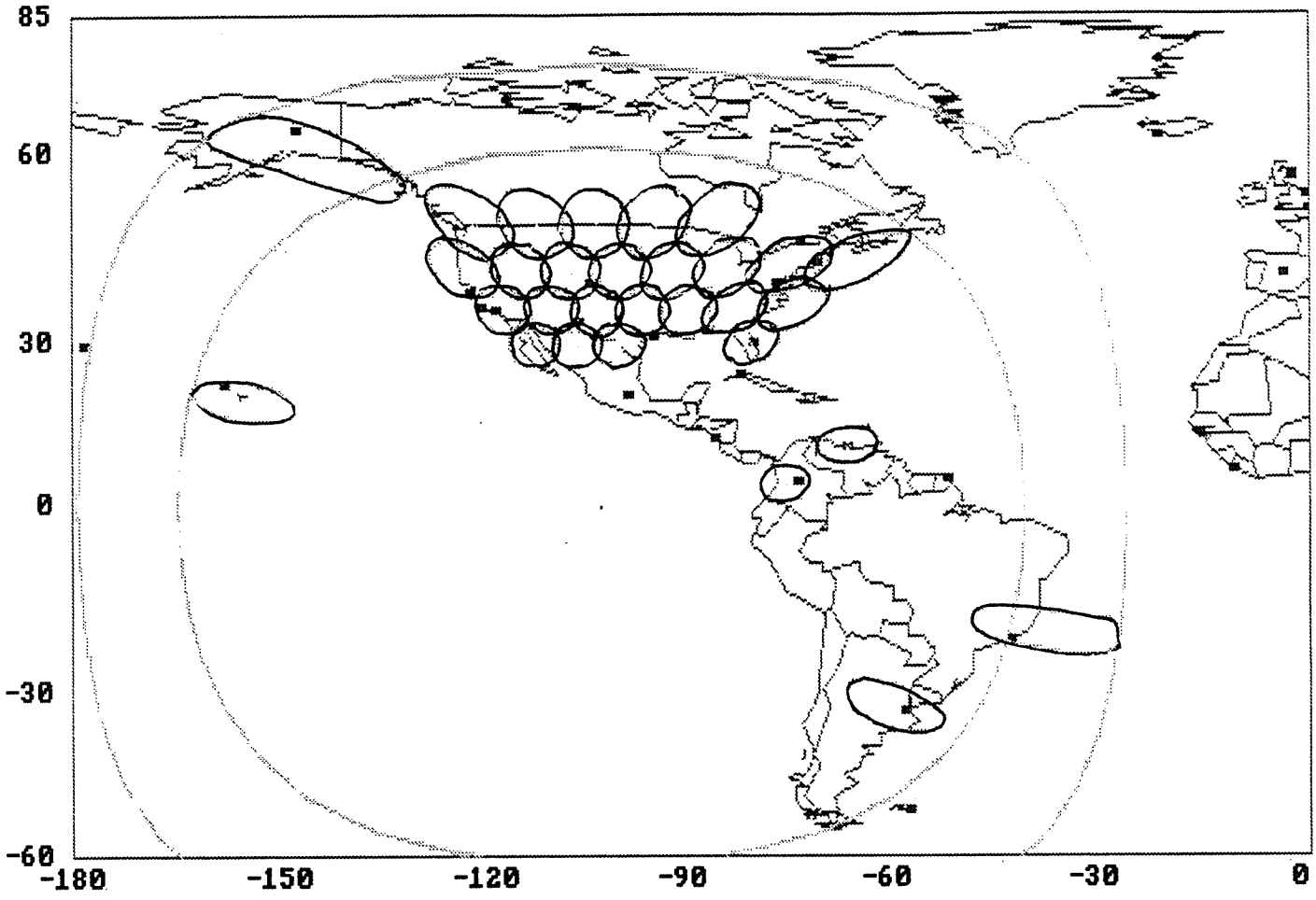


Figure 2-3b. Coverage of U.S. and South America for Satellite at 103° W.L.

degree contour of the satellite at 103° W.L.

Satellite coverage for South America, Europe-Africa, and Asia is proposed to be based on the same basic 30 beam configuration. Because these coverage areas are less regular and larger than CONUS, the beams for the initial system will cover only regions of significant demand. Because of this irregularity, however, higher frequency reuse will be obtainable. These coverage diagrams will be provided as required.

Figures 2-4a through 2-4d depict the -2, -4, -6, -10 and -20 dB antenna beam contours at 0, 3.8, 5.7 and 7.62 degrees roll or pitch scan angles. The antenna beam contours are identical for each of the proposed orbital locations.

TABLE 2-3a. Antenna Beam Pointing Directions For U.S. Coverage at 93° W.L..

Beam	IP deg.	OP deg.	Beam	IP deg.	OP deg.	Beam	IP deg.	OP deg.
1	-3.00	8.00	11	-3.03	6.33	21	-0.64	5.50
2	-3.50	7.16	12	-2.07	6.33	22	0.31	5.50
3	-2.55	7.17	13	-1.12	6.33	23	1.27	5.50
4	-1.59	7.16	14	-0.17	6.33	24	2.22	5.50
5	-0.64	7.16	15	0.79	6.33	25	-1.11	4.68
6	0.31	7.16	16	1.74	6.33	26	-0.16	4.68
7	1.27	7.16	17	2.69	6.33	27	0.80	4.68
8	2.22	7.16	18	-3.5	5.50	28	1.75	4.68
9	3.17	7.16	19	-2.55	5.50	29	-8.00	3.00
10	-3.98	6.33	20	-1.59	5.50	30	3.50	3.00

Note: IP means the angle in the plane of the orbit, and OP means the angle out-of-plane.

TABLE 2-3b. Antenna Beam Pointing Directions For U.S. and South American Coverage at 103° W.L.

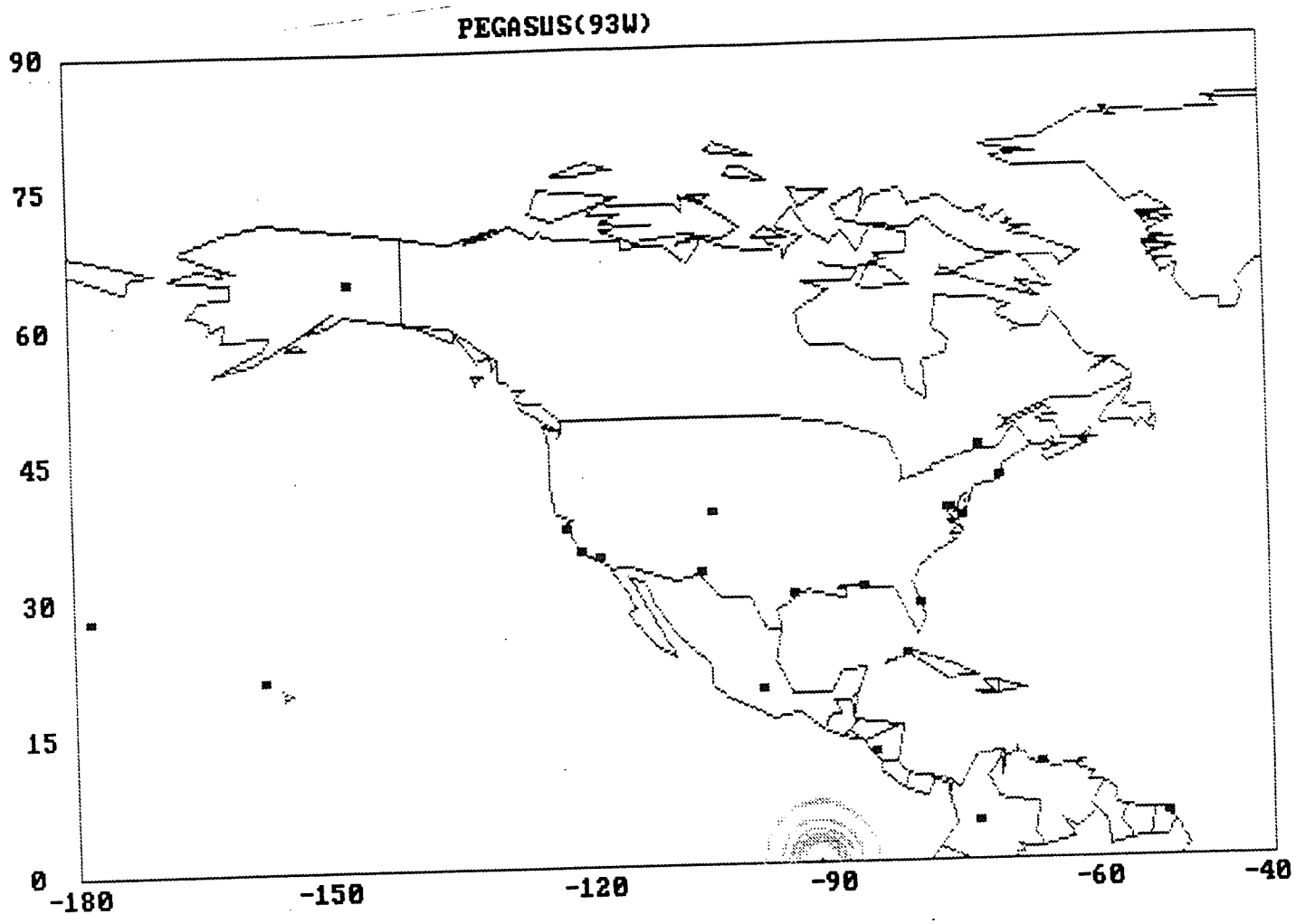
Beam	IP deg.	OP deg.	Beam	IP deg.	OP deg.	Beam	IP deg.	OP deg.
1	-3.00	8.00	11	1.33	6.33	21	3.72	5.50
2	-2.00	7.16	12	2.29	6.33	22	-1.52	4.68
3	-1.05	7.16	13	3.33	6.33	23	-0.57	4.68
4	-0.10	7.16	14	4.19	6.33	24	-0.38	4.68
5	0.86	7.16	15	-2.00	5.50	25	3.24	4.68
6	1.81	7.16	16	-1.05	5.50	26	-8.00	3.00
7	-2.48	6.33	17	-0.10	5.50	27	5.30	-5.3
8	-1.52	6.33	18	0.86	5.50	28	7.70	-3.3
9	-0.57	6.33	19	1.81	5.50	29	-4.50	0.70
10	0.38	6.33	20	2.76	5.50	30	5.70	1.80

Note: IP means the angle in the plane of the orbit, and OP means the angle out-of-plane.

TABLE 2-4 High and Low Band Segmentation and Beam Number, U.S. Coverage From Orbital Station 93° W.L. and 103° W.L.

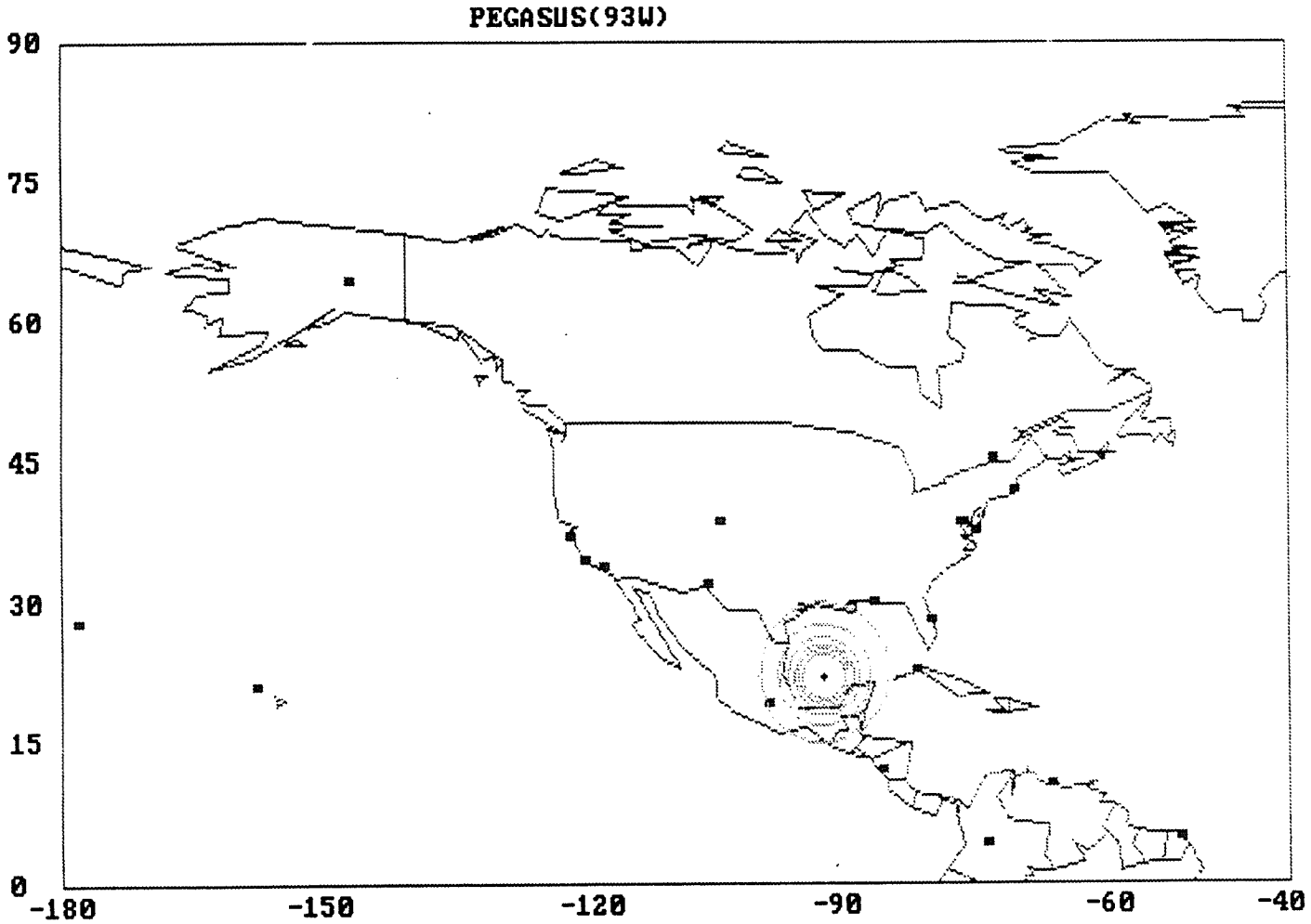
Transmit: VLP or HLP
Receive: HLP or VLP

Segment	Low Band	High Band
1	10, 12, 14, 16, 26, 28	4, 10, 17, 22
2	1, 11, 13, 15, 17, 25, 27, 29	5, 11, 23, 25
3	2, 4, 6, 8, 18, 20, 22, 24	6, 12, 24, 26, 29
4	3, 5, 7, 9, 19, 21, 23, 30	1, 7, 13, 18, 27, 30
5		8, 14, 19, 28
6		2, 9, 15, 20
7		3, 16, 21



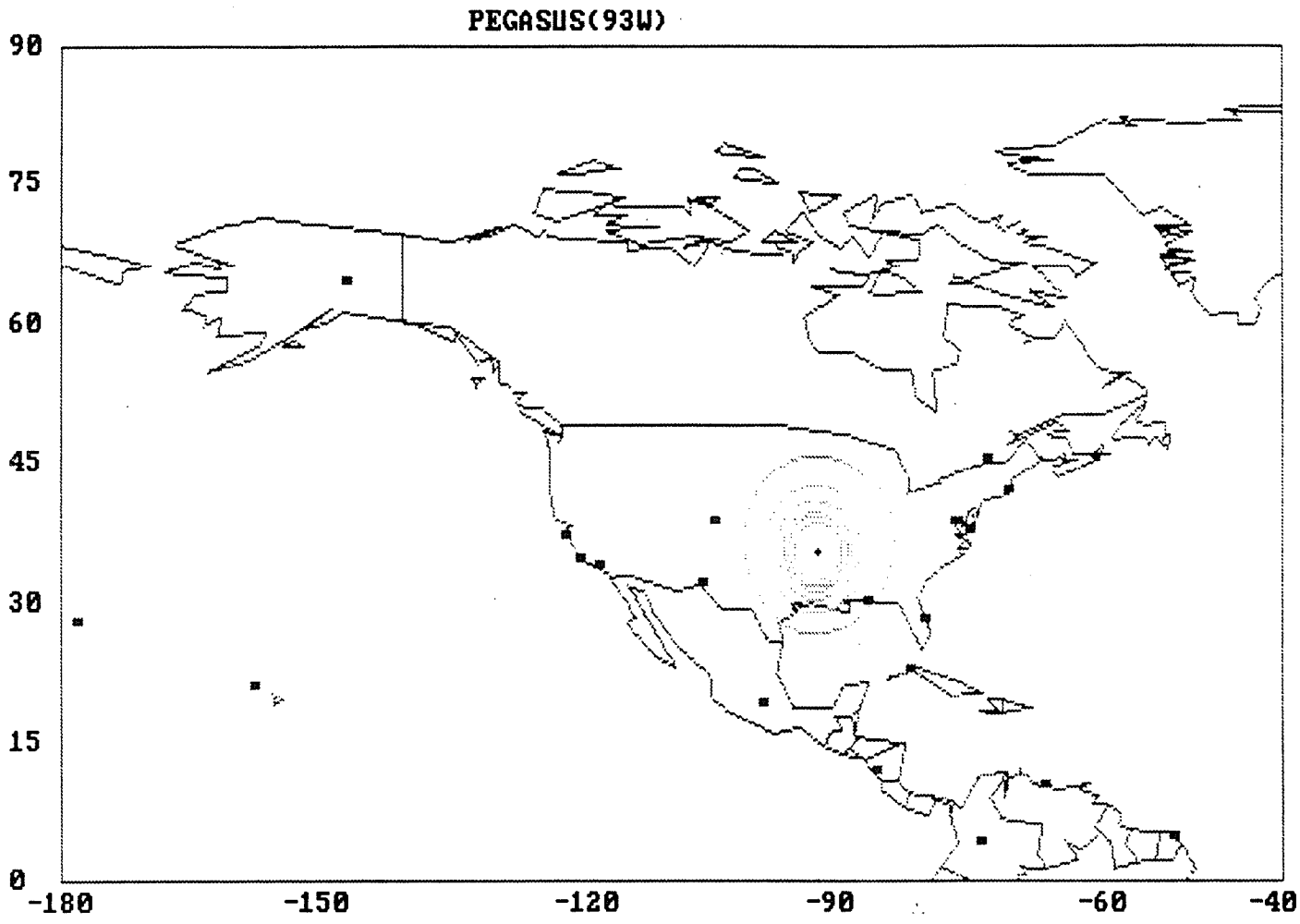
Contour Level dB	Beamwidth degrees
-2	0.78
-3	0.95
-4	1.10
-6	1.34
-10	1.73
-20	2.45

Figure 2-4a. Beam Contours, -2, -3, -4, -6, -10 and -20 dB, For Pitch Scan = 0, For Satellite at 93° W.L.



