APPENDIX B

FORM 430: COMMON CARRIER AND SATELLITE RADIO LICENSEE QUALIFICATION REPORT

FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

Approved by OMB
3060-0105
Expires 3/31/90

FCC 430

COMMON CARRIER AND SATELLITE RADIO LICENSEE QUALIFICATION REPORT

See reverse side for information regarding public burden statement.

INSTRUCTIONS

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

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

C. Do not submit a fee with this report.

1. Business Name and Address (Number, Street, State and ZIP Code) of Filer's Principal Office:

Orbital Communications Corporation
12500 Fair Lakes Circle
Fairfax, VA 22033

2. (Area Code) Telephone Number: (703) 631-3600

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

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

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

6. List the common carrier and satellite radio services in which Filer has applied or is a current licensee or permittee:

None, other than mobile satellite service applied for herewith.

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

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

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

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

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

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

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

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

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

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

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

See attached Exhibit VI

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

See attached Exhibit VII

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

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

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

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

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

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

11. CERTIFICATION

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

WILLFUL FALSE STATEMENTS MADE ON THIS APPLICATION ARE PUNISHABLE BY FINE AND IMPRISONMENT (U.S. Code, Title 18, Section 1001) and/or REVOCATION OF ANY STATION LICENSE OR CONSTRUCTION PERMIT (U.S. Code, Title 47, Section 312(a)(1)).	Date: 2/28/90	Filer *(Must correspond with that shown in item 1)*: Orbital Communications Corporation	Typed or Printed Name: Leslie C. Seeman
	Signature: [signature]		Title: Secretary

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

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

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

EXHIBIT V

RADIO STATION LICENSES

Orbital Sciences Corporation, which owns 100 percent of the outstanding shares of Orbital Communications Corporation, has been issued four experimental radio licenses as follows:

Fairfax, Virginia	XRFX	KEZXES
Boulder, Colorado	XRFX	KEZXEY
Chesapeake Bay	XRFX	KEZXET
Polar Orbiting Satellite	XRMO	KEZXER

EXHIBIT VI

Orbital Sciences Corporation ("OSC"), a Delaware corporation, owns 100 percent of the outstanding shares of the Filer, Orbital Communications Corporation ("ORBCOMM"). The business address of ORBCOMM is 12500 Fair Lakes Circle, Fairfax, Virginia 22033.

EXHIBIT VII

ORBITAL COMMUNICATIONS CORPORATION
OFFICERS AND DIRECTORS

Directors

David W. Thompson
Bruce W. Ferguson
Scott L. Webster

Officers

President	David W. Thompson
Vice President	Bruce W. Ferguson
Vice President/ Engineering	Antonio L. Elias
Treasurer	Carlton B. Crenshaw
Secretary	Leslie C. Seeman
Assistant Secretary	Karoline K. Hurd

*The business address of these officers and directors is c/o Orbital Sciences Corporation, 12500 Fair Lakes Circle, Fairfax, Virginia 22033.

EXHIBIT VIII

Controlling Corporation

(1) Orbital Communications Corporation ("ORBCOMM") is a wholly-owned subsidiary of Orbital Sciences Corporation ("OSC"). OSC is a space technology company that designs, manufactures, operates and markets a broad range of space products and services. OSC's business address is 12500 Fair Lakes Circle, Fairfax, VA 22033.

(2) & (3) OSC stockholders with holdings of 10% or more:

Name and Address	% of Voting Stock
Orbital Research Partners, L.P.*	51.0%
Hercules Incorporated**	20.0%

The foregoing entities are a United States partnership and a United States corporation, respectively.

*The business address for Orbital Research Partners, L.P. is c/o Orbital Sciences Corporation, 12500 Fair Lakes Circle, Fairfax, Virginia 22033.