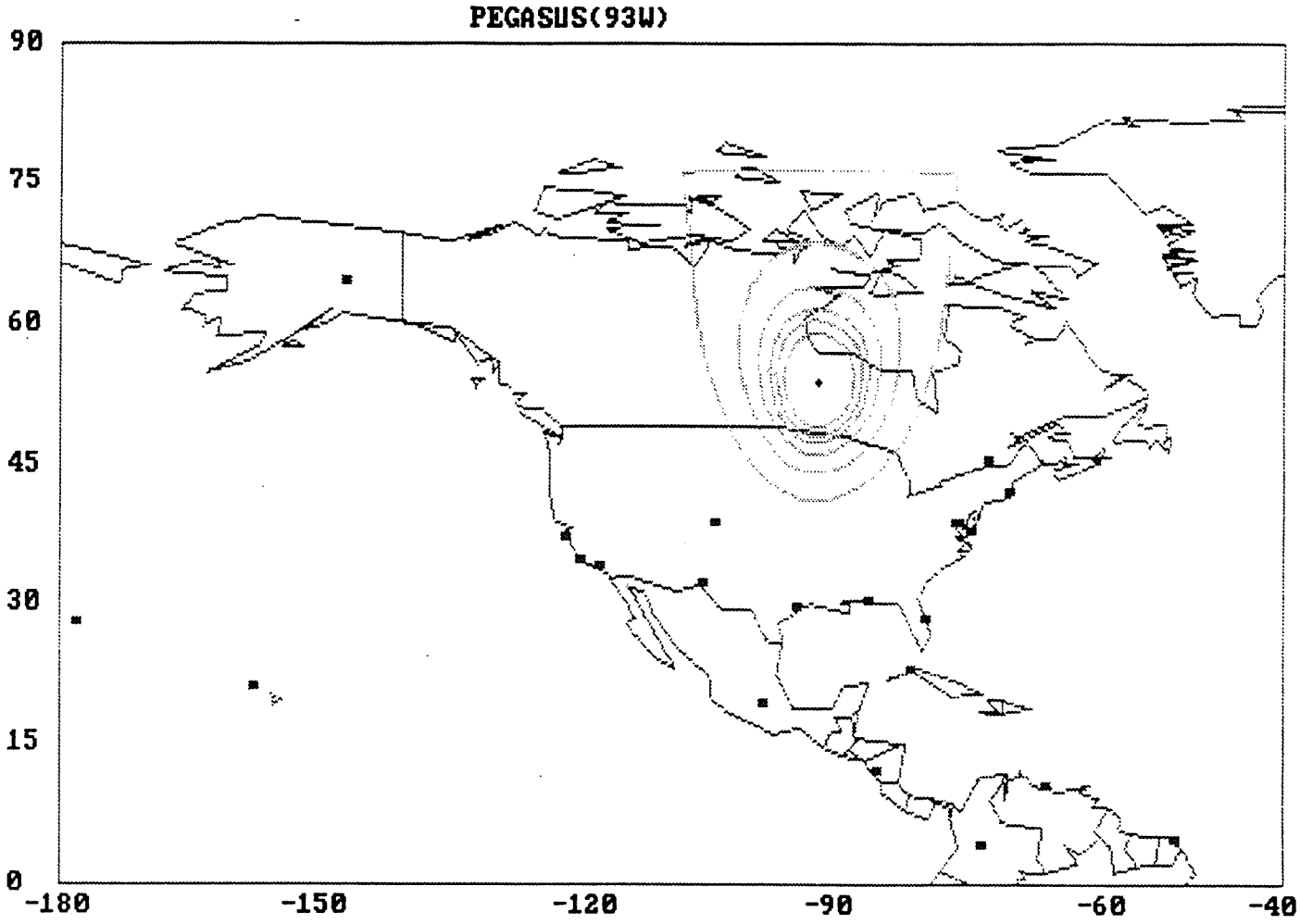
Contour Level dB	Beamwidth degrees
-2	0.78
-3	0.95
-4	1.10
-6	1.34
-10	1.73
-20	2.45

Figure 2-4b. Beam Contours, -2, -3, -4, -6, -10 and -20 dB, For Pitch Scan = 3.8, For Satellite at 93° W.L.



Contour Level dB	Beamwidth degrees
-2	0.78
-3	0.95
-4	1.10
-6	1.34
-10	1.73
-20	2.45

Figure 2-4c. Beam Contours, -2, -3, -4, -6, -10 and -20 dB, For Pitch Scan = 5.7, For Satellite at 93° W.L.



Contour Level dB	Beamwidth degrees
-2	0.78
-3	0.95
-4	1.10
-6	1.34
-10	1.73
-20	2.45

Figure 2-4d. Beam Contours, -2, -3, -4, -6, -10 and -20 dB, For Pitch Scan = 7.62, For Satellite at 93° W.L.

2.5.3. ACCESS METHOD AND ROUTING

The access method is TDM/FDM/TDMA. Uplink and downlink signals in the High Band occur on either 3.088 MBps or 61 MBps TDM/FDM carriers. Uplink and downlink signals in the Low Band occur on either 3.088 MBps or 53 MBps TDM/FDM carriers. To avoid burst collisions, access to Pegasus I is controlled by the gateway earth stations via signaling channels in each of the TDM/FDM carriers. Gateway earth stations are under the supervision of the NCC/SCC, owned and operated by Pegasus Development Corporation. Rate diversity is used wherein the maximum data rate during rain fades is 3.088 MBps. During moderate weather conditions the subscriber may request any data rate from 16 KBps up to the maximum burst rates of either 61 or 53 MBps. In addition there may be high performance earth stations operating at the higher data rates even during heavy rain.

Cessation of emission is controlled by the NCC/SCC via the TT&C system.

2.5.4. EXAMPLE TRANSMISSION PERFORMANCE.

A summary of transmission parameters is given in Table 2-5

TABLE 2-5. Transmission Parameters.

Earth Station Access	TDM/FDM
Overall Access Method	TDM/FDM/TDMA
Carrier Burst Rates, MBps (1)	
High Band	3.088 and 61
Low Band	3.088 and 53
Carrier Bandwidths, MHz	
High Band	2.85 and 56.3
Low Band	2.85 and 49.0
Modulation	QPSK
Coding	Convolutional Rate 3/4 Concatenated with Reed Solomon
Eb/No, dB	4.5 (ber = 10^-9)
Number of Antenna Beams	30, uplink or downlink
Number of Transponders	30
Transponder Gain, dB	120, nominal (4)
SFD, dBW per square meter	N/A (3)
Gain Steps, dB	1 over 20 dB range
Filters, input & output	4 pole Tschebyscheff or equivalent
Filters, channel	6 pole Tschebyscheff or equivalent
Power Control (2)	ATPC
Satellite Local Oscillator Stability, %	0.002
Earth Station Local Oscillator Stability, %	0.001
Crosspol Isolation, clear sky, dB	30
Satellite Antenna Peak Gain, dBi	50.2

(1) A minimum burst rate of 1.544 MBps also is under consideration; this selection does not alter the radiation characteristics described herein.
(2) Uplink power control is provided by each earth station. Downlink power control is provided by satellite downlink TDM/FDM channel units.
(3) A satellite, typically, is not operated at saturation; uplink PFD varies burst by burst because of uplink rain attenuation, changes in antenna gain over the field-of-view, slant range, etc.
(4) Transponder gain varies burst by burst because of downlink rain attenuation, changes in antenna gain over the field-of-view, slant range, etc.

In addition, each satellite transmitter output filter shall attenuate all signals by the following;

1) -25 dB in any 4 KHz band, between 50 and 100 percent of authorized bandwidth,

2) -35 dB in any 4 KHz band between 100 and 250 percent of authorized bandwidth,

3) -43 + 10 Log P, in dB, in any 4 KHz band greater than 250 percent of authorized bandwidth, where P is the transmitter power in watts.

2.5.4.1. Ka BAND TRANSMISSION PERFORMANCE

The Pegasus I global system performance is described under representative conditions, for various Crane Model climate regions and for typical earth station elevation angles corresponding to those regions. Within the U.S, Crane Model D2, "continental moderate" is the worst rain rate for the CONUS midwest and mid-Atlantic regions except for the area to the southeast, which is typified by Crane Model E, "sub-tropical wet." Some portions of Hawaii and Puerto Rico have Crane Model H, "tropical wet" climates. Areas to the west and north of D2 within CONUS have more moderate rain climates.

Pegasus I subscribers have many choices in earth station equipment so that they may optimize their performance and cost. Performance is described at several burst rates. 1.544 Mbps or 3.088 MBps correspond to the maximum transmitted burst rate under "rain" conditions, defined at 99.5 percent availability during rain. Subscribers may select a higher performance earth station in order to achieve, say, 99.9 percent availability due to rain. The 3.088 MBps burst rate, in a TDM/FDM format, enables a subscriber to operate with any data rate from 16 KBps up to the maximum of 3.088 MBps.

A subscriber also may require higher data rates, up to 61 MBps in the High Band and up to 53 MBps in the Low Band, requiring a higher performance earth station. Subscribers may choose these higher data rates with availabilities of 99.5 percent if the earth station performance is adequate, or may choose to obtain these data rates only at the 98 percentile with regard to rain, shifting, via rate diversity, to 3.088 MBps during heavy rain. Thus high data rates are supportable under clear sky or near-clear-sky conditions with moderate earth station performance.

The transmission performance is calculated with approximately equal contributions of uplink and downlink thermal noise and with the use of automatic transmitter power control, ATPC, in both the uplink and downlink, on a burst-by-burst basis. A 1 dB "threshold" is used in the downlink before ATPC is activated. The objective Eb/No = 4.5 dB, corresponds to a BER = 10^-9.

Table 2-6 describes important performance characteristics for the High Band for a subscriber operating at 3.088 MBps or, optionally, at 61 MBps. The HPA power, 11 dBW or 12.6 watts, for 3.088 MBps is modest for a 0.5 meter earth station antenna. However, if the subscriber transmits at 61 MBps, the HPA power increases to 17.8 dBW or 60.3 watts, still within the bounds of a low cost, mass-produced HPA. Alternatively the subscriber may opt for a larger earth station antenna; a one meter antenna reduces the HPA power for 61 MBps to 15 watts.

Table 2-7 describes similar, important performance characteristics for the Low Band. The data rate is less because the bandwidth of the Low Band is less, and the satellite antenna contributes more co-channel inter-beam interference.

More detailed transmission characteristics, such as assumptions regarding C/I and performance for different rain regions, are given in Appendix A.

TABLE 2-6. Example High Band Transmission Performance (for 0.5 meter CPE Earth Station With 0.5 dB Pointing Loss For Crane Model D2 At An Elevation Angle of 40 degrees).

EARTH-TO-SPACE Condition	Rain	Clear-Sky	98 %	Clear-Sky
ES Transmit Power, dBW	11	1.2	17.8	14.2
Output Loss, dB	-1	-1	-1	-1
ES Antenna Gain, dBi	41.8	41.8	41.8	41.8
Eirp, dBW	51.3	41.5	58.1	54.5
Frequency, GHz	29.2	29.2	29.2	29.2
Space Loss, dB	-213.3	-213.3	-213.3	-213.3
Rain & Atmos. Loss, dB	-10.8	-1	-4.6	-1
Total Loss, dB	-224.1	-214.3	-217.9	-214.3
G/T, EOC, dBi/K	17.6	17.6	17.6	17.6
Sat. Noise Temp., dB	28.6	28.6	28.6	28.6
Sat. Peak Antenna Gain, dBi	50.2	50.2	50.2	50.2
Data Rate, MBps	3.088	3.088	61	61
Bandwidth, MHz	2.85	2.85	56.3	56.3
Uplink C/I	17.2	17.2	17.2	17.2
Uplink CNR	8.3	8.3	8.3	8.3
SPACE-TO-EARTH Condition	Rain	Clear-Sky	99.5 %	Clear-Sky
Transmit Power, dBW	1.34	-6.0	14.3	7.0
Output Loss, dB	-1	-1	-1	-1
Antenna Gain, EOC, dBi	46.2	46.2	46.2	46.2
Eirp, EOC, dBW	50.04	43.2	59.5	52.2
Frequency, GHz	19.3	19.3	19.3	19.3
Space Loss, dB	-209.7	-209.7	-209.7	-209.7
Rain & Atmos. Loss, dB	-4.6	-0.5	-4.6	-0.5
Fixed Loss, dB	-1	-1	-1	-1
Total Loss, dB	-215.3	-211.2	-215.3	-211.2
G/T, dBi/K	12.9	16.1	12.9	16.1
ES Antenna Gain, dBi	38.2	38.2	38.2	38.2
ES Noise Temp., dB	24.8	21.6	24.8	21.6
Downlink CNR, dB	8.2	8.2	8.2	8.2
C/I, dB	15.4	15.4	15.4	15.4
Total CNR, dB	4.9	4.9	4.9	4.9
Eb/No, dB	4.5	4.5	4.5	4.5

TABLE 2-7. Example Low Band Transmission Performance (for 0.5 meter CPE Earth Station Operating With 0.5 dB Pointing Loss For Crane Model D2 At An Elevation Angle of 40 degrees).

EARTH-TO-SPACE Condition	Rain	Clear-Sky	98 %	Clear-Sky
ES Transmit Power, dBW	11	1.2	17.4	13.8
Output Loss, dB	-1	-1	-1	-1
ES Antenna Gain, dBi	41.8	41.8	41.8	41.8
Eirp, dBW	51.3	41.5	57.7	54.06
Frequency, GHz	29.2	29.2	29.2	29.2
Space Loss, dB	-213.3	-213.3	-213.3	-213.3
Rain & Atmos. Loss, dB	-10.8	-1	-4.6	-1
Total Loss, dB	-224.1	-214.3	-217.9	-214.3
G/T, EOC, dBi/K	17.6	17.6	17.6	17.6
Sat. Noise Temp., dB	28.6	28.6	28.6	28.6
Sat. Peak Antenna Gain, dBi	50.2	50.2	50.2	50.2
Data Rate, MBps	3.088	3.088	53	53
Bandwidth, MHz	2.85	2.85	49.0	49.0
Uplink C/I	17.2	17.2	16.3	16.3
Uplink CNR	8.3	8.3	8.3	8.3
SPACE-TO-EARTH Condition	Rain	Clear-Sky	99.5 %	Clear-Sky
Transmit Power, dBW	1.34	-6.0	13.9	6.5
Output Loss, dB	-1	-1	-1	-1
Antenna Gain, EOC, dBi	46.2	46.2	46.2	46.2
Eirp, EOC, dBW	50.04	43.2	59.07	51.7
Frequency, GHz	19.3	19.3	19.3	19.3
Space Loss, dB	-209.7	-209.7	-209.7	-209.7
Rain & Atmos. Loss, dB	-4.6	-0.5	-4.6	-0.5
Fixed Loss, dB	-1	-1	-1	-1
Total Loss, dB	-215.3	-211.2	-215.3	-211.2
G/T, dBi/K	12.9	16.1	12.9	16.1
ES Antenna Gain, dBi	38.2	38.2	38.2	38.2
ES Noise Temp., dB	24.8	21.6	24.8	21.6
Downlink CNR, dB	8.2	8.2	8.4	8.4
C/I, dB	15.4	15.4	14.7	14.7
Total CNR, dB	4.9	4.9	4.9	4.9
Eb/No, dB	4.5	4.5	4.5	4.5

2.5.4.2. ISL PERFORMANCE.

Each east or west ISL, operated in the 50 to 70 GHz millimeter wave band in a 61 and 3.088 MBps TDM/FDM format, connected to the satellite IF switch matrix. Without on-board processing, the ISL CNR must be large in order to avoid unnecessarily degrading the Ka-Band downlink or uplink CNR. A CNR = 20 dB has been assumed. Without specific information concerning final orbital locations, it has been assumed that the ISL is between two GEO satellites spaced as much as120 degrees apart. ISL performance is given in Figure 2-5, requiring a 28 watt TWTA and a 2 meter antenna.

2.5.4.3 TT&C PERFORMANCE

Since the satellite manufacturer has not yet been chosen, general performance and radiation characteristics have been assumed for these links. Launch operations are planned to be supported by Ku Band TT&C, based on a 5 meter TT&C earth station antenna and omnidirectional satellite TT&C antennas. On orbit operations will be transferred to Ka Band and based on a 5 meter TT&C earth station antenna, an omnidirectional satellite command antenna and a satellite telemetry horn antenna. TT&C performance is given in Figure 2-6, requiring a modest 2 watt satellite transmitter at Ku and Ka Band.

2.5.4.4. GENERAL RADIATION PARAMETERS

As described in Appendix A, general radiation parameters are based on the "worst case" performance, which is for a 0.5 meter CPE earth station antenna. Worst-case rain conditions occur in the southeast at an elevation angle of approximately 50 degrees, and worst-case clear-sky conditions occur at approximately 20 degrees. Both conditions pertain to the worst-case data rate, which is either 1.544 or 3.088 MBps.

ISL Link	Plane
Slant Range, Km. (1)	73000
Satellite to Satellite	
Transmitter Power, dBW	14.5
Output Loss, dB	-2
Pwr Density dBW/Hz	-65
Antenna Gain (2.0m) dBi	60.3
Eirp, peak, dBW	72.8
Pointing Loss, dB	-0.5
Eirp, dBW	72.3
Eirp Density, dBW/Hz	-4.7
Frequency, GHz	61.5
Space Loss, dB	-225.491
Misc.Loss, dB	-0.5
Total Loss, dB	-225.991
G/T, dBi/K	23.39
Sat. Temp., dB	24.9
Antenna Gain, peak, dBi	48.29
C/T, dB/K	-130.301
Data Rate, 61 MBps, dB	77.9
Bandwith, 56.3 MHz, dB	77.5
CNR, dB	20.79827
Interference C/I, dB	30
Overall CNR, dB	20.30539
Eb/No, dB	19.95539

(1) Lacking specific information on orbital locations it has been assumed that the ISL traverses the distance between satellites spaced 120 degrees.

Figure 2-5. ISL Link Performance.

	Launch Ku Band		On-Orbit Ka Band	
Slant Range, 5 deg., Km.	41127	41127	41127	41127
	Command	Telemetry	Command	Telemetry
Transmitter Power, dBW	30	3	30	3
Output Loss, dB	-2	-2	-3	-2
Pwr Density dBW/Hz	-35	-62	-36	-62
Antenna Gain, dBi (1)	55.4	22	61.8	18
Eirp, peak, dBW	83.4	23	88.8	19
Pointing Loss, dB	-0.5	-3	-0.5	0
Eirp, dBW	82.9	20	88.3	19
Eirp Density, dBW/Hz	20.4	-40	25.8	-44
Frequency, GHz	14	11.7	29.2	19.3
Space Loss, 5 deg., dB	-207.652	-206.094	-214.037	-210.441
Misc.Loss, dB	-0.5	-0.5	-1	-1
Total Loss, dB	-208.152	-206.594	-215.037	-211.441
G/T, dBi/K	-25.9	34.1	-26.8	37.7
Temp., dB	25.9	19.8	26.8	20.5
Antenna Gain, peak, dBi	0	53.9	0	58.2
C/T, dB/K	-151.152	-152.494	-153.537	-154.741
Bandwidth, dB (2)	63	63	63	63
CNR, dB	14.44713	13.10597	12.06203	10.85854
Required CNR, dB	8	8	8	8

Notes.
1) 5 meter TT&C antenna, omni satellite telemetry antenna at 11.7 GHz and horn telemetry antenna at Ka Band.
2) Command and telemetry bandwidth = 2 MHz

Figure 2-6. TT&C Link Performance, On-Orbit and Launch.

The Pegasus I system is operated with ATPC for both the uplink and downlink. Therefore, all communications signals are just strong enough to meet the objective Eb/No, with a small margin.

The PFDs are well within the levels specified by RR-28.

Pegasus also is considering on-board processing with an ATM-like switch, and may implement this technology instead of the IF switch/transponder satellite described herein if the satellite manufacturer selected to build Pegasus I has the requisite technology. In this case, the radiation levels will be somewhat less than for the IF switch/transponder type satellite described herein.

The maximum radiation levels are listed in Table 2-8. Additional parameters are given in Appendix A.

TABLE 2-8. General Radiation Parameters.

Condition (1)	Ka Band E	Ka Band Clear-Sky	ISL N/A	TT&C Clear -Sky	
Elevation Angle, degrees	50	20	N/A	5	5
Frequency, GHz	29.2	29.2	61.5	14.0	29.2
Transmit Power Into Antenna, dBW	11.7	0.6	12.5	28.2	27.0
Peak Eirp Density, dBW/Hz	-11.0	-22.1	-4.7	20.4	25.8
Frequency, GHz	19.3	19.3		11.7	19.3
Transmit Power Into Antenna, dBW	1.3	-6.6		1.0	1.0
Peak Eirp Density, dBW/Hz	-13.0	-20.9		-40.0	-44.0
PFD, per MHz	-115	-123.8			
RR 28, PFD per MHz	-105	-107.5			

(1) The parameters for beams on Puerto Rico and Hawaii, due to tropical rain may be 3.1 dB higher than given above; see Appendix A.

2.5.5. EMISSION DESIGNATORS.

The emission designators for the Pegasus I system are given in Table 2-9.

TABLE 2-9. Emission Designators.

Bandwidth MHz	Emission Designator
1.43	1M43G1W
2.85	2M85G1W
49.0	49M0G1W
56.3	56M3G1W
0 (beacon)	H000N0N
2 (telemetry)	2M00XXD
2 (command)	2M00XXD

2.5.6. SATELLITE AND CONSTELLATION CAPACITY

2.5.6.1 Ka BAND SATELLITE CAPACITY

The satellite capacity with all beams equally filled at the busy hour is 3.6 GBps.

This capacity will be augmented by a second satellite at the same orbital station operating

on the orthogonal polarization.

2.5.6.2. ISL CAPACITY

Each of the two ISLs per satellite operates at data rates of 61 and 3.088 MBps in a TDM/FDM format.

2.5.6.3. CONSTELLATION CAPACITY

For the five orbital stations, the constellation capacity, with all beams filled at the busy hour, is 36.0 GBps per polarization, one way.

2.5.7. LINK AVAILABILITY

The Pegasus I performance objective is to meet an availability due to rain of 99.5 percent. Earth station antennas larger than 0.5 meters will be required in the southeast U.S. and portions of Hawaii and Puerto Rico in order to meet this objective. An availability due to rain approaching 99.9 percent is available via proper selection of earth station antennas and HPA powers.

The same link availability analysis applies to service outside the United States.

2.5.8. ECLIPSE AND SUN TRANSIT EFFECTS

The Pegasus I satellites are designed to operate fully during solar eclipse. Earth stations experiencing sun transit within their antenna beams will experience a short outage.

2.6. INTERFERENCE AND BAND SHARING

The bands 19.7-20.2/29.5-30.0 GHz and the uplink band 28.35-28.6 GHz are allocated to the GSO FSS on an exclusive primary basis in the United States. However, issues of spectrum access may arise during the coordination process for these bands. Pegasus will support these coordination negotiations in order to help promote a mutually satisfactory outcome.

2.6.1. GSO-GSO Ka-BAND SHARING

The Commission has established the basic principles for GSO-GSO system sharing through its proceedings on the use of C Band and Ku Band, and with its recent order establishing service rules for FSS systems in the Ka Band, including a system of 2 degree spacing for satellite systems in that band. *See* Third Report and Order, CC Docket No. 92-297 (October 15, 1997) ("Ka-Band Order"). Unfortunately, these sharing criteria have not been adopted internationally, resulting in controversy over orbital positions and satellite coordination issues.

Coordination between GSO systems depends primarily on the sidelobe characteristics of the earth station antenna and on the relative radiation characteristics of the two systems being coordinated. Ka-Band systems have two unique characteristics. One is the use of physically small (but electrically large) earth station antennas, approximately 0.5 meters. The other is the use of all-digital signals which are detectable at lower signal-to-noise ratios than comparable analog signals, thus improving their resistance to interference. The single entry adjacent satellite interference, for space systems with overlapping coverage, is simply written as:

$$C/I = A + G-(29-25\ \mathrm{Log}\varphi)$$

where G is the earth station antenna gain, φ is the topocentric angle between the two space systems, and A is a measure of their relative received PFDs.

If the systems are identical, then A = 0. The factor A depends on the earth station G/T, the modulation parameters (QPSK, 8PSK etc.), the coding, the sensitivity of the demodulator, and the BER objectives. Consequently, absolute values of A can differ by several decibels. Since the Ka-Band Order permits either circular or linear polarization for GSO FSS systems, polarization isolation -- circular to linear -- might also provide additional (small) isolation.

At 19.3 GHz, a 0.5 meter antenna has a gain of 38.2 dBi, and a 0.7 meter antenna has a gain of 41.1 dBi. With a geocentric satellite spacing of 2 degrees, for satellites at 93° W.L. and 91° W.L. and earth stations within CONUS, the following holds:

C/I (0.5m) = 17.8 dB (one interference entry), and

C/I (0.7m) = 20.7 dB (one interference entry).

The main lobe of the smaller 0.5 meter antenna also may be a problem, depending on its design. Consequently, a 0.5 meter antenna is the smallest that ought to be considered for 2 degree satellite spacing. Depending on the specifics of the earth station antenna design, the minimum acceptable antenna ought to be in the range of 0.5 to 0.7 meters.

Pegasus proposes a minimum earth station antenna diameter of 0.5 meters, which also defines the maximum radiation properties of its system, and recognizes that coordination with other Ka-Band space systems serving the U.S. may preclude the use of the smaller antenna. Similarly, coordination with other Ka-Band space systems serving foreign territories, including systems with different satellite spacing and different

radiation characteristics, also may preclude the use of the smaller antennas. As stated above, Pegasus will support these coordination negotiations in order to help promote a mutually satisfactory outcome.

2.6.2. GSO-GSO ISL BAND SHARING

Pegasus generally is aware of the need for ISLs for FSS and MSS GSO and NGSO systems, and that the millimeter wave bands also are used by government space systems. Nevertheless, Pegasus prefers ISLs in the millimeter band from 50 to 70 GHz, because they are commercially proven. Optical ISLs are not commercially proven. The Ka-band Order confirms that the Commission has not yet resolved all of the issues relating to millimeter wave band (and other band) sharing. Pegasus will support any coordination negotiations in order to help promote a mutually satisfactory outcome.

2.6.3 SHARING WITH FS

The downlink band 18.35-18.6 GHz is shared on a co-primary basis with the Fixed Services ("FS"). There will be potential earth station locations in the path of an FS link that cannot be coordinated, despite the use of building and other shielding. In these cases, the subscriber earth station will be operated only in the 19.7-20.2/29.5-30.0 GHz band. Pegasus will participate in coordination arrangements to protect existing operational FS and FSS facilities.

2.7. TECHNICAL QUALIFICATIONS

2.7.1. BANDWIDTH UTILIZATION

With 30 beams, the Low Band develops 30 x 62 MHz = 1860 MHz from a 250 MHz allocation or 7.4 times frequency reuse. With 30 beams, the High Band develops 30 x 70.7 MHz = 2121 MHz from a 500 MHz allocation or 4.2 times frequency reuse.

Because of the geographical breadth of the area, bandwidth utilization in South America and Asia will be even more efficient, with the satellite beams even more widely separated. The Pegasus I design develops its spectrum efficiency via multiple spot beams. The use of orthogonal polarization is planned to permit increased capacity at each orbital location.

2.7.2. POLARIZATION

Pegasus I is expected to operate with horizontal/vertical linear polarization, with transmit and receive signals orthogonally polarized. Pegasus plans to increase orbital efficiency by operating an orthogonally polarized satellite at each orbital location.

2.7.3. ORBITAL EFFICIENCY

Pegasus I, through the use of automatic transmitter power control ("ATPC") for both earth stations and satellites, minimizes potential harmful interference to space systems at adjacent orbital slots. Pegasus proposes to operate with 2 degree geocentric spacing from satellites having similar but not identical radiation characteristics. Rare interference events, caused by lack of rain-path shielding, can be compensated by ATPC.

3.0. MARKETS AND SERVICES

Pegasus I can provide data rates from 16 KBps up to approximately 60 MBps to any subscriber terminal and route such communications to any other earth station anywhere in the coverage area of the Pegasus I satellite constellation. Communications signals may be one-way or two-way or broadcast, all with bandwidth on-demand.

With full audio, video, and graphics capabilities, Pegasus I will provide users with a diverse array of multimedia services. Residential, business, and government subscribers will be able to benefit from a variety of applications. Residential service will

provide entertainment, information, news, financial data, and Internet capability. The system will also facilitate distance learning, remote medical services, and telecommuting. Pegasus I will provide benefits to law enforcement, public safety and disaster management, and defense preparedness.

4.0. SYSTEM COST AND FINANCING

4.1. IMPLEMENTATION SCHEDULE

The time of licensing is unclear, due to uncertainties relating to the coordination of orbital stations. Consequently, all schedules are tied to the time of licensing. A three-year construction period is anticipated because the satellite technology is well within the envelope of satellites now under construction.

TABLE 4-1. IMPLEMENTATION SCHEDULE The following implementation schedule is within the requirements specified in the Ka-Band Order.

Event	Months
Development	-12 to 0
Time of Licensing	0
Spacecraft Contract	+12
Launch Vehicle Contract	+18
NCC/SCC Installed	+38
First TT&C Installed	+38
First Launch	+42
Second Launch	+46
Third Launch	+50
Fourth Launch	+54
Fifth Launch	+57
Sixth Launch	+60
Seventh Launch	+63
Eighth Launch	+76
Ninth Launch	+69
Tenth Launch	+72

4.2. SCHEDULE OF COSTS

A schedule of costs is given in Table 4-2 for the space segment and its associated ground segment. The cost of Pegasus I through the first year of operation is $1,953 M.

TABLE 4-2 Schedule of System Costs.

(Per satellite)	
Satellite Cost, $M	80
Launcher Cost, $M	70
Insurance, $M	27
Launching Cost, $M	3
Launched Cost, $M	180
Launched Cost for Constellation	1,800
NCC/SCC, U.S., $M	50
TT&C, U.S., $M	1
Earth Station Development	
Gateway ES, $M	10
Subscriber ES, $M	12
Pre-operational Expenses, $M	30
Operational Expenses, 1 Yr., $M	50
Total Cost, Through First Year of Operations, $M	1,953

4.3. SYSTEM FINANCING

Pegasus believes that it is financially qualified to construct and operate the proposed domestic fixed satellite system. Should the Commission conclude, however, that Pegasus does not satisfy the financial requirements of 25.140(b)-(e), Pegasus asks the Commission to grant Pegasus a waiver of this requirement pursuant to Section 1.3 of the Commission's rules. A waiver would be consistent with both Commission precedent and the public interest goal of encouraging new entrants into the satellite communications industry.

5.0. LEGAL INFORMATION

5.1 NAME AND ADDRESS OF APPLICANT AND LEGAL COUNSEL

Attached at Appendix B on Form 312 is information describing the legal qualifications of Pegasus. In addition, the following information is provided.

(1) Name, address, and telephone number of the applicant:

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5.2 REGULATORY CLASSIFICATION

In response to Section 25.114(c)(14) of the Commission's rules, Pegasus proposes

to operate the space stations described in this application on a noncommon carrier basis through privately negotiated contractual arrangments reflecting individual customer's requirements.

Respectfully submitted,

PEGASUS DEVELOPMENT CORPORATION

By: _____

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Dated: December 22, 1997

APPENDIX A

TRANSMISSION CHARACTERISTICS.

A-1. TRANSMISSION ASSUMPTIONS. Estimations of basic transmission assumptions are given in Tables A-1 and A-2 for the High Band and Low Band respectively.

TABLE A-1. Transmission Assumptions, High Band.

Elevation, degrees	20	30	40	50	60
Crane Model Region	A	B	D2	E	H
Interference, dB	20	20	20	20	20
Antenna C/I, dB	21	21	21	21	21
ISL CNR, dB	20	20	20	20	20
Xpol, dB	30	30	30	30	28
Total Downlink C/I, dB	15.4	15.4	15.4	15.4	15.4
Total Uplink C/I, dB	17.2	17.2	17.2	17.2	17.1

Table A-2. Transmission Assumptions, Low Band.

Elevation, degrees	20	30	40	50	60
Crane Model Region	A	B	D2	E	H
Interference, dB	20	20	20	20	20
Antenna C/I, dB	19	19	19	19	19
ISL CNR, dB	20	20	20	20	20
Xpol, dB	30	30	30	30	28
Total Downlink C/I, dB	14.7	14.7	14.7	14.7	14.7
Total Uplink C/I, dB	16.3	16.3	16.3	16.3	16.2

Satellite burst rates down to 1.544 MBps during rain, are under consideration which involve tradeoffs relating to the satellite technology such as IF switching versus on-board processing and switching. The radiation characteristics stated herein are not changed by varying the burst rate over the range of 1.544 to 3.088 MBps , for the same rain and other propagation conditions and for the same earth station.

A2. Ka BAND TRANSMISSION. Figures A-1a, b and c depict transmission performance with 0.5 meter earth station antennas at 3.088 MBps for rain, clear sky and 98 percentile conditions for typical Crane Model climate regions and typical earth station antenna elevation angles. Uplink and downlink thermal noise contributions are approximately balanced. An earth station HPA power of 11 dBW or 12.6 watts is required to sustain this link under rain conditions corresponding to Crane Model D2 at an elevation angle of 40 degrees, typical of central CONUS. Subscribers operating in Crane Region H may elect to substitute a larger antenna in order to reduce the required HPA power. Subscribers requiring better availability than 99.5 percent during rain also may

elect to use higher powered HPAs, larger antennas or a combination. The PFDs meet the requirements of RR-28.

Figures A-2a, b and c depict transmission performance with a 0.7 meter earth station antenna.

Both Figures A-1 and A-2 apply to both the High Band and Low Band, with small error, the only difference arising from the lower antenna C/I in the Low Band.

Figures A-3a, b and c depict performance at the data rate of 61 MBps in the High Band with a 0.7 meter earth station antenna. Earth station HPA powers of the order of 100 watts are required to sustain this data rate under the stated rain conditions. Somewhat less power is required to support this link at the 98 percentile. The HPA power also is reduced if a larger antenna is employed.

Figures A-4a, b and c depict performance with a 0.5 meter antenna, increasing the HPA and satellite power correspondingly.

Figures A-5a, b and c depict performance in the Low Band at 53 MBps with a 0.5 meter earth station antenna and Figures A-6a, b and c depict similar performance with a 0.7 meter earth station antenna.

Figures A-7a, b and c depict performance at 1.54 MBps with a 0.5 meter earth station antenna, the performance defined to be the "worst" case with regard to radiation characteristics.

Subscribers have many equipment choices depending on their climate location, elevation angle and availability and data rate requirements.

Elevation, degrees	20	30	40	50	60
Slant Range, Km.	39555	38612	37780	37078	36520
Scan Half Angle, degrees	8.17	7.53	6.65	5.58	4.34
Crane Model Region (0.995)	A	B	D2	E	H
Earth To Space, ES-to-Satellite					
Transmitter Power, dBW	9.6	8.49	11	12.74	15.83
Output Loss, dB	-1	-1	-1	-1	-1
Pwr Density dBW/Hz	-55.9	-57.01	-54.5	-52.76	-49.67
Antenna Gain (0.5m) dBi	41.8	41.8	41.8	41.8	41.8
Eirp, peak, dBW	50.4	49.29	51.8	53.54	56.63
Pointing Loss, dB	-0.5	-0.5	-0.5	-0.5	-0.5
Eirp, dBW	49.9	48.79	51.3	53.04	56.13
Eirp Density, dBW/Hz	-14.1	-15.21	-12.7	-10.96	-7.87
Frequency, GHz	29.2	29.2	29.2	29.2	29.2
Space Loss, dB	-213.699	-213.489	-213.300	-213.137	-213.006
Loss, dB	-9	-8.1	-10.8	-12.7	-15.9
Total Loss, dB	-222.699	-221.589	-224.100	-225.837	-228.906
G/T, EOC, dBi/K	17.6	17.6	17.6	17.6	17.6
Sat. Temp., dB	28.6	28.6	28.6	28.6	28.6
Antenna Gain, peak, dBi	50.2	50.2	50.2	50.2	50.2
C/T, dB/K	-155.199	-155.199	-155.200	-155.197	-155.176
Data Rate (3.088MBps) dB	64.9	64.9	64.9	64.9	64.9
Bandwidth, dB	64.5	64.5	64.5	64.5	64.5
Uplink CNR, dB	8.900546	8.900128	8.899335	8.902248	8.923959
Total C/I, dB	17.22544	17.22544	17.22544	17.22544	17.09338
Total Uplink CNR, dB	8.304665	8.304301	8.303609	8.306149	8.307830
Space To Earth, Satellite-to-ES					
Transmitter Power, dBW	0.49	-0.16	1.34	2.34	3.79
Output Loss, dB	-1	-1	-1	-1	-1
Pwr. Density, dBW/Hz	-65.01	-65.66	-64.16	-63.16	-61.71
Antenna Gain, EOC, dBi	46.2	46.2	46.2	46.2	46.2
Eirp, EOC, dBW	45.69	45.04	46.54	47.54	48.99
Eirp, max, dBW	49.69	49.04	50.54	51.54	52.99
Eirp Density, dBW/Hz	-14.81	-15.46	-13.96	-12.96	-11.51
Frequency, GHz	19.3	19.3	19.3	19.3	19.3
Space Loss, dB	-210.102	-209.893	-209.704	-209.541	-209.409
Rain & Atmos. Loss, dB	-3.7	-3.4	-4.6	-5.5	-6.8
Fixed Loss, dB	-1	-1	-1	-1	-1
Total Loss, dB	-214.802	-214.293	-215.304	-216.041	-217.209
G/T, dBi/K	13.25031	13.39047	12.90358	12.64081	12.36341
ES Antenna Gain (0.5m) dBi	38.2	38.2	38.2	38.2	38.2
ES Temp. (rain) dB	24.44968	24.30952	24.79641	25.05918	25.33658
C/T, dB/K	-155.862	-155.862	-155.860	-155.860	-155.856
Data Rate (3.088 MBps) db	64.9	64.9	64.9	64.9	64.9
Bandwidth, dB	64.5	64.5	64.5	64.5	64.5
Downlink CNR, dB	8.237372	8.237114	8.239426	8.239572	8.243887
Total C/I, dB	15.38452	15.38452	15.38452	15.38452	15.29763
Total Downlink CNR, dB	4.857783	4.857500	4.858249	4.859464	4.854431
Downlink Eb/No, dB	4.507783	4.507500	4.508249	4.509464	4.504431
PFD per MHz	-117.746	-118.186	-116.497	-115.334	-113.752

Figure A-1a. Link Performance, 0.5 meter ES, Crane Model Rain, 3.088 MBps, High Or Low Band.