**The business address for Hercules Incorporated is Hercules Plaza, Wilmington, Delaware 19894.

(4) OSC Directors:

Name	Position
David W. Thompson*	Chairman of the Board, President and Chief Executive Officer
Bruce W. Ferguson*	Director
Scott L. Webster*	Director
Steven D. Fisher*	Director
Fred. C. Alcorn*	Director
Kelly H. Burke*	Director
James C. Custer*	Director
Daniel J. Fink*	Director
David S. Hollingsworth**	Director
J. Paul Kinloch*	Director
Douglas S. Luke, Jr.*	Director
Thomas O. Paine*	Director
Harrison H. Schmitt*	Director
Richard Schwartz**	Director

*The business address for these directors is c/o Orbital Sciences Corporation, 12500 Fair Lakes Circle, Fairfax, Virginia 22033.

**The business address for Messrs. Hollingsworth and Schwartz is c/o Hercules Incorporated, Hercules Plaza, Wilmington, Delaware 19894.

APPENDIX C

FINANCIAL STATEMENT OF OSC

INDEX TO FINANCIAL STATEMENTS

Consolidated Financial Statements of Orbital Sciences Corporation for Fiscal Years Ended December 31, 1987 and 1988 and for Nine Months Ended September 30, 1989

INDEPENDENT AUDITORS' REPORT

The Board of Directors and Stockholders
Orbital Sciences Corporation:

We have audited the consolidated balance sheet of Orbital Sciences Corporation and subsidiaries as of September 30, 1989 and the related consolidated statements of operations, stockholders' equity, and cash flows for the nine-month period ended September 30, 1989. These consolidated financial statements are the responsibility of the Company's management. Our responsibility is to express an opinion on these consolidated financial statements based on our audit.

We conducted our audit in accordance with generally accepted auditing standards. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements. An audit also includes assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall financial statement presentation. We believe that our audit provides a reasonable basis for our opinion.

In our opinion, the consolidated financial statements referred to above present fairly in all material respects, the financial position of Orbital Sciences Corporation and subsidiaries at September 30, 1989, and the results of their operations and their cash flows for the nine-month period then ended, in conformity with generally accepted accounting principles.

KPMG PEAT MARWICK

Washington, D.C.
February 4, 1990

INDEPENDENT AUDITORS' REPORT

To Orbital Sciences Corporation:

We have audited the accompanying consolidated balance sheet of ORBITAL SCIENCES CORPORATION (a Delaware corporation) and subsidiaries as of December 31, 1988, and the related consolidated statements of operations and stockholders' equity for each of the two years in the period then ended, the consolidated statement of cash flows for the year ended December 31, 1988, and the consolidated statement of changes in financial position for the year ended December 31, 1987. These financial statements are the responsibility of the Company's management. Our responsibility is to express an opinion on these financial statements based on our audits.

We conducted our audits in accordance with generally accepted auditing standards. Those standards require that we plan and perform an audit to obtain reasonable assurance about whether the financial statements are free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements. An audit also includes assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall financial statement presentation. We believe that our audits provide a reasonable basis for our opinion.

In our opinion, the financial statements referred to above present fairly, in all material respects, the financial position of Orbital Sciences Corporation and subsidiaries as of December 31, 1988, and the results of their operations for each of the two years in the period then ended, and their cash flows for the year ended December 31, 1988, and the changes in their financial position for the year ended December 31, 1987, in conformity with generally accepted accounting principles.

As discussed in Note 2 to the financial statements, the Company, as required by generally accepted accounting principles, has presented a statement of cash flows for the year ended December 31, 1988, in place of a statement of changes in financial position.

ARTHUR ANDERSEN & CO.

Washington, D.C.,
March 28, 1989.

ORBITAL SCIENCES CORPORATION
CONSOLIDATED BALANCE SHEETS
(In thousands, except share data)

ASSETS

	December 31, 1988	September 30, 1989
CURRENT ASSETS:		
Cash and cash equivalents	$ 14,721	$ 9,658
Contract receivables	22,462	21,277
Components inventory	—	1,740
Other current assets	1,045	116
Total current assets	38,228	32,791
PROPERTY, PLANT AND EQUIPMENT, at cost, less accumulated depreciation and amortization $959 and $3,033, respectively	18,813	18,482
EXCESS OF PURCHASE PRICE OVER NET ASSETS ACQUIRED, less accumulated amoritzation of $198 and $1,448, respectively	27,677	30,916
DEPOSITS AND OTHER ASSETS	887	445
	$ 85,605	$ 82,634