Elevation, degrees	20	30	40	50	60
Slant Range, Km.	39555	38612	37780	37078	36520
Scan Half Angle, degrees	8.17	7.53	6.65	5.58	4.34
Crane Model Region (0.995)	A	B	D2	E	H
Earth To Space, ES-to-Satellite					
Transmitter Power, dBW	1.6	1.39	1.2	1.04	0.93
Output Loss, dB	-1	-1	-1	-1	-1
Pwr Density dBW/Hz	-63.9	-64.11	-64.3	-64.46	-64.57
Antenna Gain (0.5m) dBi	41.8	41.8	41.8	41.8	41.8
Eirp, peak, dBW	42.4	42.19	42	41.84	41.73
Pointing Loss, dB	-0.5	-0.5	-0.5	-0.5	-0.5
Eirp, dBW	41.9	41.69	41.5	41.34	41.23
Eirp Density, dBW/Hz	-22.1	-22.31	-22.5	-22.66	-22.77
Frequency, GHz	29.2	29.2	29.2	29.2	29.2
Space Loss, dB	-213.699	-213.489	-213.300	-213.137	-213.006
Loss, dB	-1	-1	-1	-1	-1
Total Loss, dB	-214.699	-214.489	-214.300	-214.137	-214.006
G/T, EOC, dBi/K	17.6	17.6	17.6	17.6	17.6
Sat. Temp., dB	28.6	28.6	28.6	28.6	28.6
Antenna Gain, peak, dBi	50.2	50.2	50.2	50.2	50.2
C/T, dB/K	-155.199	-155.199	-155.200	-155.197	-155.176
Data Rate (3.088MBps) dB	64.9	64.9	64.9	64.9	64.9
Bandwidth, dB	64.5	64.5	64.5	64.5	64.5
Uplink CNR, dB	8.900546	8.900128	8.899335	8.902248	8.923959
Total C/I, dB	17.22544	17.22544	17.22544	17.22544	17.09338
Total Uplink CNR, dB	8.304665	8.304301	8.303609	8.306149	8.307830
Space To Earth, Satellite-to-ES					
Transmitter Power, dBW	-5.58	-5.79	-5.99	-6.14	-6.27
Output Loss, dB	-1	-1	-1	-1	-1
Pwr. Density, dBW/Hz	-71.08	-71.29	-71.49	-71.64	-71.77
Antenna Gain, EOC, dBi	46.2	46.2	46.2	46.2	46.2
Eirp, EOC, dBW	39.62	39.41	39.21	39.06	38.93
Eirp, max, dBW	43.62	43.41	43.21	43.06	42.93
Eirp Density, dBW/Hz	-20.88	-21.09	-21.29	-21.44	-21.57
Frequency, GHz	19.3	19.3	19.3	19.3	19.3
Space Loss, dB	-210.102	-209.893	-209.704	-209.541	-209.409
Rain & Atmos. Loss, dB	-0.5	-0.5	-0.5	-0.5	-0.5
Fixed Loss, dB	-1	-1	-1	-1	-1
Total Loss, dB	-211.602	-211.393	-211.204	-211.041	-210.909
G/T, dBi/K	16.12128	16.12128	16.12128	16.12128	16.12128
ES Antenna Gain (0.5m) dBi	38.2	38.2	38.2	38.2	38.2
ES Temp., dB	21.57871	21.57871	21.57871	21.57871	21.57871
C/T, dB/K	-155.861	-155.862	-155.872	-155.859	-155.858
Data Rate (3.088 MBps) db	64.9	64.9	64.9	64.9	64.9
Bandwidth, dB	64.5	64.5	64.5	64.5	64.5
Downlink CNR, dB	8.238344	8.237926	8.227133	8.240046	8.241756
Total C/I, dB	15.38452	15.38452	15.38452	15.38452	15.29763
Total Downlink CNR, dB	4.858229	4.857873	4.852601	4.859682	4.853454
Downlink Eb/No, dB	4.508229	4.507873	4.502601	4.509682	4.503454
PFD per MHz	-123.816	-123.816	-123.827	-123.814	-123.812

Figure A-1b. Link Performance, 0.5 meter ES, Clear Sky, 3.088 MBps, High Or Low Band.

Elevation, degrees	20	30	40	50	60
Slant Range, Km.	39555	38612	37780	37078	36520
Scan Half Angle, degrees	8.17	7.53	6.65	5.58	4.34
Crane Model Region (0.995)	A	B	D2	E	H
Earth To Space, ES-to-Satellite					
Transmitter Power, dBW	5.4	4.79	4.8	3.94	4.13
Output Loss, dB	-1	-1	-1	-1	-1
Pwr Density dBW/Hz	-60.1	-60.71	-60.7	-61.56	-61.37
Antenna Gain (0.5) dBi	41.8	41.8	41.8	41.8	41.8
Eirp, peak, dBW	46.2	45.59	45.6	44.74	44.93
Pointing Loss, dB	-0.5	-0.5	-0.5	-0.5	-0.5
Eirp, dBW	45.7	45.09	45.1	44.24	44.43
Eirp Density, dBW/Hz	-18.3	-18.91	-18.9	-19.76	-19.57
Frequency, GHz	29.2	29.2	29.2	29.2	29.2
Space Loss, dB	-213.699	-213.489	-213.300	-213.137	-213.006
Loss, dB	-4.8	-4.4	-4.6	-3.9	-4.2
Total Loss, dB	-218.499	-217.889	-217.900	-217.037	-217.206
G/T, EOC, dBi/K	17.6	17.6	17.6	17.6	17.6
Sat. Temp., dB	28.6	28.6	28.6	28.6	28.6
Antenna Gain, peak, dBi	50.2	50.2	50.2	50.2	50.2
C/T, dB/K	-155.199	-155.199	-155.200	-155.197	-155.176
Data Rate (3.088MBps) dB	64.9	64.9	64.9	64.9	64.9
Bandwidth, dB	64.5	64.5	64.5	64.5	64.5
Uplink CNR, dB	8.900546	8.900128	8.899335	8.902248	8.923959
Total C/I, dB	17.22544	17.22544	17.22544	17.22544	17.09338
Total Uplink CNR, dB	8.304665	8.304301	8.303609	8.306149	8.307830
Space To Earth, Satellite-to-ES					
Transmitter Power, dBW	-5.58	-5.79	-5.99	-6.14	-6.27
Output Loss, dB	-1	-1	-1	-1	-1
Pwr. Density, dBW/Hz	-71.08	-71.29	-71.49	-71.64	-71.77
Antenna Gain, EOC, dBi	46.2	46.2	46.2	46.2	46.2
Eirp, EOC, dBW	39.62	39.41	39.21	39.06	38.93
Eirp, max, dBW	43.62	43.41	43.21	43.06	42.93
Eirp Density, dBW/Hz	-20.88	-21.09	-21.29	-21.44	-21.57
Frequency, GHz	19.3	19.3	19.3	19.3	19.3
Space Loss, dB	-210.102	-209.893	-209.704	-209.541	-209.409
Rain & Atmos. Loss, dB	-0.5	-0.5	-0.5	-0.5	-0.5
Fixed Loss, dB	-1	-1	-1	-1	-1
Total Loss, dB	-211.602	-211.393	-211.204	-211.041	-210.909
G/T, dBi/K	16.12128	16.12128	16.12128	16.12128	16.12128
ES Antenna Gain (0.5m) dBi	38.2	38.2	38.2	38.2	38.2
ES Temp. (rain) dB	21.57871	21.57871	21.57871	21.57871	21.57871
C/T, dB/K	-155.861	-155.862	-155.872	-155.859	-155.858
Data Rate (3.088 MBps) db	64.9	64.9	64.9	64.9	64.9
Bandwidth, dB	64.5	64.5	64.5	64.5	64.5
Downlink CNR, dB	8.238344	8.237926	8.227133	8.240046	8.241756
Total C/I, dB	15.38452	15.38452	15.38452	15.38452	15.29763
Total Downlink CNR, dB	4.858229	4.857873	4.852601	4.859682	4.853454
Downlink Eb/No, dB	4.508229	4.507873	4.502601	4.509682	4.503454
PFD per MHz	-123.816	-123.816	-123.827	-123.814	-123.812

Figure A-1c. Link Performance, 0.5 meter ES, 98 Percentile Uplink Rain, Clear Sky Downlink, 3.088 MBps, High Or Low Band.

Elevation, degrees	20	30	40	50	60
Slant Range, Km.	39555	38612	37780	37078	36520
Scan Half Angle, degrees	8.17	7.53	6.65	5.58	4.34
Crane Model Region (0.995)	A	B	D2	E	H
Earth To Space, ES-to-Satellite					
Transmitter Power, dBW	6.7	5.59	8.1	9.84	12.93
Output Loss, dB	-1	-1	-1	-1	-1
Pwr Density dBW/Hz	-58.8	-59.91	-57.4	-55.66	-52.57
Antenna Gain (0.7m) dBi	44.7	44.7	44.7	44.7	44.7
Eirp, peak, dBW	50.4	49.29	51.8	53.54	56.63
Pointing Loss, dB	-0.5	-0.5	-0.5	-0.5	-0.5
Eirp, dBW	49.9	48.79	51.3	53.04	56.13
Eirp Density, dBW/Hz	-14.1	-15.21	-12.7	-10.96	-7.87
Frequency, GHz	29.2	29.2	29.2	29.2	29.2
Space Loss, dB	-213.699	-213.489	-213.300	-213.137	-213.006
Loss, dB	-9	-8.1	-10.8	-12.7	-15.9
Total Loss, dB	-222.699	-221.589	-224.100	-225.837	-228.906
G/T, EOC, dBi/K	17.6	17.6	17.6	17.6	17.6
Sat. Temp., dB	28.6	28.6	28.6	28.6	28.6
Antenna Gain, peak, dBi	50.2	50.2	50.2	50.2	50.2
C/T, dB/K	-155.199	-155.199	-155.200	-155.197	-155.176
Data Rate (3.088MBps) dB	64.9	64.9	64.9	64.9	64.9
Bandwidth, dB	64.5	64.5	64.5	64.5	64.5
Uplink CNR, dB	8.900546	8.900128	8.899335	8.902248	8.923959
Total C/I, dB	17.22544	17.22544	17.22544	17.22544	17.09338
Total Uplink CNR, dB	8.304665	8.304301	8.303609	8.306149	8.307830
Space To Earth, Satellite-to-ES					
Transmitter Power, dBW	-2.41	-3.06	-1.56	-0.56	0.89
Output Loss, dB	-1	-1	-1	-1	-1
Pwr. Density, dBW/Hz	-67.91	-68.56	-67.06	-66.06	-64.61
Antenna Gain, EOC, dBi	46.2	46.2	46.2	46.2	46.2
Eirp, EOC, dBW	42.79	42.14	43.64	44.64	46.09
Eirp, max, dBW	46.79	46.14	47.64	48.64	50.09
Eirp Density, dBW/Hz	-17.71	-18.36	-16.86	-15.86	-14.41
Frequency, GHz	19.3	19.3	19.3	19.3	19.3
Space Loss, dB	-210.102	-209.893	-209.704	-209.541	-209.409
Rain & Atmos. Loss, dB	-3.7	-3.4	-4.6	-5.5	-6.8
Fixed Loss, dB	-1	-1	-1	-1	-1
Total Loss, dB	-214.802	-214.293	-215.304	-216.041	-217.209
G/T, dBi/K	16.15031	16.29047	15.80358	15.54081	15.26341
ES Antenna Gain (0.7m) dBi	41.1	41.1	41.1	41.1	41.1
ES Temp. (rain) dB	24.44968	24.30952	24.79641	25.05918	25.33658
C/T, dB/K	-155.862	-155.862	-155.860	-155.860	-155.856
Data Rate (3.088 MBps) db	64.9	64.9	64.9	64.9	64.9
Bandwidth, dB	64.5	64.5	64.5	64.5	64.5
Downlink CNR, dB	8.237372	8.237114	8.239426	8.239572	8.243887
Total C/I, dB	15.38452	15.38452	15.38452	15.38452	15.29763
Total Downlink CNR, dB	4.857783	4.857500	4.858249	4.859464	4.854431
Downlink Eb/No, dB	4.507783	4.507500	4.508249	4.509464	4.504431
PFD per MHz	-120.646	-121.086	-119.397	-118.234	-116.652

Figure A-2a. Link Performance, 0.7 meter ES, Crane Model Rain, 3.088 MBps, High Or Low Band.

Elevation, degrees	20	30	40	50	60
Slant Range, Km.	39555	38612	37780	37078	36520
Scan Half Angle, degrees	8.17	7.53	6.65	5.58	4.34
Crane Model Region (0.995)	A	B	D2	E	H
Earth To Space, ES-to-Satellite					
Transmitter Power, dBW	-1.3	-1.51	-1.7	-1.86	-1.97
Output Loss, dB	-1	-1	-1	-1	-1
Pwr Density dBW/Hz	-66.8	-67.01	-67.2	-67.36	-67.47
Antenna Gain (0.7m) dBi	44.7	44.7	44.7	44.7	44.7
Eirp, peak, dBW	42.4	42.19	42	41.84	41.73
Pointing Loss, dB	-0.5	-0.5	-0.5	-0.5	-0.5
Eirp, dBW	41.9	41.69	41.5	41.34	41.23
Eirp Density, dBW/Hz	-22.1	-22.31	-22.5	-22.66	-22.77
Frequency, GHz	29.2	29.2	29.2	29.2	29.2
Space Loss, dB	-213.699	-213.489	-213.300	-213.137	-213.006
Loss, dB	-1	-1	-1	-1	-1
Total Loss, dB	-214.699	-214.489	-214.300	-214.137	-214.006
G/T, EOC, dBi/K	17.6	17.6	17.6	17.6	17.6
Sat. Temp., dB	28.6	28.6	28.6	28.6	28.6
Antenna Gain, peak, dBi	50.2	50.2	50.2	50.2	50.2
C/T, dB/K	-155.199	-155.199	-155.200	-155.197	-155.176
Data Rate (3.088MBps) dB	64.9	64.9	64.9	64.9	64.9
Bandwidth, dB	64.5	64.5	64.5	64.5	64.5
Uplink CNR, dB	8.900546	8.900128	8.899335	8.902248	8.923959
Total C/I, dB	17.22544	17.22544	17.22544	17.22544	17.09338
Total Uplink CNR, dB	8.304665	8.304301	8.303609	8.306149	8.307830
Space To Earth, Satellite-to-ES					
Transmitter Power, dBW	-8.48	-8.69	-8.89	-9.04	-9.17
Output Loss, dB	-1	-1	-1	-1	-1
Pwr. Density, dBW/Hz	-73.98	-74.19	-74.39	-74.54	-74.67
Antenna Gain, EOC, dBi	46.2	46.2	46.2	46.2	46.2
Eirp, EOC, dBW	36.72	36.51	36.31	36.16	36.03
Eirp, max, dBW	40.72	40.51	40.31	40.16	40.03
Eirp Density, dBW/Hz	-23.78	-23.99	-24.19	-24.34	-24.47
Frequency, GHz	19.3	19.3	19.3	19.3	19.3
Space Loss, dB	-210.102	-209.893	-209.704	-209.541	-209.409
Rain & Atmos. Loss, dB	-0.5	-0.5	-0.5	-0.5	-0.5
Fixed Loss, dB	-1	-1	-1	-1	-1
Total Loss, dB	-211.602	-211.393	-211.204	-211.041	-210.909
G/T, dBi/K	19.02128	19.02128	19.02128	19.02128	19.02128
ES Antenna Gain (0.7m) dBi	41.1	41.1	41.1	41.1	41.1
ES Temp., dB	21.57871	21.57871	21.57871	21.57871	21.57871
C/T, dB/K	-155.861	-155.862	-155.872	-155.859	-155.858
Data Rate (3.088 MBps) db	64.9	64.9	64.9	64.9	64.9
Bandwidth, dB	64.5	64.5	64.5	64.5	64.5
Downlink CNR, dB	8.238344	8.237926	8.227133	8.240046	8.241756
Total C/I, dB	15.38452	15.38452	15.38452	15.38452	15.29763
Total Downlink CNR, dB	4.858229	4.857873	4.852601	4.859682	4.853454
Downlink Eb/No, dB	4.508229	4.507873	4.502601	4.509682	4.503454
PFD per MHz	-126.716	-126.716	-126.727	-126.714	-126.712

Figure A-2b. Link Performance, 0.7 meter ES, Clear Sky, 3.088 MBps, High Or Low Band.

Elevation, degrees	20	30	40	50	60
Slant Range, Km.	39555	38612	37780	37078	36520
Scan Half Angle, degrees	8.17	7.53	6.65	5.58	4.34
Crane Model Region (0.995)	A	B	D2	E	H
Earth To Space, ES-to-Satellite					
Transmitter Power, dBW	2.5	1.89	1.9	1.04	1.23
Output Loss, dB	-1	-1	-1	-1	-1
Pwr Density dBW/Hz	-63	-63.61	-63.6	-64.46	-64.27
Antenna Gain (0.7) dBi	44.7	44.7	44.7	44.7	44.7
Eirp, peak, dBW	46.2	45.59	45.6	44.74	44.93
Pointing Loss, dB	-0.5	-0.5	-0.5	-0.5	-0.5
Eirp, dBW	45.7	45.09	45.1	44.24	44.43
Eirp Density, dBW/Hz	-18.3	-18.91	-18.9	-19.76	-19.57
Frequency, GHz	29.2	29.2	29.2	29.2	29.2
Space Loss, dB	-213.699	-213.489	-213.300	-213.137	-213.006
Loss, dB	-4.8	-4.4	-4.6	-3.9	-4.2
Total Loss, dB	-218.499	-217.889	-217.900	-217.037	-217.206
G/T, EOC, dBi/K	17.6	17.6	17.6	17.6	17.6
Sat. Temp., dB	28.6	28.6	28.6	28.6	28.6
Antenna Gain, peak, dBi	50.2	50.2	50.2	50.2	50.2
C/T, dB/K	-155.199	-155.199	-155.200	-155.197	-155.176
Data Rate (3.088MBps) dB	64.9	64.9	64.9	64.9	64.9
Bandwidth, dB	64.5	64.5	64.5	64.5	64.5
Uplink CNR, dB	8.900546	8.900128	8.899335	8.902248	8.923959
Total C/I, dB	17.22544	17.22544	17.22544	17.22544	17.09338
Total Uplink CNR, dB	8.304665	8.304301	8.303609	8.306149	8.307830
Space To Earth, Satellite-to-ES					
Transmitter Power, dBW	-8.48	-8.69	-8.89	-9.04	-9.17
Output Loss, dB	-1	-1	-1	-1	-1
Pwr. Density, dBW/Hz	-73.98	-74.19	-74.39	-74.54	-74.67
Antenna Gain, EOC, dBi	46.2	46.2	46.2	46.2	46.2
Eirp, EOC, dBW	36.72	36.51	36.31	36.16	36.03
Eirp, max, dBW	40.72	40.51	40.31	40.16	40.03
Eirp Density, dBW/Hz	-23.78	-23.99	-24.19	-24.34	-24.47
Frequency, GHz	19.3	19.3	19.3	19.3	19.3
Space Loss, dB	-210.102	-209.893	-209.704	-209.541	-209.409
Rain & Atmos. Loss, dB	-0.5	-0.5	-0.5	-0.5	-0.5
Fixed Loss, dB	-1	-1	-1	-1	-1
Total Loss, dB	-211.602	-211.393	-211.204	-211.041	-210.909
G/T, dBi/K	19.02128	19.02128	19.02128	19.02128	19.02128
ES Antenna Gain (0.7m) dBi	41.1	41.1	41.1	41.1	41.1
ES Temp. (rain) dB	21.57871	21.57871	21.57871	21.57871	21.57871
C/T, dB/K	-155.861	-155.862	-155.872	-155.859	-155.858
Data Rate (3.088 MBps) db	64.9	64.9	64.9	64.9	64.9
Bandwidth, dB	64.5	64.5	64.5	64.5	64.5
Downlink CNR, dB	8.238344	8.237926	8.227133	8.240046	8.241756
Total C/I, dB	15.38452	15.38452	15.38452	15.38452	15.29763
Total Downlink CNR, dB	4.858229	4.857873	4.852601	4.859682	4.853454
Downlink Eb/No, dB	4.508229	4.507873	4.502601	4.509682	4.503454
PFD per MHz	-126.716	-126.716	-126.727	-126.714	-126.712

Figure A-2c. Link Performance, 0.7 meter ES, 98 Percentile Uplink Rain, Clear Sky Downlink, 3.088 MBps, High Or Low Band.