LIABILITIES AND STOCKHOLDERS' EQUITY

	December 31, 1988	September 30, 1989
CURRENT LIABILITIES:		
Current portion of long-term obligations and redeemable preferred stock	$ 227	$ 4,305
Short-term borrowings	1,970	7,417
Accounts payable	9,380	12,728
Accrued expenses	7,181	7,089
Deferred revenue	9,618	6,121
Deferred income taxes	3,349	511
Other current liabilities	—	180
Total current liabilities	31,725	38,351
LONG-TERM OBLIGATIONS, net of current portion	2,920	171
COMMITMENTS AND CONTINGENCIES (Notes 4,7,8,10,11 and 12)		
REDEEMABLE EXCHANGEABLE PREFERRED STOCK: Series B, par value $1,000; 6,000 shares authorized, issued and outstanding, net of current portion	6,000	4,500
STOCKHOLDERS' EQUITY		
Preferred stock, par value $.01; 10,000,000 shares authorized, no shares issued or outstanding	—	—
Common Stock, par value $.01; 40,000,000 shares authorized; and 8,035,898 and 8,036,298 shares issued and outstanding, respectively	80	80
Additional paid-in capital	49,460	49,548
Retained earnings (deficit)	(4,580)	(10,016)
Total stockholders' equity	44,960	39,612
TOTAL LIABILITIES AND STOCKHOLDERS' EQUITY	$ 85,605	$ 82,634

The accompanying notes are an integral part of these consolidated statements.

ORBITAL SCIENCES CORPORATION
CONSOLIDATED STATEMENTS OF OPERATIONS
(In thousands, except share data)

	Year Ended December 31,		Nine Months Ended September 30,
	1987	1988	1989
REVENUES	$25,295	$35,089	$56,795
COSTS OF GOODS SOLD	23,527	37,248	55,853
GROSS PROFIT (LOSS)	1,768	(2,159)	942
SELLING, GENERAL AND ADMINISTRATIVE EXPENSES	1,837	4,441	6,624
AMORTIZATION OF EXCESS OF PURCHASE PRICE OVER NET ASSETS ACQUIRED	—	198	1,250
INTEREST INCOME, net of interest expense of $49, $135 and $901, respectively	347	408	110
INCOME (LOSS) BEFORE PROVISION (BENEFIT) FOR INCOME TAXES	278	(6,390)	(6,822)
PROVISION (BENEFIT) FOR INCOME TAXES	72	(601)	(1,386)
NET INCOME (LOSS)	$ 206	$ (5,789)	$ (5,436)
NET INCOME (LOSS) PER SHARE	$0.04	($0.96)	($0.68)
SHARES USED IN COMPUTING NET INCOME (LOSS) PER SHARE	5,641,808	6,010,994	8,036,161

The accompanying notes are an integral part of these consolidated statements.

ORBITAL SCIENCES CORPORATION
CONSOLIDATED STATEMENTS OF STOCKHOLDERS' EQUITY
(In thousands, except share data)

	Common Stock Shares	Common Stock Amount	Additional Paid-In Capital	Retained Earnings (Deficit)	Total
BALANCE, December 31, 1986, as restated (note 15)	5,564,774	$56	$2,607	$513	$ 3,176
Shares issued to employees, stock repurchased and retired and warrants exercised	75,600	—	45	(2)	43
Net Income	—	—	—	206	206
Partnership flow-through losses	—	—	(295)	295	—
BALANCE at December 31, 1987	5,640,374	56	2,357	1,012	3,425
Shares issued to Hercules	1,607,180	16	31,960	—	31,976
Shares issued to Space Data stockholders	750,000	8	14,992	—	15,000
Stock warrants exercised, stock options and stock repurchased and retired	38,344	—	184	—	184
Repayment of notes receivable from stockholders	—	—	4	—	4
Partnership capital contribution	—	—	160	—	160
Net loss	—	—	—	(5,789)	(5,789)
Partnership flow-through losses	—	—	(197)	197	—
BALANCE, December 31, 1988	8,035,898	80	49,460	(4,580)	44,960
Shares issued to employees and Hercules	400	—	29	—	29
Repayment of notes receivable from stockholders	—	—	59	—	59
Net loss	—	—	—	(5,436)	(5,436)
BALANCE, September 30, 1989	8,036,298	$80	$49,548	($10,016)	$39,612

The accompanying notes are an integral part of these consolidated statements.

ORBITAL SCIENCES CORPORATION
CONSOLIDATED STATEMENTS OF CASH FLOWS
(Amounts in Thousands)

	Year Ended December 31, 1988	Nine Months Ended September 30, 1989
CASH FLOWS FROM OPERATING ACTIVITIES:		
Net loss	($5,789)	($5,436)
Adjustments to reconcile net loss to net cash used in operating activities:		
Depreciation and amortization expense	897	3,324
Non-cash contract expense	210	1,094
Change in assets and liabilities net of effects from purchase of Space Data:		
(Increase) decrease in contract receivables	(5,202)	(2,555)
(Increase) decrease in components inventory	—	(1,740)
(Increase) decrease in other current assets	(987)	343
(Increase) decrease in deposits and other assets	—	442
(Increase) decrease in deferred registration costs	423	—
Increase (decrease) in accounts payable and accrued expenses	6,049	2,162
Increase (decrease) in deferred revenue	3,789	(3,497)
Increase (decrease) in deferred income taxes	(682)	(1,386)
Increase (decrease) in other current liabilities	—	180
Net cash used in operating activities	(1,292)	(7,069)
CASH FLOWS FROM INVESTING ACTIVITIES:		
Capital expenditures	(2,742)	(12,645)
Proceeds from sale of facility (note 12)	—	9,288
Payment for purchase of Space Data	(17,747)	—
Net cash used in investing activities	(20,489)	(3,357)
CASH FLOWS FROM FINANCING ACTIVITIES:		
Proceeds from issuance of common stock	32,160	29
Partnership capital contributions	160	—
Net short-term borrowings	(2,408)	5,447
Principal payments on long-term obligations	(38)	(172)
Collection on notes receivable from stockholders	4	59
Net cash provided by financing activities	29,878	5,363
NET INCREASE (DECREASE) IN CASH AND CASH EQUIVALENTS	8,097	(5,063)
CASH AND CASH EQUIVALENTS, beginning of year	6,624	14,721
CASH AND CASH EQUIVALENTS, end of year	$14,721	$9,658

SUPPLEMENTAL SCHEDULE OF NONCASH INVESTING AND FINANCING ACTIVITIES:

In 1988, the Company acquired all of the capital stock of Space Data and in conjunction with the acquisition, liabilities were assumed as follows:

Fair value of assets acquired	$ 48,210
Cash paid for Space Data stock (including transaction costs)	(17,747)
Common stock issued	(15,000)
Liabilities assumed	$ 15,463

The accompanying notes are an integral part of these consolidated statements.

ORBITAL SCIENCES CORPORATION
CONSOLIDATED STATEMENTS OF CHANGES IN FINANCIAL POSITION
(In thousands)

	Year Ended December 31, 1987
CASH PROVIDED FROM OPERATIONS:	
Net Income	$206
Add noncash items:	
Depreciation and amortization	208
Office lease rental abatement	102
Amortization of discount on note payable to placement agent	37
	553
Increase in contract receivables	(1,828)
Decrease in other current assets	125
Increase in deferred registration costs	(423)
Increase in accounts payable and accrued expenses	7,151
Increase in deferred income taxes	72
Increase in deferred revenue	2,111
Net cash from operations	7,761
FINANCING ACTIVITIES:	
Payment of note payable to placement agent	(150)
Payments of notes payable	(46)
Proceeds from sales of common stock	162
Increase in notes receivable from stockholders	(117)
Stock repurchased and retired	(2)
Net cash used in financing activities	(153)
OTHER:	
Purchase of property, plant and equipment	(3,462)
Other	(124)
Net cash used for other	(3,586)
CASH AND CASH EQUIVALENTS:	
Net change during the period	4,022
Balance, beginning of period	2,602
Balance, end of period	$6,624

The accompanying notes are an integral part of this consolidated statement.