Elevation, degrees	20	30	40	50	60
Slant Range, Km.	39555	38612	37780	37078	36520
Scan Half Angle, degrees	8.17	7.53	6.65	5.58	4.34
Crane Model Region (0.995)	A	B	D2	E	H
Earth To Space, ES-to-Satellite					
Transmitter Power, dBW	19.7	18.59	21.1	22.84	25.93
Output Loss, dB	-1	-1	-1	-1	-1
Pwr Density dBW/Hz	-58.8	-59.91	-57.4	-55.66	-52.57
Antenna Gain (0.7m) dBi	44.7	44.7	44.7	44.7	44.7
Eirp, peak, dBW	63.4	62.29	64.8	66.54	69.63
Pointing Loss, dB	-0.5	-0.5	-0.5	-0.5	-0.5
Eirp, dBW	62.9	61.79	64.3	66.04	69.13
Eirp Density, dBW/Hz	-14.1	-15.21	-12.7	-10.96	-7.87
Frequency, GHz	29.2	29.2	29.2	29.2	29.2
Space Loss, dB	-213.699	-213.489	-213.300	-213.137	-213.006
Loss, dB	-9	-8.1	-10.8	-12.7	-15.9
Total Loss, dB	-222.699	-221.589	-224.100	-225.837	-228.906
G/T, EOC, dBi/K	17.6	17.6	17.6	17.6	17.6
Sat. Temp., dB	28.6	28.6	28.6	28.6	28.6
Antenna Gain, peak, dBi	50.2	50.2	50.2	50.2	50.2
C/T, dB/K	-142.199	-142.199	-142.200	-142.197	-142.176
Data Rate (61MBps) dB	77.9	77.9	77.9	77.9	77.9
Bandwidth (56.3 MHz) dB	77.5	77.5	77.5	77.5	77.5
Uplink CNR, dB	8.900546	8.900128	8.899335	8.902248	8.923959
Total C/I, dB	17.22544	17.22544	17.22544	17.22544	17.09338
Total Uplink CNR, dB	8.304665	8.304301	8.303609	8.306149	8.307830
Space To Earth, Satellite-to-ES					
Transmitter Power, dBW	10.59	9.94	11.44	12.44	13.89
Output Loss, dB	-1	-1	-1	-1	-1
Pwr. Density, dBW/Hz	-67.91	-68.56	-67.06	-66.06	-64.61
Antenna Gain, EOC, dBi	46.2	46.2	46.2	46.2	46.2
Eirp, EOC, dBW	55.79	55.14	56.64	57.64	59.09
Eirp, max, dBW	59.79	59.14	60.64	61.64	63.09
Eirp Density, dBW/Hz	-17.71	-18.36	-16.86	-15.86	-14.41
Frequency, GHz	19.3	19.3	19.3	19.3	19.3
Space Loss, dB	-210.102	-209.893	-209.704	-209.541	-209.409
Rain & Atmos. Loss, dB	-3.7	-3.4	-4.6	-5.5	-6.8
Fixed Loss, dB	-1	-1	-1	-1	-1
Total Loss, dB	-214.802	-214.293	-215.304	-216.041	-217.209
G/T, dBi/K	16.15031	16.29047	15.80358	15.54081	15.26341
ES Antenna Gain (0.7m) dBi	41.1	41.1	41.1	41.1	41.1
ES Temp. (rain) dB	24.44968	24.30952	24.79641	25.05918	25.33658
C/T, dB/K	-142.862	-142.862	-142.860	-142.860	-142.856
Data Rate (61 MBps) db	77.9	77.9	77.9	77.9	77.9
Bandwidth (56.3 MHz) dB	77.5	77.5	77.5	77.5	77.5
Downlink CNR, dB	8.237372	8.237114	8.239426	8.239572	8.243887
Total C/I, dB	15.38452	15.38452	15.38452	15.38452	15.29763
Total Downlink CNR, dB	4.857783	4.857500	4.858249	4.859464	4.854431
Downlink Eb/No, dB	4.507783	4.507500	4.508249	4.509464	4.504431
PFD per MHz	-120.646	-121.086	-119.397	-118.234	-116.652

Figure A-3a. Link Performance, 0.7 meter ES, Crane Model Rain, 61 MBps, High Band.

Elevation, degrees	20	30	40	50	60
Slant Range, Km.	39555	38612	37780	37078	36520
Scan Half Angle, degrees	8.17	7.53	6.65	5.58	4.34
Crane Model Region (0.995)	A	B	D2	E	H
Earth To Space, ES-to-Satellite					
Transmitter Power, dBW	11.7	11.49	11.3	11.14	11.03
Output Loss, dB	-1	-1	-1	-1	-1
Pwr Density dBW/Hz	-66.8	-67.01	-67.2	-67.36	-67.47
Antenna Gain (0.7m) dBi	44.7	44.7	44.7	44.7	44.7
Eirp, peak, dBW	55.4	55.19	55	54.84	54.73
Pointing Loss, dB	-0.5	-0.5	-0.5	-0.5	-0.5
Eirp, dBW	54.9	54.69	54.5	54.34	54.23
Eirp Density, dBW/Hz	-22.1	-22.31	-22.5	-22.66	-22.77
Frequency, GHz	29.2	29.2	29.2	29.2	29.2
Space Loss, dB	-213.699	-213.489	-213.300	-213.137	-213.006
Loss, dB	-1	-1	-1	-1	-1
Total Loss, dB	-214.699	-214.489	-214.300	-214.137	-214.006
G/T, EOC, dBi/K	17.6	17.6	17.6	17.6	17.6
Sat. Temp., dB	28.6	28.6	28.6	28.6	28.6
Antenna Gain, peak, dBi	50.2	50.2	50.2	50.2	50.2
C/T, dB/K	-142.199	-142.199	-142.200	-142.197	-142.176
Data Rate (61MBps) dB	77.9	77.9	77.9	77.9	77.9
Bandwidth (56.3 MHz) dB	77.5	77.5	77.5	77.5	77.5
Uplink CNR, dB	8.900546	8.900128	8.899335	8.902248	8.923959
Total C/I, dB	17.22544	17.22544	17.22544	17.22544	17.09338
Total Uplink CNR, dB	8.304665	8.304301	8.303609	8.306149	8.307830
Space To Earth, Satellite-to-ES					
Transmitter Power, dBW	4.52	4.31	4.11	3.96	3.83
Output Loss, dB	-1	-1	-1	-1	-1
Pwr. Density, dBW/Hz	-73.98	-74.19	-74.39	-74.54	-74.67
Antenna Gain, EOC, dBi	46.2	46.2	46.2	46.2	46.2
Eirp, EOC, dBW	49.72	49.51	49.31	49.16	49.03
Eirp, max, dBW	53.72	53.51	53.31	53.16	53.03
Eirp Density, dBW/Hz	-23.78	-23.99	-24.19	-24.34	-24.47
Frequency, GHz	19.3	19.3	19.3	19.3	19.3
Space Loss, dB	-210.102	-209.893	-209.704	-209.541	-209.409
Rain & Atmos. Loss, dB	-0.5	-0.5	-0.5	-0.5	-0.5
Fixed Loss, dB	-1	-1	-1	-1	-1
Total Loss, dB	-211.602	-211.393	-211.204	-211.041	-210.909
G/T, dBi/K	19.02128	19.02128	19.02128	19.02128	19.02128
ES Antenna Gain (0.7m) dBi	41.1	41.1	41.1	41.1	41.1
ES Temp., dB	21.57871	21.57871	21.57871	21.57871	21.57871
C/T, dB/K	-142.861	-142.862	-142.872	-142.859	-142.858
Data Rate (61 MBps) db	77.9	77.9	77.9	77.9	77.9
Bandwidth (56.3 MHz) dB	77.5	77.5	77.5	77.5	77.5
Downlink CNR, dB	8.238344	8.237926	8.227133	8.240046	8.241756
Total C/I, dB	15.38452	15.38452	15.38452	15.38452	15.29763
Total Downlink CNR, dB	4.858229	4.857873	4.852601	4.859682	4.853454
Downlink Eb/No, dB	4.508229	4.507873	4.502601	4.509682	4.503454
PFD per MHz	-126.716	-126.716	-126.727	-126.714	-126.712

Figure A-3b. Link Performance, 0.7 meter ES, Clear Sky, 61 MBps, High Band.

Elevation, degrees	20	30	40	50	60
Slant Range, Km.	39555	38612	37780	37078	36520
Scan Half Angle, degrees	8.17	7.53	6.65	5.58	4.34
Crane Model Region (0.995)	A	B	D2	E	H
Earth To Space, ES-to-Satellite					
Transmitter Power, dBW	15.5	14.89	14.9	14.04	14.23
Output Loss, dB	-1	-1	-1	-1	-1
Pwr Density dBW/Hz	-63	-63.61	-63.6	-64.46	-64.27
Antenna Gain (0.7) dBi	44.7	44.7	44.7	44.7	44.7
Eirp, peak, dBW	59.2	58.59	58.6	57.74	57.93
Pointing Loss, dB	-0.5	-0.5	-0.5	-0.5	-0.5
Eirp, dBW	58.7	58.09	58.1	57.24	57.43
Eirp Density, dBW/Hz	-18.3	-18.91	-18.9	-19.76	-19.57
Frequency, GHz	29.2	29.2	29.2	29.2	29.2
Space Loss, dB	-213.699	-213.489	-213.300	-213.137	-213.006
Loss, dB	-4.8	-4.4	-4.6	-3.9	-4.2
Total Loss, dB	-218.499	-217.889	-217.900	-217.037	-217.206
G/T, EOC, dBi/K	17.6	17.6	17.6	17.6	17.6
Sat. Temp., dB	28.6	28.6	28.6	28.6	28.6
Antenna Gain, peak, dBi	50.2	50.2	50.2	50.2	50.2
C/T, dB/K	-142.199	-142.199	-142.200	-142.197	-142.176
Data Rate (61MBps) dB	77.9	77.9	77.9	77.9	77.9
Bandwidth (56.3 MHz) dB	77.5	77.5	77.5	77.5	77.5
Uplink CNR, dB	8.900546	8.900128	8.899335	8.902248	8.923959
Total C/I, dB	17.22544	17.22544	17.22544	17.22544	17.09338
Total Uplink CNR, dB	8.304665	8.304301	8.303609	8.306149	8.307830
Space To Earth, Satellite-to-ES					
Transmitter Power, dBW	4.52	4.31	4.11	3.96	3.83
Output Loss, dB	-1	-1	-1	-1	-1
Pwr. Density, dBW/Hz	-73.98	-74.19	-74.39	-74.54	-74.67
Antenna Gain, EOC, dBi	46.2	46.2	46.2	46.2	46.2
Eirp, EOC, dBW	49.72	49.51	49.31	49.16	49.03
Eirp, max, dBW	53.72	53.51	53.31	53.16	53.03
Eirp Density, dBW/Hz	-23.78	-23.99	-24.19	-24.34	-24.47
Frequency, GHz	19.3	19.3	19.3	19.3	19.3
Space Loss, dB	-210.102	-209.893	-209.704	-209.541	-209.409
Rain & Atmos. Loss, dB	-0.5	-0.5	-0.5	-0.5	-0.5
Fixed Loss, dB	-1	-1	-1	-1	-1
Total Loss, dB	-211.602	-211.393	-211.204	-211.041	-210.909
G/T, dBi/K	19.02128	19.02128	19.02128	19.02128	19.02128
ES Antenna Gain (0.7m) dBi	41.1	41.1	41.1	41.1	41.1
ES Temp. (rain) dB	21.57871	21.57871	21.57871	21.57871	21.57871
C/T, dB/K	-142.861	-142.862	-142.872	-142.859	-142.858
Data Rate (61 MBps) db	77.9	77.9	77.9	77.9	77.9
Bandwidth (56.3 MHz) dB	77.5	77.5	77.5	77.5	77.5
Downlink CNR, dB	8.238344	8.237926	8.227133	8.240046	8.241756
Total C/I, dB	15.38452	15.38452	15.38452	15.38452	15.29763
Total Downlink CNR, dB	4.858229	4.857873	4.852601	4.859682	4.853454
Downlink Eb/No, dB	4.508229	4.507873	4.502601	4.509682	4.503454
PFD per MHz	-126.716	-126.716	-126.727	-126.714	-126.712

Figure A-3c. Link Performance, 0.7 meter ES, 98 Percentile Uplink Rain, Clear Sky Downlink, 61 MBps, High Band.

Elevation, degrees	20	30	40	50	60
Slant Range, Km.	39555	38612	37780	37078	36520
Scan Half Angle, degrees	8.17	7.53	6.65	5.58	4.34
Crane Model Region (0.995)	A	B	D2	E	H
Earth To Space, ES-to-Satellite					
Transmitter Power, dBW	22.6	21.49	24	25.74	28.83
Output Loss, dB	-1	-1	-1	-1	-1
Pwr Density dBW/Hz	-55.9	-57.01	-54.5	-52.76	-49.67
Antenna Gain (0.5m) dBi	41.8	41.8	41.8	41.8	41.8
Eirp, peak, dBW	63.4	62.29	64.8	66.54	69.63
Pointing Loss, dB	-0.5	-0.5	-0.5	-0.5	-0.5
Eirp, dBW	62.9	61.79	64.3	66.04	69.13
Eirp Density, dBW/Hz	-14.1	-15.21	-12.7	-10.96	-7.87
Frequency, GHz	29.2	29.2	29.2	29.2	29.2
Space Loss, dB	-213.699	-213.489	-213.300	-213.137	-213.006
Loss, dB	-9	-8.1	-10.8	-12.7	-15.9
Total Loss, dB	-222.699	-221.589	-224.100	-225.837	-228.906
G/T, EOC, dBi/K	17.6	17.6	17.6	17.6	17.6
Sat. Temp., dB	28.6	28.6	28.6	28.6	28.6
Antenna Gain, peak, dBi	50.2	50.2	50.2	50.2	50.2
C/T, dB/K	-142.199	-142.199	-142.200	-142.197	-142.176
Data Rate (61MBps) dB	77.9	77.9	77.9	77.9	77.9
Bandwidth (56.3 MHz) dB	77.5	77.5	77.5	77.5	77.5
Uplink CNR, dB	8.900546	8.900128	8.899335	8.902248	8.923959
Total C/I, dB	17.22544	17.22544	17.22544	17.22544	17.09338
Total Uplink CNR, dB	8.304665	8.304301	8.303609	8.306149	8.307830
Space To Earth, Satellite-to-ES					
Transmitter Power, dBW	13.49	12.84	14.34	15.34	16.79
Output Loss, dB	-1	-1	-1	-1	-1
Pwr. Density, dBW/Hz	-65.01	-65.66	-64.16	-63.16	-61.71
Antenna Gain, EOC, dBi	46.2	46.2	46.2	46.2	46.2
Eirp, EOC, dBW	58.69	58.04	59.54	60.54	61.99
Eirp, max, dBW	62.69	62.04	63.54	64.54	65.99
Eirp Density, dBW/Hz	-14.81	-15.46	-13.96	-12.96	-11.51
Frequency, GHz	19.3	19.3	19.3	19.3	19.3
Space Loss, dB	-210.102	-209.893	-209.704	-209.541	-209.409
Rain & Atmos. Loss, dB	-3.7	-3.4	-4.6	-5.5	-6.8
Fixed Loss, dB	-1	-1	-1	-1	-1
Total Loss, dB	-214.802	-214.293	-215.304	-216.041	-217.209
G/T, dBi/K	13.25031	13.39047	12.90358	12.64081	12.36341
ES Antenna Gain (0.5m) dBi	38.2	38.2	38.2	38.2	38.2
ES Temp. (rain) dB	24.44968	24.30952	24.79641	25.05918	25.33658
C/T, dB/K	-142.862	-142.862	-142.860	-142.860	-142.856
Data Rate (61 MBps) db	77.9	77.9	77.9	77.9	77.9
Bandwidth (56.3 MHz) dB	77.5	77.5	77.5	77.5	77.5
Downlink CNR, dB	8.237372	8.237114	8.239426	8.239572	8.243887
Total C/I, dB	15.38452	15.38452	15.38452	15.38452	15.29763
Total Downlink CNR, dB	4.857783	4.857500	4.858249	4.859464	4.854431
Downlink Eb/No, dB	4.507783	4.507500	4.508249	4.509464	4.504431
PFD per MHz	-117.746	-118.186	-116.497	-115.334	-113.752

Figure A-4a. Link Performance, 0.5 meter ES, Crane Model Rain, 61 MBps, High Band.