ORBITAL SCIENCES CORPORATION
NOTES TO CONSOLIDATED FINANCIAL STATEMENTS
DECEMBER 31, 1987, 1988 AND SEPTEMBER 30, 1989

(1) ORGANIZATION, CONSOLIDATION, ACQUISITION AND EQUITY ISSUANCE

Organization of Partnership and SSC

Orbital Sciences Corporation ("OSC") was incorporated in Delaware on June 30, 1987 to consolidate assets, liabilities and operations of Space Systems Corporation (formerly named Orbital Sciences Corporation) ("SSC") and Orbital Research Partners, L.P. ("the Partnership") through an exchange offer to the Partnership and to the stockholders of SSC (the "Consolidation"). As a result of the Consolidation, consummated on February 16, 1988, SSC became a wholly-owned subsidiary of OSC and OSC acquired substantially all of the assets and liabilities of the Partnership. SSC Common and Series A Preferred stockholders received 1,567,034 shares of OSC Common Stock in exchange for 584,775 shares of SSC Common Stock and 1,800 SSC Series A Preferred shares. SSC Series B Preferred stockholders received 6,000 shares of OSC Series B Preferred stock in exchange for 6,000 shares of SSC Series B Preferred stock. The Partnership received 4,100,000 shares of OSC Common Stock. OSC and its subsidiaries are collectively referred to herein as the "Company". The Partnership is the majority stockholder of the Company.

The Consolidation has been accounted for as a combination of entities under common control which results in accounting treatment similar to a pooling of interests. The balance sheets as of December 31, 1988, and statements of operations for the years ending December 31, 1987 and 1988, reflect combined results of OSC, SSC and the Partnership, as if the Consolidation had been consummated at January 1, 1986. Partnership losses of $295,000 and $197,000 for the years ending December 31, 1987 and 1988, respectively, are reflected as reductions to additional paid-in capital. Intercompany transactions have been eliminated.

SSC, formerly Orbital Sciences Corporation, was incorporated in Delaware on April 2, 1982, to develop, manufacture, test and market commercial space transportation systems. Orbital Research Corporation ("ORC"), a wholly-owned subsidiary of SSC, was incorporated on September 30, 1983, and is the Managing General Partner of the Partnership. The Partnership was formed on October 20, 1983 for the purpose of designing, developing and commercially marketing an orbit transfer vehicle (referred to as the Transfer Orbit Stage, or "TOS"). Three officers and one other stockholder are special general partners of the Partnership (the "Special General Partners"), ORC and the Special General Partners are collectively hereinafter referred to as the "General Partners".

Acquisition of Space Data Corporation

On November 9, 1988, the Company acquired the stock of Space Data Corporation ("Space Data") through a merger into a wholly-owned subsidiary of OSC organized for that purpose. The consideration consisted of a cash payment of $17,500,000, of which $5,000,000 is currently escrowed, and the issuance of 750,000 shares of the Company's Common Stock, in exchange for 100% of the outstanding Common Stock of Space Data. The merger has been accounted for using the purchase method of accounting. Accordingly, the acquired assets and liabilities were assigned a portion of the purchase price equal to the estimated individual fair values of such assets and liabilities, and the remainder of the purchase price as excess of purchase price over net assets acquired. (See note 2) The Consolidated Statements of Operations include Space Data results commencing from November 9, 1988.

Equity Issuance to Hercules Incorporated

Simultaneously with the acquisition of Space Data, Hercules Incorporated ("Hercules") and the Company entered into a Stock Purchase Agreement dated November 9, 1988 (the "Stock Purchase Agreement") whereby Hercules purchased 1,606,842 shares of the Company's Common Stock at $20 per share, for a total purchase price of $32,136,840. As of September 30, 1989, Hercules owned 1,607,260 shares of the Company's Common Stock. The Stock Purchase Agreement provides that not less than $10,000,000 of the proceeds from Hercules' investment will be used to fund the development of the Pegasus vehicle. (See note 3) Under the Stock Purchase Agreement, the Company cannot pay dividends to holders of its Common Stock exceeding 25% of its net profit after tax for any fiscal period unless such action has been approved by two-thirds of its directors. Hercules has been granted certain preemptive rights with respect to future issuances of the Company's capital stock and sales of shares held by certain stockholders. In the event that the consolidated net worth of the Company at the end of any fiscal quarter declines below $28,600,000 and remains below such amount at the end of the next fiscal quarter-end, six members of the board of directors have agreed to resign if requested to do so by Hercules, and to vote their shares for replacement candidates nominated by Hercules. A Stockholder's Agreement containing certain of these provisions terminates on November 9, 1993.