Elevation, degrees	20	30	40	50	60
Slant Range, Km.	39555	38612	37780	37078	36520
Scan Half Angle, degrees	8.17	7.53	6.65	5.58	4.34
Crane Model Region (0.995)	A	B	D2	E	H
Earth To Space, ES-to-Satellite					
Transmitter Power, dBW	14.6	14.39	14.2	14.04	13.93
Output Loss, dB	-1	-1	-1	-1	-1
Pwr Density dBW/Hz	-63.9	-64.11	-64.3	-64.46	-64.57
Antenna Gain (0.5m) dBi	41.8	41.8	41.8	41.8	41.8
Eirp, peak, dBW	55.4	55.19	55	54.84	54.73
Pointing Loss, dB	-0.5	-0.5	-0.5	-0.5	-0.5
Eirp, dBW	54.9	54.69	54.5	54.34	54.23
Eirp Density, dBW/Hz	-22.1	-22.31	-22.5	-22.66	-22.77
Frequency, GHz	29.2	29.2	29.2	29.2	29.2
Space Loss, dB	-213.699	-213.489	-213.300	-213.137	-213.006
Loss, dB	-1	-1	-1	-1	-1
Total Loss, dB	-214.699	-214.489	-214.300	-214.137	-214.006
G/T, EOC, dBi/K	17.6	17.6	17.6	17.6	17.6
Sat. Temp., dB	28.6	28.6	28.6	28.6	28.6
Antenna Gain, peak, dBi	50.2	50.2	50.2	50.2	50.2
C/T, dB/K	-142.199	-142.199	-142.200	-142.197	-142.176
Data Rate (61MBps) dB	77.9	77.9	77.9	77.9	77.9
Bandwidth (56.3 MHz) dB	77.5	77.5	77.5	77.5	77.5
Uplink CNR, dB	8.900546	8.900128	8.899335	8.902248	8.923959
Total C/I, dB	17.22544	17.22544	17.22544	17.22544	17.09338
Total Uplink CNR, dB	8.304665	8.304301	8.303609	8.306149	8.307830
Space To Earth, Satellite-to-ES					
Transmitter Power, dBW	7.42	7.21	7.01	6.86	6.73
Output Loss, dB	-1	-1	-1	-1	-1
Pwr. Density, dBW/Hz	-71.08	-71.29	-71.49	-71.64	-71.77
Antenna Gain, EOC, dBi	46.2	46.2	46.2	46.2	46.2
Eirp, EOC, dBW	52.62	52.41	52.21	52.06	51.93
Eirp, max, dBW	56.62	56.41	56.21	56.06	55.93
Eirp Density, dBW/Hz	-20.88	-21.09	-21.29	-21.44	-21.57
Frequency, GHz	19.3	19.3	19.3	19.3	19.3
Space Loss, dB	-210.102	-209.893	-209.704	-209.541	-209.409
Rain & Atmos. Loss, dB	-0.5	-0.5	-0.5	-0.5	-0.5
Fixed Loss, dB	-1	-1	-1	-1	-1
Total Loss, dB	-211.602	-211.393	-211.204	-211.041	-210.909
G/T, dBi/K	16.12128	16.12128	16.12128	16.12128	16.12128
ES Antenna Gain (0.5m) dBi	38.2	38.2	38.2	38.2	38.2
ES Temp., dB	21.57871	21.57871	21.57871	21.57871	21.57871
C/T, dB/K	-142.861	-142.862	-142.872	-142.859	-142.858
Data Rate (61 MBps) db	77.9	77.9	77.9	77.9	77.9
Bandwidth (56.3 MHz) dB	77.5	77.5	77.5	77.5	77.5
Downlink CNR, dB	8.238344	8.237926	8.227133	8.240046	8.241756
Total C/I, dB	15.38452	15.38452	15.38452	15.38452	15.29763
Total Downlink CNR, dB	4.858229	4.857873	4.852601	4.859682	4.853454
Downlink Eb/No, dB	4.508229	4.507873	4.502601	4.509682	4.503454
PFD per MHz	-123.816	-123.816	-123.827	-123.814	-123.812

Figure A-4b. Link Performance, 0.5 meter ES, Clear Sky, 61 MBps, High Band.

Elevation, degrees	20	30	40	50	60
Slant Range, Km.	39555	38612	37780	37078	36520
Scan Half Angle, degrees	8.17	7.53	6.65	5.58	4.34
Crane Model Region (0.995)	A	B	D2	E	H
Earth To Space, ES-to-Satellite					
Transmitter Power, dBW	18.4	17.79	17.8	16.94	17.13
Output Loss, dB	-1	-1	-1	-1	-1
Pwr Density dBW/Hz	-60.1	-60.71	-60.7	-61.56	-61.37
Antenna Gain (0.5) dBi	41.8	41.8	41.8	41.8	41.8
Eirp, peak, dBW	59.2	58.59	58.6	57.74	57.93
Pointing Loss, dB	-0.5	-0.5	-0.5	-0.5	-0.5
Eirp, dBW	58.7	58.09	58.1	57.24	57.43
Eirp Density, dBW/Hz	-18.3	-18.91	-18.9	-19.76	-19.57
Frequency, GHz	29.2	29.2	29.2	29.2	29.2
Space Loss, dB	-213.699	-213.489	-213.300	-213.137	-213.006
Loss, dB	-4.8	-4.4	-4.6	-3.9	-4.2
Total Loss, dB	-218.499	-217.889	-217.900	-217.037	-217.206
G/T, EOC, dBi/K	17.6	17.6	17.6	17.6	17.6
Sat. Temp., dB	28.6	28.6	28.6	28.6	28.6
Antenna Gain, peak, dBi	50.2	50.2	50.2	50.2	50.2
C/T, dB/K	-142.199	-142.199	-142.200	-142.197	-142.176
Data Rate (61MBps) dB	77.9	77.9	77.9	77.9	77.9
Bandwidth (56.3 MHz) dB	77.5	77.5	77.5	77.5	77.5
Uplink CNR, dB	8.900546	8.900128	8.899335	8.902248	8.923959
Total C/I, dB	17.22544	17.22544	17.22544	17.22544	17.09338
Total Uplink CNR, dB	8.304665	8.304301	8.303609	8.306149	8.307830
Space To Earth, Satellite-to-ES					
Transmitter Power, dBW	7.42	7.21	7.01	6.86	6.73
Output Loss, dB	-1	-1	-1	-1	-1
Pwr. Density, dBW/Hz	-71.08	-71.29	-71.49	-71.64	-71.77
Antenna Gain, EOC, dBi	46.2	46.2	46.2	46.2	46.2
Eirp, EOC, dBW	52.62	52.41	52.21	52.06	51.93
Eirp, max, dBW	56.62	56.41	56.21	56.06	55.93
Eirp Density, dBW/Hz	-20.88	-21.09	-21.29	-21.44	-21.57
Frequency, GHz	19.3	19.3	19.3	19.3	19.3
Space Loss, dB	-210.102	-209.893	-209.704	-209.541	-209.409
Rain & Atmos. Loss, dB	-0.5	-0.5	-0.5	-0.5	-0.5
Fixed Loss, dB	-1	-1	-1	-1	-1
Total Loss, dB	-211.602	-211.393	-211.204	-211.041	-210.909
G/T, dBi/K	16.12128	16.12128	16.12128	16.12128	16.12128
ES Antenna Gain (0.5m) dBi	38.2	38.2	38.2	38.2	38.2
ES Temp. (rain) dB	21.57871	21.57871	21.57871	21.57871	21.57871
C/T, dB/K	-142.861	-142.862	-142.872	-142.859	-142.858
Data Rate (61 MBps) db	77.9	77.9	77.9	77.9	77.9
Bandwidth (56.3 MHz) dB	77.5	77.5	77.5	77.5	77.5
Downlink CNR, dB	8.238344	8.237926	8.227133	8.240046	8.241756
Total C/I, dB	15.38452	15.38452	15.38452	15.38452	15.29763
Total Downlink CNR, dB	4.858229	4.857873	4.852601	4.859682	4.853454
Downlink Eb/No, dB	4.508229	4.507873	4.502601	4.509682	4.503454
PFD per MHz	-123.816	-123.816	-123.827	-123.814	-123.812

Figure A-4c. Link Performance, 0.5 meter ES, 98 Percentile Uplink Rain, Clear Sky Downlink, 61 MBps, High Band.

Elevation, degrees	20	30	40	50	60
Slant Range, Km.	39555	38612	37780	37078	36520
Scan Half Angle, degrees	8.17	7.53	6.65	5.58	4.34
Crane Model Region (0.995)	A	B	D2	E	H
Earth To Space, ES-to-Satellite					
Transmitter Power, dBW	22.16	21.05	23.56	25.3	28.39
Output Loss, dB	-1	-1	-1	-1	-1
Pwr Density dBW/Hz	-55.74	-56.85	-54.34	-52.6	-49.51
Antenna Gain (0.5m) dBi	41.8	41.8	41.8	41.8	41.8
Eirp, peak, dBW	62.96	61.85	64.36	66.1	69.19
Pointing Loss, dB	-0.5	-0.5	-0.5	-0.5	-0.5
Eirp, dBW	62.46	61.35	63.86	65.6	68.69
Eirp Density, dBW/Hz	-13.94	-15.05	-12.54	-10.8	-7.71
Frequency, GHz	29.2	29.2	29.2	29.2	29.2
Space Loss, dB	-213.699	-213.489	-213.300	-213.137	-213.006
Loss, dB	-9	-8.1	-10.8	-12.7	-15.9
Total Loss, dB	-222.699	-221.589	-224.100	-225.837	-228.906
G/T, EOC, dBi/K	17.6	17.6	17.6	17.6	17.6
Sat. Temp., dB	28.6	28.6	28.6	28.6	28.6
Antenna Gain, peak, dBi	50.2	50.2	50.2	50.2	50.2
C/T, dB/K	-142.639	-142.639	-142.640	-142.637	-142.616
Data Rate (53MBps) dB	77.2	77.2	77.2	77.2	77.2
Bandwidth (49 MHz) dB	76.9	76.9	76.9	76.9	76.9
Uplink CNR, dB	9.060546	9.060128	9.059335	9.062248	9.083959
Total C/I, dB	16.27285	16.27285	16.27285	16.27285	16.16648
Total Uplink CNR, dB	8.305052	8.304701	8.304034	8.306482	8.307481
Space To Earth, Satellite-to-ES					
Transmitter Power, dBW	13.02	12.37	13.87	14.87	16.32
Output Loss, dB	-1	-1	-1	-1	-1
Pwr. Density, dBW/Hz	-64.88	-65.53	-64.03	-63.03	-61.58
Antenna Gain, EOC, dBi	46.2	46.2	46.2	46.2	46.2
Eirp, EOC, dBW	58.22	57.57	59.07	60.07	61.52
Eirp, max, dBW	62.22	61.57	63.07	64.07	65.52
Eirp Density, dBW/Hz	-14.68	-15.33	-13.83	-12.83	-11.38
Frequency, GHz	19.3	19.3	19.3	19.3	19.3
Space Loss, dB	-210.102	-209.893	-209.704	-209.541	-209.409
Rain & Atmos. Loss, dB	-3.7	-3.4	-4.6	-5.5	-6.8
Fixed Loss, dB	-1	-1	-1	-1	-1
Total Loss, dB	-214.802	-214.293	-215.304	-216.041	-217.209
G/T, dBi/K	13.25031	13.39047	12.90358	12.64081	12.36341
ES Antenna Gain (0.5m) dBi	38.2	38.2	38.2	38.2	38.2
ES Temp. (rain) dB	24.44968	24.30952	24.79641	25.05918	25.33658
C/T, dB/K	-143.332	-143.332	-143.330	-143.330	-143.326
Data Rate (53 MBps) db	77.2	77.2	77.2	77.2	77.2
Bandwidth (49 MHz) dB	76.9	76.9	76.9	76.9	76.9
Downlink CNR, dB	8.367372	8.367114	8.369426	8.369572	8.373887
Total C/I, dB	14.73799	14.73799	14.73799	14.73799	14.66302
Total Downlink CNR, dB	4.855025	4.854752	4.855480	4.856651	4.851255
Downlink Eb/No, dB	4.505025	4.504752	4.505480	4.506651	4.501255
PFD per MHz	-117.616	-118.056	-116.367	-115.204	-113.622

Figure A-5a. Link Performance, 0.5 meter ES, Crane Model Rain, 53 MBps, Low Band.

Elevation, degrees	20	30	40	50	60
Slant Range, Km.	39555	38612	37780	37078	36520
Scan Half Angle, degrees	8.17	7.53	6.65	5.58	4.34
Crane Model Region (0.995)	A	B	D2	E	H
Earth To Space, ES-to-Satellite					
Transmitter Power, dBW	14.16	13.95	13.76	13.6	13.49
Output Loss, dB	-1	-1	-1	-1	-1
Pwr Density dBW/Hz	-63.74	-63.95	-64.14	-64.3	-64.41
Antenna Gain (0.5m) dBi	41.8	41.8	41.8	41.8	41.8
Eirp, peak, dBW	54.96	54.75	54.56	54.4	54.29
Pointing Loss, dB	-0.5	-0.5	-0.5	-0.5	-0.5
Eirp, dBW	54.46	54.25	54.06	53.9	53.79
Eirp Density, dBW/Hz	-21.94	-22.15	-22.34	-22.5	-22.61
Frequency, GHz	29.2	29.2	29.2	29.2	29.2
Space Loss, dB	-213.699	-213.489	-213.300	-213.137	-213.006
Loss, dB	-1	-1	-1	-1	-1
Total Loss, dB	-214.699	-214.489	-214.300	-214.137	-214.006
G/T, EOC, dBi/K	17.6	17.6	17.6	17.6	17.6
Sat. Temp., dB	28.6	28.6	28.6	28.6	28.6
Antenna Gain, peak, dBi	50.2	50.2	50.2	50.2	50.2
C/T, dB/K	-142.639	-142.639	-142.640	-142.637	-142.616
Data Rate (53MBps) dB	77.2	77.2	77.2	77.2	77.2
Bandwidth (49 MHz) dB	76.9	76.9	76.9	76.9	76.9
Uplink CNR, dB	9.060546	9.060128	9.059335	9.062248	9.083959
Total C/I, dB	16.27285	16.27285	16.27285	16.27285	16.16648
Total Uplink CNR, dB	8.305052	8.304701	8.304034	8.306482	8.307481
Space To Earth, Satellite-to-ES					
Transmitter Power, dBW	6.95	6.74	6.54	6.39	6.26
Output Loss, dB	-1	-1	-1	-1	-1
Pwr. Density, dBW/Hz	-70.95	-71.16	-71.36	-71.51	-71.64
Antenna Gain, EOC, dBi	46.2	46.2	46.2	46.2	46.2
Eirp, EOC, dBW	52.15	51.94	51.74	51.59	51.46
Eirp, max, dBW	56.15	55.94	55.74	55.59	55.46
Eirp Density, dBW/Hz	-20.75	-20.96	-21.16	-21.31	-21.44
Frequency, GHz	19.3	19.3	19.3	19.3	19.3
Space Loss, dB	-210.102	-209.893	-209.704	-209.541	-209.409
Rain & Atmos. Loss, dB	-0.5	-0.5	-0.5	-0.5	-0.5
Fixed Loss, dB	-1	-1	-1	-1	-1
Total Loss, dB	-211.602	-211.393	-211.204	-211.041	-210.909
G/T, dBi/K	16.12128	16.12128	16.12128	16.12128	16.12128
ES Antenna Gain (0.5m) dBi	38.2	38.2	38.2	38.2	38.2
ES Temp., dB	21.57871	21.57871	21.57871	21.57871	21.57871
C/T, dB/K	-143.331	-143.332	-143.342	-143.329	-143.328
Data Rate (53 MBps) db	77.2	77.2	77.2	77.2	77.2
Bandwidth (49 MHz) dB	76.9	76.9	76.9	76.9	76.9
Downlink CNR, dB	8.368344	8.367926	8.357133	8.370046	8.371756
Total C/I, dB	14.73799	14.73799	14.73799	14.73799	14.66302
Total Downlink CNR, dB	4.855458	4.855113	4.850002	4.856862	4.850308
Downlink Eb/No, dB	4.505458	4.505113	4.500002	4.506862	4.500308
PFD per MHz	-123.686	-123.686	-123.697	-123.684	-123.682

Figure A-5b. Link Performance, 0.5 meter ES, Clear Sky, 53 MBps, Low Band.

Elevation, degrees	20	30	40	50	60
Slant Range, Km.	39555	38612	37780	37078	36520
Scan Half Angle, degrees	8.17	7.53	6.65	5.58	4.34
Crane Model Region (0.995)	A	B	D2	E	H
Earth To Space, ES-to-Satellite					
Transmitter Power, dBW	17.96	17.35	17.36	16.5	16.69
Output Loss, dB	-1	-1	-1	-1	-1
Pwr Density dBW/Hz	-59.94	-60.55	-60.54	-61.4	-61.21
Antenna Gain (0.5) dBi	41.8	41.8	41.8	41.8	41.8
Eirp, peak, dBW	58.76	58.15	58.16	57.3	57.49
Pointing Loss, dB	-0.5	-0.5	-0.5	-0.5	-0.5
Eirp, dBW	58.26	57.65	57.66	56.8	56.99
Eirp Density, dBW/Hz	-18.14	-18.75	-18.74	-19.6	-19.41
Frequency, GHz	29.2	29.2	29.2	29.2	29.2
Space Loss, dB	-213.699	-213.489	-213.300	-213.137	-213.006
Loss, dB	-4.8	-4.4	-4.6	-3.9	-4.2
Total Loss, dB	-218.499	-217.889	-217.900	-217.037	-217.206
G/T, EOC, dBi/K	17.6	17.6	17.6	17.6	17.6
Sat. Temp., dB	28.6	28.6	28.6	28.6	28.6
Antenna Gain, peak, dBi	50.2	50.2	50.2	50.2	50.2
C/T, dB/K	-142.639	-142.639	-142.640	-142.637	-142.616
Data Rate (53MBps) dB	77.2	77.2	77.2	77.2	77.2
Bandwidth (49 MHz) dB	76.9	76.9	76.9	76.9	76.9
Uplink CNR, dB	9.060546	9.060128	9.059335	9.062248	9.083959
Total C/I, dB	16.27285	16.27285	16.27285	16.27285	16.16648
Total Uplink CNR, dB	8.305052	8.304701	8.304034	8.306482	8.307481
Space To Earth, Satellite-to-ES					
Transmitter Power, dBW	6.95	6.74	6.54	6.39	6.26
Output Loss, dB	-1	-1	-1	-1	-1
Pwr. Density, dBW/Hz	-70.95	-71.16	-71.36	-71.51	-71.64
Antenna Gain, EOC, dBi	46.2	46.2	46.2	46.2	46.2
Eirp, EOC, dBW	52.15	51.94	51.74	51.59	51.46
Eirp, max, dBW	56.15	55.94	55.74	55.59	55.46
Eirp Density, dBW/Hz	-20.75	-20.96	-21.16	-21.31	-21.44
Frequency, GHz	19.3	19.3	19.3	19.3	19.3
Space Loss, dB	-210.102	-209.893	-209.704	-209.541	-209.409
Rain & Atmos. Loss, dB	-0.5	-0.5	-0.5	-0.5	-0.5
Fixed Loss, dB	-1	-1	-1	-1	-1
Total Loss, dB	-211.602	-211.393	-211.204	-211.041	-210.909
G/T, dBi/K	16.12128	16.12128	16.12128	16.12128	16.12128
ES Antenna Gain (0.5m) dBi	38.2	38.2	38.2	38.2	38.2
ES Temp. (rain) dB	21.57871	21.57871	21.57871	21.57871	21.57871
C/T, dB/K	-143.331	-143.332	-143.342	-143.329	-143.328
Data Rate (53 MBps) db	77.2	77.2	77.2	77.2	77.2
Bandwidth (49 MHz) dB	76.9	76.9	76.9	76.9	76.9
Downlink CNR, dB	8.368344	8.367926	8.357133	8.370046	8.371756
Total C/I, dB	14.73799	14.73799	14.73799	14.73799	14.66302
Total Downlink CNR, dB	4.855458	4.855113	4.850002	4.856862	4.850308
Downlink Eb/No, dB	4.505458	4.505113	4.500002	4.506862	4.500308
PFD per MHz	-123.686	-123.686	-123.697	-123.684	-123.682

Figure A-5c. Link Performance, 0.5 meter ES, 98 Percentile Uplink Rain, Clear Sky Downlink, 53 MBps, Low Band.