The following supplemental financial information, as restated, presents the results of operations, on a pro forma basis, as though the Company and Space Data had been combined, and the Hercules shares had been issued, on January 1, 1987.

	Unaudited (in thousands, except share data)	
	1987	1988
Revenues	$42,174	$56,260
Net income (loss)	(1,890)	(5,017)
Earnings (loss) per share	(0.24)	(0.63)
Shares used in computing net income (loss) per share	7,995,562	8,026,544

(2) SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES

Principles of Consolidation

The Consolidated Financial Statements include the accounts of OSC and its wholly-owned subsidiaries. All significant intercompany accounts have been eliminated in consolidation.

Presentation

The accompanying financial statements are presented as of and for the two years ended December 31, 1988 and as of and for the nine-month period ended September 30, 1989, which comprises substantially a complete fiscal year. Certain reclassifications have been made to the 1987 and 1988 financial statements to conform to the September 30, 1989 financial presentation.

Revenue Recognition

The Company's largest source of revenues are from a fixed-price-incentive-fee contract (the "NASA TOS Contract") with the National Aeronautics and Space Administration ("NASA") for two TOS vehicles. Revenues are recognized using the percentage-of-completion method based on costs incurred in relation to total estimated costs. The fee under the NASA TOS Contract may be increased or decreased in accordance with cost incentive provisions which measure actual performance against established targets. The incentive fee is included in revenue at the time the amounts can be reasonably determined.

Revenues on cost-plus-fixed-fee contracts are recognized to the extent of costs incurred plus a proportionate amount of fee earned. Revenues on fixed-price contracts are recognized using the percentage-of-completion method based on costs incurred in relation to total estimated costs. Anticipated losses are recognized as soon as they become known.

Research and Development

Research and development costs are expensed as incurred. These expenses are allocated, when appropriate, to government contracts under government-mandated cost accounting procedures.

Research and development costs of approximately $2,175,000, and $4,872,000 and $7,410,000 are included in costs of goods sold for 1987, 1988 and the nine-month period ended September 30, 1989 ("the 1989 period"), respectively. These costs include research and development and other concept studies.

Depreciation and Amortization

Depreciation and amortization are provided using the straight-line or units of production method as follows:

Buildings	18 and 19 years
Equipment	3 to 10 years, or units of production

Excess of Purchase Price Over Net Assets Acquired

The excess of purchase price over the fair value of the net tangible and identifiable intangible assets acquired, recorded as a result of the purchase of Space Data, is being amortized using the straight-line method over a period of 20 years. During the 1989 period, as a result of obtaining additional information subsequent to the merger on November 8, 1988, the Space Data purchase price was reallocated to reflect a more accurate valuation of assets and liabilities acquired. As a result of the reallocation, the value of the net tangible and identifiable intangible assets acquired decreased by approximately $4,300,000, with a resulting increase to the excess of purchase price over net assets acquired.

Warranty Policy

The Company does not give "standard product warranties". However, the Company occasionally accepts warranty clauses in contracts. The Company records the liability for warranty claims when it determines that a specific material liability exists. Although the Company has recorded a warranty reserve for the DARPA Pegasus Contract (See note 3), the Company has not recorded any liability for future warranty claims on other contracts because these expenses, if any, are not expected to be material.

Income Taxes

Provisions for Federal and state income taxes are computed at current tax rates on reported financial statement income. Deferred income tax provisions represent the tax effect of significant timing differences between financial statement income and current taxable earnings. Research and development and investment tax credits are recorded currently as a reduction of the income tax provision.

Income (Loss) Per Share

Income (loss) per common and common equivalent share is calculated using the weighted average number of shares and equivalents, to the extent dilutive, outstanding during the periods. Common Stock equivalents are comprised of stock options and warrants.

Consolidated Statements of Cash Flows and Changes in Financial Position

As provided for in Statement of Financial Accounting Standard Number 95 "Statements of Cash Flows", the Company has elected not to restate the Consolidated Statements of Changes in Financial Position for the year ended December 31, 1987. For purposes of its statements of cash flows, the Company considers all highly liquid debt instruments purchased with a maturity of three months or less to be cash equivalents.

Components Inventory

Inventory, stated at cost on a specific identification basis, including allocated indirect costs, is comprised primarily of partially assembled components.

(3) **MAJOR CONTRACTS**

NASA TOS Contract

On March 13, 1987, the Company signed the NASA TOS Contract for the Mars Observer and the Advanced Communications Technology Satellite ("ACTS") missions with a contract value of approximately $78,600,000, which has been increased to approximately $163,000,000 as of September 30, 1989. The NASA TOS Contract provides that the contract price will include an allocable portion of the research and development costs incurred in developing the TOS system to be amortized over the estimated number of TOS sales, including commercial and international sales. The Company has received $9,000,000 of amortization payments which are recognized as revenue utilizing the percentage-of-completion method over the remaining term of the contract. Under the terms of the NASA TOS Contract, the Company will be required to forfeit approximately one-half of its contract target profit should a failure occur on either the Mars Observer or ACTS mission that is attributable to the TOS vehicle used for the mission.

In June 1987, the Company signed a Mars Observer and ACTS production subcontract with Martin Marietta Corporation ("Martin Marietta"). The Company was notified by Martin Marietta in 1988 that Martin Marietta projected significant cost overruns for its subcontract. Accordingly, in 1988 an adjustment was made to the amount of fee recorded to bring the fee recorded to date into agreement with the revised projected total contract fee. Additionally, in the fourth quarter of 1988 the Company revised its estimated total contract costs to include certain costs which are contract specific but are separately recoverable from NASA. As a result of this adjustment, revenues recorded were decreased by $1,800,000 in 1988.

In 1987, the Company signed a TOS flight activation contract with Martin Marietta with a target price of approximately $6,300,000. In 1988, the Company and Martin Marietta modified the contract whereby the price was increased by $204,000, and the scope of work was reduced by a net amount of $687,000, eliminating any contingent liability for cost overruns by the Company.

DARPA Pegasus Contract

During 1988, the Company was notified by the Defense Advanced Research Projects Agency ("DARPA") that the Company's Pegasus vehicle had been selected under a competitive procurement to launch a payload. A contract ("DARPA Pegasus Contract") was signed for the purchase of one launch vehicle with options for five additional launches, for a firm-fixed-price of $6,000,000 each launch. DARPA has exercised options for two additional launches.

The Company and Hercules entered into an agreement dated November 9, 1988, relating to the development and production of the Pegasus vehicle. Each party shall bear the development costs arising from the performance of its responsibilities, pursuant to the agreement. Under the terms of the DARPA Pegasus Contract, the Company is the prime contractor and Hercules is acting as a subcontractor. Initially, profits and losses on Pegasus sales will be shared on an equal basis until the Hercules investment costs have been recovered, at which time the Company will receive 60% and Hercules will receive 40%.

During the year ended December 31, 1988 and the 1989 period, the Company made payments of $1,125,000 and $2,500,000 to Hercules, representing Hercules' share of contract progress payments received from DARPA. During the 1989 period, the Company, due to increased cost estimates by Hercules, recorded approximately $1,090,000 as an estimated contract shortfall on the Pegasus contract, which is included in cost of goods sold in the accompanying consolidated statement of operations.

Minuteman CFE Contract

In January 1985, the Company's Space Data division entered into a firm fixed-price contract with the U.S. Air Force (the "Minuteman CFE Contract") for the production of 20 Minuteman rocket consolidated front end or attitude control, telemetry flight termination modules. The total value of the Minuteman CFE Contract is approximately $32,000,000. As of September 30, 1989, revenue of approximately $26.9 million had been recognized by the Company. The Minuteman CFE Contract requires the Company to warrant against any form of failure, other than failures due to mishandling by the Government or its representatives, for a period of ten years or until launch, whichever is sooner. Performance under the Minuteman CFE Contract is currently expected to be completed in 1991. The U.S. Government receives unlimited rights in technological data developed in the performance of the Minuteman CFE Contract.