Elevation, degrees	20	30	40	50	60
Slant Range, Km.	39555	38612	37780	37078	36520
Scan Half Angle, degrees	8.17	7.53	6.65	5.58	4.34
Crane Model Region (0.995)	A	B	D2	E	H
Earth To Space, ES-to-Satellite					
Transmitter Power, dBW	19.26	18.15	20.66	22.4	25.49
Output Loss, dB	-1	-1	-1	-1	-1
Pwr Density dBW/Hz	-58.64	-59.75	-57.24	-55.5	-52.41
Antenna Gain (0.7m) dBi	44.7	44.7	44.7	44.7	44.7
Eirp, peak, dBW	62.96	61.85	64.36	66.1	69.19
Pointing Loss, dB	-0.5	-0.5	-0.5	-0.5	-0.5
Eirp, dBW	62.46	61.35	63.86	65.6	68.69
Eirp Density, dBW/Hz	-13.94	-15.05	-12.54	-10.8	-7.71
Frequency, GHz	29.2	29.2	29.2	29.2	29.2
Space Loss, dB	-213.699	-213.489	-213.300	-213.137	-213.006
Loss, dB	-9	-8.1	-10.8	-12.7	-15.9
Total Loss, dB	-222.699	-221.589	-224.100	-225.837	-228.906
G/T, EOC, dBi/K	17.6	17.6	17.6	17.6	17.6
Sat. Temp., dB	28.6	28.6	28.6	28.6	28.6
Antenna Gain, peak, dBi	50.2	50.2	50.2	50.2	50.2
C/T, dB/K	-142.639	-142.639	-142.640	-142.637	-142.616
Data Rate (53MBps) dB	77.2	77.2	77.2	77.2	77.2
Bandwidth (49 MHz) dB	76.9	76.9	76.9	76.9	76.9
Uplink CNR, dB	9.060546	9.060128	9.059335	9.062248	9.083959
Total C/I, dB	16.27285	16.27285	16.27285	16.27285	16.16648
Total Uplink CNR, dB	8.305052	8.304701	8.304034	8.306482	8.307481
Space To Earth, Satellite-to-ES					
Transmitter Power, dBW	10.12	9.47	10.97	11.97	13.42
Output Loss, dB	-1	-1	-1	-1	-1
Pwr. Density, dBW/Hz	-67.78	-68.43	-66.93	-65.93	-64.48
Antenna Gain, EOC, dBi	46.2	46.2	46.2	46.2	46.2
Eirp, EOC, dBW	55.32	54.67	56.17	57.17	58.62
Eirp, max, dBW	59.32	58.67	60.17	61.17	62.62
Eirp Density, dBW/Hz	-17.58	-18.23	-16.73	-15.73	-14.28
Frequency, GHz	19.3	19.3	19.3	19.3	19.3
Space Loss, dB	-210.102	-209.893	-209.704	-209.541	-209.409
Rain & Atmos. Loss, dB	-3.7	-3.4	-4.6	-5.5	-6.8
Fixed Loss, dB	-1	-1	-1	-1	-1
Total Loss, dB	-214.802	-214.293	-215.304	-216.041	-217.209
G/T, dBi/K	16.15031	16.29047	15.80358	15.54081	15.26341
ES Antenna Gain (0.7m) dBi	41.1	41.1	41.1	41.1	41.1
ES Temp. (rain) dB	24.44968	24.30952	24.79641	25.05918	25.33658
C/T, dB/K	-143.332	-143.332	-143.330	-143.330	-143.326
Data Rate (53 MBps) db	77.2	77.2	77.2	77.2	77.2
Bandwidth (49 MHz) dB	76.9	76.9	76.9	76.9	76.9
Downlink CNR, dB	8.367372	8.367114	8.369426	8.369572	8.373887
Total C/I, dB	14.73799	14.73799	14.73799	14.73799	14.66302
Total Downlink CNR, dB	4.855025	4.854752	4.855480	4.856651	4.851255
Downlink Eb/No, dB	4.505025	4.504752	4.505480	4.506651	4.501255
PFD per MHz	-120.516	-120.956	-119.267	-118.104	-116.522

Figure A-6a. Link Performance, 0.7 meter ES, Crane Model Rain, 53 MBps, Low Band.

Elevation, degrees	20	30	40	50	60
Slant Range, Km.	39555	38612	37780	37078	36520
Scan Half Angle, degrees	8.17	7.53	6.65	5.58	4.34
Crane Model Region (0.995)	A	B	D2	E	H
Earth To Space, ES-to-Satellite					
Transmitter Power, dBW	11.26	11.05	10.86	10.7	10.59
Output Loss, dB	-1	-1	-1	-1	-1
Pwr Density dBW/Hz	-66.64	-66.85	-67.04	-67.2	-67.31
Antenna Gain (0.7m) dBi	44.7	44.7	44.7	44.7	44.7
Eirp, peak, dBW	54.96	54.75	54.56	54.4	54.29
Pointing Loss, dB	-0.5	-0.5	-0.5	-0.5	-0.5
Eirp, dBW	54.46	54.25	54.06	53.9	53.79
Eirp Density, dBW/Hz	-21.94	-22.15	-22.34	-22.5	-22.61
Frequency, GHz	29.2	29.2	29.2	29.2	29.2
Space Loss, dB	-213.699	-213.489	-213.300	-213.137	-213.006
Loss, dB	-1	-1	-1	-1	-1
Total Loss, dB	-214.699	-214.489	-214.300	-214.137	-214.006
G/T, EOC, dBi/K	17.6	17.6	17.6	17.6	17.6
Sat. Temp., dB	28.6	28.6	28.6	28.6	28.6
Antenna Gain, peak, dBi	50.2	50.2	50.2	50.2	50.2
C/T, dB/K	-142.639	-142.639	-142.640	-142.637	-142.616
Data Rate (53MBps) dB	77.2	77.2	77.2	77.2	77.2
Bandwidth (49 MHz) dB	76.9	76.9	76.9	76.9	76.9
Uplink CNR, dB	9.060546	9.060128	9.059335	9.062248	9.083959
Total C/I, dB	16.27285	16.27285	16.27285	16.27285	16.16648
Total Uplink CNR, dB	8.305052	8.304701	8.304034	8.306482	8.307481
Space To Earth, Satellite-to-ES					
Transmitter Power, dBW	4.05	3.84	3.64	3.49	3.36
Output Loss, dB	-1	-1	-1	-1	-1
Pwr. Density, dBW/Hz	-73.85	-74.06	-74.26	-74.41	-74.54
Antenna Gain, EOC, dBi	46.2	46.2	46.2	46.2	46.2
Eirp, EOC, dBW	49.25	49.04	48.84	48.69	48.56
Eirp, max, dBW	53.25	53.04	52.84	52.69	52.56
Eirp Density, dBW/Hz	-23.65	-23.86	-24.06	-24.21	-24.34
Frequency, GHz	19.3	19.3	19.3	19.3	19.3
Space Loss, dB	-210.102	-209.893	-209.704	-209.541	-209.409
Rain & Atmos. Loss, dB	-0.5	-0.5	-0.5	-0.5	-0.5
Fixed Loss, dB	-1	-1	-1	-1	-1
Total Loss, dB	-211.602	-211.393	-211.204	-211.041	-210.909
G/T, dBi/K	19.02128	19.02128	19.02128	19.02128	19.02128
ES Antenna Gain (0.7m) dBi	41.1	41.1	41.1	41.1	41.1
ES Temp., dB	21.57871	21.57871	21.57871	21.57871	21.57871
C/T, dB/K	-143.331	-143.332	-143.342	-143.329	-143.328
Data Rate (53 MBps) db	77.2	77.2	77.2	77.2	77.2
Bandwidth (49 MHz) dB	76.9	76.9	76.9	76.9	76.9
Downlink CNR, dB	8.368344	8.367926	8.357133	8.370046	8.371756
Total C/I, dB	14.73799	14.73799	14.73799	14.73799	14.66302
Total Downlink CNR, dB	4.855458	4.855113	4.850002	4.856862	4.850308
Downlink Eb/No, dB	4.505458	4.505113	4.500002	4.506862	4.500308
PFD per MHz	-126.586	-126.586	-126.597	-126.584	-126.582

Figure A-6b. Link Performance, 0.7 meter ES, Clear Sky, 53 MBps, Low Band.

Elevation, degrees	20	30	40	50	60
Slant Range, Km.	39555	38612	37780	37078	36520
Scan Half Angle, degrees	8.17	7.53	6.65	5.58	4.34
Crane Model Region (0.995)	A	B	D2	E	H
Earth To Space, ES-to-Satellite					
Transmitter Power, dBW	15.06	14.45	14.46	13.6	13.79
Output Loss, dB	-1	-1	-1	-1	-1
Pwr Density dBW/Hz	-62.84	-63.45	-63.44	-64.3	-64.11
Antenna Gain (0.7) dBi	44.7	44.7	44.7	44.7	44.7
Eirp, peak, dBW	58.76	58.15	58.16	57.3	57.49
Pointing Loss, dB	-0.5	-0.5	-0.5	-0.5	-0.5
Eirp, dBW	58.26	57.65	57.66	56.8	56.99
Eirp Density, dBW/Hz	-18.14	-18.75	-18.74	-19.6	-19.41
Frequency, GHz	29.2	29.2	29.2	29.2	29.2
Space Loss, dB	-213.699	-213.489	-213.300	-213.137	-213.006
Loss, dB	-4.8	-4.4	-4.6	-3.9	-4.2
Total Loss, dB	-218.499	-217.889	-217.900	-217.037	-217.206
G/T, EOC, dBi/K	17.6	17.6	17.6	17.6	17.6
Sat. Temp., dB	28.6	28.6	28.6	28.6	28.6
Antenna Gain, peak, dBi	50.2	50.2	50.2	50.2	50.2
C/T, dB/K	-142.639	-142.639	-142.640	-142.637	-142.616
Data Rate (53MBps) dB	77.2	77.2	77.2	77.2	77.2
Bandwidth (49 MHz) dB	76.9	76.9	76.9	76.9	76.9
Uplink CNR, dB	9.060546	9.060128	9.059335	9.062248	9.083959
Total C/I, dB	16.27285	16.27285	16.27285	16.27285	16.16648
Total Uplink CNR, dB	8.305052	8.304701	8.304034	8.306482	8.307481
Space To Earth, Satellite-to-ES					
Transmitter Power, dBW	4.05	3.84	3.64	3.49	3.36
Output Loss, dB	-1	-1	-1	-1	-1
Pwr. Density, dBW/Hz	-73.85	-74.06	-74.26	-74.41	-74.54
Antenna Gain, EOC, dBi	46.2	46.2	46.2	46.2	46.2
Eirp, EOC, dBW	49.25	49.04	48.84	48.69	48.56
Eirp, max, dBW	53.25	53.04	52.84	52.69	52.56
Eirp Density, dBW/Hz	-23.65	-23.86	-24.06	-24.21	-24.34
Frequency, GHz	19.3	19.3	19.3	19.3	19.3
Space Loss, dB	-210.102	-209.893	-209.704	-209.541	-209.409
Rain & Atmos. Loss, dB	-0.5	-0.5	-0.5	-0.5	-0.5
Fixed Loss, dB	-1	-1	-1	-1	-1
Total Loss, dB	-211.602	-211.393	-211.204	-211.041	-210.909
G/T, dBi/K	19.02128	19.02128	19.02128	19.02128	19.02128
ES Antenna Gain (0.7m) dBi	41.1	41.1	41.1	41.1	41.1
ES Temp. (rain) dB	21.57871	21.57871	21.57871	21.57871	21.57871
C/T, dB/K	-143.331	-143.332	-143.342	-143.329	-143.328
Data Rate (53 MBps) db	77.2	77.2	77.2	77.2	77.2
Bandwidth (49 MHz) dB	76.9	76.9	76.9	76.9	76.9
Downlink CNR, dB	8.368344	8.367926	8.357133	8.370046	8.371756
Total C/I, dB	14.73799	14.73799	14.73799	14.73799	14.66302
Total Downlink CNR, dB	4.855458	4.855113	4.850002	4.856862	4.850308
Downlink Eb/No, dB	4.505458	4.505113	4.500002	4.506862	4.500308
PFD per MHz	-126.586	-126.586	-126.597	-126.584	-126.582

Figure A-6c. Link Performance, 0.7 meter ES, 98 Percentile Uplink Rain, Clear Sky Downlink, 53 MBps, Low Band.

Elevation, degrees	20	30	40	50	60
Slant Range, Km.	39555	38612	37780	37078	36520
Scan Half Angle, degrees	8.17	7.53	6.65	5.58	4.34
Crane Model Region (0.995)	A	B	D2	E	H
Earth To Space, ES-to-Satellite					
Transmitter Power, dBW	6.6	5.49	8	9.74	12.83
Output Loss, dB	-1	-1	-1	-1	-1
Pwr Density dBW/Hz	-55.9	-57.01	-54.5	-52.76	-49.67
Antenna Gain (0.5m) dBi	41.8	41.8	41.8	41.8	41.8
Eirp, peak, dBW	47.4	46.29	48.8	50.54	53.63
Pointing Loss, dB	-0.5	-0.5	-0.5	-0.5	-0.5
Eirp, dBW	46.9	45.79	48.3	50.04	53.13
Eirp Density, dBW/Hz	-14.1	-15.21	-12.7	-10.96	-7.87
Frequency, GHz	29.2	29.2	29.2	29.2	29.2
Space Loss, dB	-213.699	-213.489	-213.300	-213.137	-213.006
Loss, dB	-9	-8.1	-10.8	-12.7	-15.9
Total Loss, dB	-222.699	-221.589	-224.100	-225.837	-228.906
G/T, EOC, dBi/K	17.6	17.6	17.6	17.6	17.6
Sat. Temp., dB	28.6	28.6	28.6	28.6	28.6
Antenna Gain, peak, dBi	50.2	50.2	50.2	50.2	50.2
C/T, dB/K	-158.199	-158.199	-158.200	-158.197	-158.176
Data Rate (1.544MBps) dB	61.9	61.9	61.9	61.9	61.9
Bandwidth (1.43 MHz) dB	61.5	61.5	61.5	61.5	61.5
Uplink CNR, dB	8.900546	8.900128	8.899335	8.902248	8.923959
Total C/I, dB	17.22544	17.22544	17.22544	17.22544	17.09338
Total Uplink CNR, dB	8.304665	8.304301	8.303609	8.306149	8.307830
Space To Earth, Satellite-to-ES					
Transmitter Power, dBW	-2.51	-3.16	-1.66	-0.66	0.79
Output Loss, dB	-1	-1	-1	-1	-1
Pwr. Density, dBW/Hz	-65.01	-65.66	-64.16	-63.16	-61.71
Antenna Gain, EOC, dBi	46.2	46.2	46.2	46.2	46.2
Eirp, EOC, dBW	42.69	42.04	43.54	44.54	45.99
Eirp, max, dBW	46.69	46.04	47.54	48.54	49.99
Eirp Density, dBW/Hz	-14.81	-15.46	-13.96	-12.96	-11.51
Frequency, GHz	19.3	19.3	19.3	19.3	19.3
Space Loss, dB	-210.102	-209.893	-209.704	-209.541	-209.409
Rain & Atmos. Loss, dB	-3.7	-3.4	-4.6	-5.5	-6.8
Fixed Loss, dB	-1	-1	-1	-1	-1
Total Loss, dB	-214.802	-214.293	-215.304	-216.041	-217.209
G/T, dBi/K	13.25031	13.39047	12.90358	12.64081	12.36341
ES Antenna Gain (0.5m) dBi	38.2	38.2	38.2	38.2	38.2
ES Temp. (rain) dB	24.44968	24.30952	24.79641	25.05918	25.33658
C/T, dB/K	-158.862	-158.862	-158.860	-158.860	-158.856
Data Rate (1.544 MBps) db	61.9	61.9	61.9	61.9	61.9
Bandwidth (1.43 MHz) dB	61.5	61.5	61.5	61.5	61.5
Downlink CNR, dB	8.237372	8.237114	8.239426	8.239572	8.243887
Total C/I, dB	15.38452	15.38452	15.38452	15.38452	15.29763
Total Downlink CNR, dB	4.857783	4.857500	4.858249	4.859464	4.854431
Downlink Eb/No, dB	4.507783	4.507500	4.508249	4.509464	4.504431
PFD per MHz	-117.746	-118.186	-116.497	-115.334	-113.752

Figure A-7a. Link Performance, 0.5 meter ES, Crane Model Rain, 1.54 MBps, High Or Low Band.

Elevation, degrees	20	30	40	50	60
Slant Range, Km.	39555	38612	37780	37078	36520
Scan Half Angle, degrees	8.17	7.53	6.65	5.58	4.34
Crane Model Region (0.995)	A	B	D2	E	H
Earth To Space, ES-to-Satellite					
Transmitter Power, dBW	-1.4	-1.61	-1.8	-1.96	-2.07
Output Loss, dB	-1	-1	-1	-1	-1
Pwr Density dBW/Hz	-63.9	-64.11	-64.3	-64.46	-64.57
Antenna Gain (0.5m) dBi	41.8	41.8	41.8	41.8	41.8
Eirp, peak, dBW	39.4	39.19	39	38.84	38.73
Pointing Loss, dB	-0.5	-0.5	-0.5	-0.5	-0.5
Eirp, dBW	38.9	38.69	38.5	38.34	38.23
Eirp Density, dBW/Hz	-22.1	-22.31	-22.5	-22.66	-22.77
Frequency, GHz	29.2	29.2	29.2	29.2	29.2
Space Loss, dB	-213.699	-213.489	-213.300	-213.137	-213.006
Loss, dB	-1	-1	-1	-1	-1
Total Loss, dB	-214.699	-214.489	-214.300	-214.137	-214.006
G/T, EOC, dBi/K	17.6	17.6	17.6	17.6	17.6
Sat. Temp., dB	28.6	28.6	28.6	28.6	28.6
Antenna Gain, peak, dBi	50.2	50.2	50.2	50.2	50.2
C/T, dB/K	-158.199	-158.199	-158.200	-158.197	-158.176
Data Rate (1.544MBps) dB	61.9	61.9	61.9	61.9	61.9
Bandwidth (1.43 MHz) dB	61.5	61.5	61.5	61.5	61.5
Uplink CNR, dB	8.900546	8.900128	8.899335	8.902248	8.923959
Total C/I, dB	17.22544	17.22544	17.22544	17.22544	17.09338
Total Uplink CNR, dB	8.304665	8.304301	8.303609	8.306149	8.307830
Space To Earth, Satellite-to-ES					
Transmitter Power, dBW	-8.58	-8.79	-8.99	-9.14	-9.27
Output Loss, dB	-1	-1	-1	-1	-1
Pwr. Density, dBW/Hz	-71.08	-71.29	-71.49	-71.64	-71.77
Antenna Gain, EOC, dBi	46.2	46.2	46.2	46.2	46.2
Eirp, EOC, dBW	36.62	36.41	36.21	36.06	35.93
Eirp, max, dBW	40.62	40.41	40.21	40.06	39.93
Eirp Density, dBW/Hz	-20.88	-21.09	-21.29	-21.44	-21.57
Frequency, GHz	19.3	19.3	19.3	19.3	19.3
Space Loss, dB	-210.102	-209.893	-209.704	-209.541	-209.409
Rain & Atmos. Loss, dB	-0.5	-0.5	-0.5	-0.5	-0.5
Fixed Loss, dB	-1	-1	-1	-1	-1
Total Loss, dB	-211.602	-211.393	-211.204	-211.041	-210.909
G/T, dBi/K	16.12128	16.12128	16.12128	16.12128	16.12128
ES Antenna Gain (0.5m) dBi	38.2	38.2	38.2	38.2	38.2
ES Temp., dB	21.57871	21.57871	21.57871	21.57871	21.57871
C/T, dB/K	-158.861	-158.862	-158.872	-158.859	-158.858
Data Rate (1.544 MBps) db	61.9	61.9	61.9	61.9	61.9
Bandwidth (1.43 MHz) dB	61.5	61.5	61.5	61.5	61.5
Downlink CNR, dB	8.238344	8.237926	8.227133	8.240046	8.241756
Total C/I, dB	15.38452	15.38452	15.38452	15.38452	15.29763
Total Downlink CNR, dB	4.858229	4.857873	4.852601	4.859682	4.853454
Downlink Eb/No, dB	4.508229	4.507873	4.502601	4.509682	4.503454
PFD per MHz	-123.816	-123.816	-123.827	-123.814	-123.812

Figure A-7b. Link Performance, 0.5 meter ES, Clear Sky, 1.544 MBps, High Or Low Band.

Elevation, degrees	20	30	40	50	60
Slant Range, Km.	39555	38612	37780	37078	36520
Scan Half Angle, degrees	8.17	7.53	6.65	5.58	4.34
Crane Model Region (0.995)	A	B	D2	E	H
Earth To Space, ES-to-Satellite					
Transmitter Power, dBW	2.4	1.79	1.8	0.94	1.13
Output Loss, dB	-1	-1	-1	-1	-1
Pwr Density dBW/Hz	-60.1	-60.71	-60.7	-61.56	-61.37
Antenna Gain (0.5) dBi	41.8	41.8	41.8	41.8	41.8
Eirp, peak, dBW	43.2	42.59	42.6	41.74	41.93
Pointing Loss, dB	-0.5	-0.5	-0.5	-0.5	-0.5
Eirp, dBW	42.7	42.09	42.1	41.24	41.43
Eirp Density, dBW/Hz	-18.3	-18.91	-18.9	-19.76	-19.57
Frequency, GHz	29.2	29.2	29.2	29.2	29.2
Space Loss, dB	-213.699	-213.489	-213.300	-213.137	-213.006
Loss, dB	-4.8	-4.4	-4.6	-3.9	-4.2
Total Loss, dB	-218.499	-217.889	-217.900	-217.037	-217.206
G/T, EOC, dBi/K	17.6	17.6	17.6	17.6	17.6
Sat. Temp., dB	28.6	28.6	28.6	28.6	28.6
Antenna Gain, peak, dBi	50.2	50.2	50.2	50.2	50.2
C/T, dB/K	-158.199	-158.199	-158.200	-158.197	-158.176
Data Rate (1.544MBps) dB	61.9	61.9	61.9	61.9	61.9
Bandwidth (1.43 MHz) dB	61.5	61.5	61.5	61.5	61.5
Uplink CNR, dB	8.900546	8.900128	8.899335	8.902248	8.923959
Total C/I, dB	17.22544	17.22544	17.22544	17.22544	17.09338
Total Uplink CNR, dB	8.304665	8.304301	8.303609	8.306149	8.307830
Space To Earth, Satellite-to-ES					
Transmitter Power, dBW	-8.58	-8.79	-8.99	-9.14	-9.27
Output Loss, dB	-1	-1	-1	-1	-1
Pwr. Density, dBW/Hz	-71.08	-71.29	-71.49	-71.64	-71.77
Antenna Gain, EOC, dBi	46.2	46.2	46.2	46.2	46.2
Eirp, EOC, dBW	36.62	36.41	36.21	36.06	35.93
Eirp, max, dBW	40.62	40.41	40.21	40.06	39.93
Eirp Density, dBW/Hz	-20.88	-21.09	-21.29	-21.44	-21.57
Frequency, GHz	19.3	19.3	19.3	19.3	19.3
Space Loss, dB	-210.102	-209.893	-209.704	-209.541	-209.409
Rain & Atmos. Loss, dB	-0.5	-0.5	-0.5	-0.5	-0.5
Fixed Loss, dB	-1	-1	-1	-1	-1
Total Loss, dB	-211.602	-211.393	-211.204	-211.041	-210.909
G/T, dBi/K	16.12128	16.12128	16.12128	16.12128	16.12128
ES Antenna Gain (0.5m) dBi	38.2	38.2	38.2	38.2	38.2
ES Temp. (rain) dB	21.57871	21.57871	21.57871	21.57871	21.57871
C/T, dB/K	-158.861	-158.862	-158.872	-158.859	-158.858
Data Rate (1.544 MBps) db	61.9	61.9	61.9	61.9	61.9
Bandwidth (1.43 MHz) dB	61.5	61.5	61.5	61.5	61.5
Downlink CNR, dB	8.238344	8.237926	8.227133	8.240046	8.241756
Total C/I, dB	15.38452	15.38452	15.38452	15.38452	15.29763
Total Downlink CNR, dB	4.858229	4.857873	4.852601	4.859682	4.853454
Downlink Eb/No, dB	4.508229	4.507873	4.502601	4.509682	4.503454
PFD per MHz	-123.816	-123.816	-123.827	-123.814	-123.812

Figure A-7c. Link Performance, 0.5 meter ES, 98 Percentile Uplink Rain, Clear Sky Downlink, 1.544 MBps, High Or Low Band.

Elevation, degrees	20	30	40	50	60
Slant Range, Km.	39555	38612	37780	37078	36520
Scan Half Angle, degrees	8.17	7.53	6.65	5.58	4.34
Crane Model Region (0.995)	A	B	D2	E	H
Earth To Space, ES-to-Satellite					
Transmitter Power, dBW	6.6	5.49	8	9.74	12.83
Output Loss, dB	-1	-1	-1	-1	-1
Pwr Density dBW/Hz	-55.9	-57.01	-54.5	-52.76	-49.67
Antenna Gain (0.5m) dBi	41.8	41.8	41.8	41.8	41.8
Eirp, peak, dBW	47.4	46.29	48.8	50.54	53.63
Pointing Loss, dB	-0.5	-0.5	-0.5	-0.5	-0.5
Eirp, dBW	46.9	45.79	48.3	50.04	53.13
Eirp Density, dBW/Hz	-14.1	-15.21	-12.7	-10.96	-7.87
Frequency, GHz	29.2	29.2	29.2	29.2	29.2
Space Loss, dB	-213.699	-213.489	-213.300	-213.137	-213.006
Loss, dB	-9	-8.1	-10.8	-12.7	-15.9
Total Loss, dB	-222.699	-221.589	-224.100	-225.837	-228.906
G/T, EOC, dBi/K	17.6	17.6	17.6	17.6	17.6
Sat. Temp., dB	28.6	28.6	28.6	28.6	28.6
Antenna Gain, peak, dBi	50.2	50.2	50.2	50.2	50.2
C/T, dB/K	-158.199	-158.199	-158.200	-158.197	-158.176
Data Rate (1.544MBps) dB	61.9	61.9	61.9	61.9	61.9
Bandwidth (1.43 MHz) dB	61.5	61.5	61.5	61.5	61.5
Uplink CNR, dB	8.900546	8.900128	8.899335	8.902248	8.923959
Total C/I, dB	17.22544	17.22544	17.22544	17.22544	17.09338
Total Uplink CNR, dB	8.304665	8.304301	8.303609	8.306149	8.307830
Space To Earth, Satellite-to-ES					
Transmitter Power, dBW	-2.51	-3.16	-1.66	-0.66	0.79
Output Loss, dB	-1	-1	-1	-1	-1
Pwr. Density, dBW/Hz	-65.01	-65.66	-64.16	-63.16	-61.71
Antenna Gain, EOC, dBi	46.2	46.2	46.2	46.2	46.2
Eirp, EOC, dBW	42.69	42.04	43.54	44.54	45.99
Eirp, max, dBW	46.69	46.04	47.54	48.54	49.99
Eirp Density, dBW/Hz	-14.81	-15.46	-13.96	-12.96	-11.51
Frequency, GHz	19.3	19.3	19.3	19.3	19.3
Space Loss, dB	-210.102	-209.893	-209.704	-209.541	-209.409
Rain & Atmos. Loss, dB	-3.7	-3.4	-4.6	-5.5	-6.8
Fixed Loss, dB	-1	-1	-1	-1	-1
Total Loss, dB	-214.802	-214.293	-215.304	-216.041	-217.209
G/T, dBi/K	13.25031	13.39047	12.90358	12.64081	12.36341
ES Antenna Gain (0.5m) dBi	38.2	38.2	38.2	38.2	38.2
ES Temp. (rain) dB	24.44968	24.30952	24.79641	25.05918	25.33658
C/T, dB/K	-158.862	-158.862	-158.860	-158.860	-158.856
Data Rate (1.544 MBps) db	61.9	61.9	61.9	61.9	61.9
Bandwidth (1.43 MHz) dB	61.5	61.5	61.5	61.5	61.5
Downlink CNR, dB	8.237372	8.237114	8.239426	8.239572	8.243887
Total C/I, dB	15.38452	15.38452	15.38452	15.38452	15.29763
Total Downlink CNR, dB	4.857783	4.857500	4.858249	4.859464	4.854431
Downlink Eb/No, dB	4.507783	4.507500	4.508249	4.509464	4.504431
PFD per MHz	-117.746	-118.186	-116.497	-115.334	-113.752

Figure A-7a. Link Performance, 0.5 meter ES, Crane Model Rain, 1.544 MBps, High Or Low Band.

APPENDIX B

FCC FORM 312

FCC 312
Main Form

FEDERAL COMMUNICATIONS COMMISSION
APPLICATION FOR SATELLITE SPACE AND EARTH STATION AUTHORIZATIONS

Approved by OMB 3060-0678
Est. Avg Burden Hours Per Response: 10 Hrs

FCC Use Only
File Number:
Call Sign:

PAYOR AND FILING FEE INFORMATION

a. Payor Name: Fisher Wayland Cooper Leader & Zaragoza L.L.P.				b. Daytime Telephone Number: (202) 659-3494
c. Mailing Street Address or P.O. Box: 2001 Pennsylvania Avenue, N.W., Suite 400				d. FCC Account Number: 0530190523
e. City: Washington		f. State: DC	g. Zip Code: 20006	h. Country Code (if not U.S.A.)
i. Payment Type Code: BNY	j. Quantity: 5	k. Fee Due for Payment Type Code in (i): $85,045	l. Total Amount Paid: $425,225	FCC Use Only

APPLICANT INFORMATION

1. Legal Name of Applicant: Pegasus Development Corporation			2. Voice Telephone Number: (610) 341-0766
3. Other Name Used for Doing Business (if any)			4. Fax Telephone Number: (610) 341-1835
5. Mailing Street Address or P.O. Box: 5 Radnor Corporate Center, Suite 454 100 Matsonford Road ATTENTION:		6. City: Radnor	
		7. State / Country (if not U.S.A.): PA	8. Zip Code: 19087
9. Name of Contact Representative (If other than applicant): Bruce D. Jacobs			10. Voice Telephone Number: (202) 659-3494
11. Firm or Company Name: Fisher Wayland Cooper Leader & Zaragoza L.L.P.			12. Fax Telephone Number: (202) 296-6518
13. Mailing Street Address or P.O. Box: 2001 Pennsylvania Avenue, N.W., Suite 400 ATTENTION:		14. City: Washington	
		15. State / Country (if not U.S.A.): DC	16. Zip Code: 20006

CLASSIFICATION OF FILING

17. Place an "X" in the box next to the classification that applies to this filing for both questions a. and b. Mark only one box for 17a and only one box for 17b.

- [ ] a1. Earth Station
- [X] a2. Space Station

- [X] b1. Application for License of New Station
- [ ] b2. Application for Registration of New Domestic Receive-Only Station
- [ ] b3. Amendment to a Pending Application
- [ ] b4. Modification of License or Registration
- [ ] b5. Assignment of License or Registration
- [ ] b6. Transfer of Control of License or Registration
- [ ] b7. Notification of Minor Modification
- [ ] b8. Other (Please Specify): _____

18. If this filing is in reference to an existing station, enter:
Call sign of station: N/A

19. If this filing is an amendment to a pending application enter:
(a) Date pending application was filed: N/A
(b) File number of pending application:

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.

[X] a. Fixed Satellite [ ] b. Mobile Satellite [ ] c. Radiodetermination Satellite [ ] d. Earth Exploration Satellite [ ] e. Other (please specify) _____

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

[ ] a. Common Carrier [X] b. Non-Common Carrier

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

[ ] a. Using U.S. licensed satellites [ ] b. Using Non-U.S. licensed satellites

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 N/A

24. FREQUENCY BAND(S): Place an "X" in the box(es) next to all applicable frequency band(s). TT&C: Ku Band (12/14 GHz) ISL Links: 50-70 GHz

[ ] a. C-Band (4/6 GHz) Ka Band: 28.35-28.6 GHz, 29.25-29.5 GHz, 29.5-30 GHz, 17.7-18.8 GHz, 19.7-20.2 GHz

[X] b. Ku-Band (12/14 GHz) [X] 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 [X] 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 N/A

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.

N/A

[ ] a -- authorization to add new emission designator and related service
[ ] b -- authorization to change emission designator and related service
[ ] c -- authorization to increase EIRP and EIRP density
[ ] d -- authorization to replace antenna
[ ] e -- authorization to add antenna
[ ] f -- authorization to relocate fixed station
[ ] g -- authorization to change assigned frequency(ies)
[ ] h -- authorization to add Points of Communication (satellites & countries)
[ ] i -- authorization to change Points of Communication (satellites & countries)
[ ] j -- authorization for facilities for which environmental assessment and radiation hazard reporting is required
[ ] 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? [ ] YES [X] NO

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 Exhibit A to this application.

A Radiation Hazard Study must accompany all applications as Exhibit B 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?	☐ YES	☒ NO
30. Is the applicant an alien or the representative of an alien?	☐ YES	☒ NO
31. Is the applicant a corporation organized under the laws of any foreign government?	☐ YES	☒ 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?	☐ YES	☒ 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?	☐ YES	☒ NO
34. If any answer to questions 29, 30, 31, 32 and/or 33 is Yes, attach as Exhibit C an 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 Exhibit D, copies of the requests for waivers or exceptions with supporting documents.	☒ YES	☐ 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 Exhibit E, an explanation of the circumstances.	☐ YES	☒ 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?	☐ YES	☒ 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?	☐ YES	☒ 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 preceeding two items?	☐ YES	☒ NO
40. 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.	☒ YES	☐ NO

41. Description. (Summarize the nature of the application and the services to be provided).

Pegasus Development Corporation proposes to launch and operate the Pegasus I Satellite System in the Ka Band to provide high data rate wideband communications services.

CERTIFICATION

The Applicant waives any claim to the use of any particular frequency or of the electromagnetic spectrum as against the regulatory power of the United States because of the previous use of the same, whether by license or otherwise, and requests an authorization in accordance with this application. The applicant certifies that grant of this application would not cause the applicant to be in violation of the spectrum aggregation limit in 47 CFR Part 20. All statements made in exhibits are a material part hereof and are incorporated herein as if set out in full in this application. The undersigned, individually and for the applicant, hereby certifies that all statements made in this application and in all attached exhibits are true, complete and correct to the best of his or her knowledge and belief, and are made in good faith.

42. Applicant is a (an): (Place an "X" in the box next to applicable response.)

☐ a. Individual ☐ b. Unincorporated Association ☐ c. Partnership ☒ d. Corporation ☐ e. Governmental Entity ☐ f. Other (Please specify) _____

43. Typed Name of Person Signing	44. Title of Person Signing
Nicholas A. Pagon	President

45. Signature	46. Date
Nicholas A. Pagon	December 22, 1997

WILLFUL FALSE STATEMENTS MADE ON THIS FORM ARE PUNISHABLE BY FINE AND/OR IMPRISONMENT (U.S. Code, Title 18, Section 1001), AND/OR REVOCATION OF ANY STATION AUTHORIZATION (U.S. Code, Title 47, Section 312(a)(1)), AND/OR FORFEITURE (U.S. Code, Title 47, Section 503).

WAIVER

Waiver for Filing Fee

The identical technical design of the satellites at each orbital location permits Pegasus Development Corporation to file a geostationary satellite application fee for each orbital location, pursuant to waiver of Section 1.1107(9) of the Commission's rules. See Public Notice, 76181 (August 26, 1997).

APPENDIX C

BALANCE SHEET FOR
PEGASUS COMMUNICATIONS CORPORATION

Pegasus Communications Corporation

Consolidated Balance Sheets

	December 31, 1996	September 30, 1997 (unaudited)
ASSETS		
Current assets:		
Cash and cash equivalents	$8,582,369	$34,210,959
Restricted cash	-	1,181,306
Accounts receivable, less allowance for doubtful accounts of $243,000 and $346,000, respectively	9,155,545	10,577,322
Program rights	1,289,437	1,588,392
Inventory	697,957	759,638
Deferred taxes	1,290,397	1,290,397
Prepaid expenses and other	851,592	1,250,836
Total current assets	21,867,297	50,858,850
Property and equipment, net	24,115,138	27,423,266
Intangible assets, net	126,236,128	237,511,764
Program rights	1,294,985	1,747,621
Deposits and other	166,498	199,404
Total assets	$173,680,046	$317,740,905
LIABILITIES AND TOTAL EQUITY		
Current liabilities:		
Notes payable	$48,610	
Current portion of long-term debt	315,223	$4,894,945
Accounts payable	5,075,981	5,705,241
Accrued interest	5,592,083	3,456,814
Accrued expenses	3,803,993	3,738,944
Current portion of program rights payable	601,205	897,687
Total current liabilities	15,437,095	18,693,631
Long-term debt, net	115,211,610	152,423,965
Program rights payable	1,365,284	1,242,102
Deferred taxes	1,339,859	1,389,859
Total liabilities	133,353,848	173,749,557
Commitments and contingent liabilities	-	-
Minority interest	-	3,000,000
Series A preferred stock	-	108,677,500
Common stockholders' equity:		
Class A common stock	46,632	53,425
Class B common stock	45,819	45,819
Additional paid-in capital	57,736,011	57,017,011
Accumulated deficit	(17,502,264)	(24,802,407)
Total common stockholders' equity	40,326,198	32,313,848
Total liabilities and stockholders' equity	$173,680,046	$317,740,905

This balance sheet is from the Securities and Exchange Commission 10-Q filed by Pegasus Communications Corporation for the period ending September 30, 1997. Explanatory notes contained in the 10-Q are excluded here.

APPENDIX D

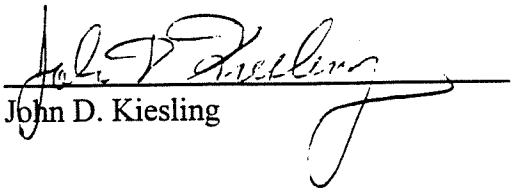
ENGINEER'S CERTIFICATION

Technical Certification

I, John D. Kiesling, Consultant, certify under perjury that:

I am the technically qualified person with overall responsibility for preparation of the technical information contained in the instant application of Pegasus Development Corporation, for a license to operate a communications satellite system in the Ka Band.

I am familiar with the requirements of Part 25 of the Commission's rules, and the information contained in the application is true and correct to the best of my belief.



John D. Kiesling

December 22, 1997