Starbird Contracts

In June 1985 and July 1989, the Company's Space Data division entered into firm fixed-price contracts with the U.S. Air Force (the "Phase I Starbird Contract" and "Phase II Starbird Contract," respectively) to develop and to launch the Starbird launch vehicle and related products and services. The total value of the Phase I Starbird Contract, including a predecessor suborbital vehicle contract, is approximately $15,700,000 and the total value of the Phase II Starbird Contract is approximately $12,100,000. As of September 30, 1989, revenue of approximately $14,100,000 had been recognized by the Company. Performance under the Phase I and Phase II Starbird Contracts is currently expected to be complete by August 31, 1990 and April 1, 1991, respectively.

(4) CONTRACT RECEIVABLES

The components of contract receivables are as follows (in thousands):

	December 31, 1988	September 30, 1989
Billed and billable	$11,669	$11,820
Recoverable costs and accrued profit not billed	8,496	6,628
Retainages due upon contract completion	2,297	2,829
	$22,462	$21,277

Recoverable costs and accrued profits not billed and retainages are amounts primarily due after one year and will be billed on the basis of contract terms and delivery schedules.

Consistent with provisions in government contracts, a substantial portion of the payments to the Company under U.S. Government contracts are provisional payments which are subject to potential adjustment upon audit by the Defense Contract Audit Agency or by other appropriate government agencies. In the opinion of management, any adjustments resulting from audits of contracts will not have a material adverse impact on the Company's financial condition or results of future operations.

(5) PROPERTY, PLANT AND EQUIPMENT

Property, plant and equipment consisted of the following (in thousands):

	December 31, 1988	September 30, 1989
Land	$1,295	$717
Buildings	2,394	1,450
Machinery and equipment	9,249	17,310
Factory equipment under construction	4,890	89
Purchased software and technical drawings	1,944	1,949
Less accumulated depreciation and amortization	(959)	(3,033)
	$18,813	$18,482

(6) ACCRUED EXPENSES

Accrued expenses consisted of the following (in thousands):

	December 31, 1988	September 30, 1989
Accrued subcontract costs	$4,460	$2,557
Payroll, taxes withheld and fringe benefits	1,031	1,566
Other accrued expenses	1,690	2,966
	$7,181	$7,089

(7) SHORT-TERM BORROWINGS

The Company has two bank revolving credit facilities, aggregating $15,000,000, which expire in the second quarter of 1990. Borrowings bear interest at a rate equal to the prime rate and are secured by billed contract receivables, real property and equipment (See notes 4 and 5). Balances of $500,000 and $6,100,000 were outstanding as of December 31, 1988 and September 30, 1989, respectively. The Company had outstanding at December 31, 1988, letters of credit for $724,000, which were reserved against one line of credit. Subsequent to September 30, 1989 these lines of credit were expanded to a total of $17,500,000.

Space Data employees from time to time advance the Company funds, repayable on demand, for use in its operations. Interest on the advances accrues at the prime interest rate.

(8) LONG-TERM OBLIGATIONS

The Company assumed a $2,810,000 term loan from Space Data on November 9, 1988. This loan requires interest payments at the bank's prime rate plus 1.25% and monthly principal payments of $10,000. The balance of the loan is due in full on April 30, 1990 and is secured by real property and improvements thereon (See note 5).

The Company paid interest of $49,000, $129,000 and $705,000 in 1987, 1988 and the 1989 period for short and long-term obligations.

(9) INCOME TAXES

The provision (benefit) for income taxes consists of the following (in thousands):

	December 31,		September 30,
	1987	1988	1989
Current provision - State	---	66	---
Deferred provision (benefit) -			
Federal	32	(667)	(1,214)
State	40	---	(172)
	$72	($601)	($1,386)

During the year ended December 31, 1988 and the 1989 period, the Company realized a deferred benefit from net operating losses of $667,000 and $1,386,000 respectively reducing the deferred income tax liability.

The deferred income tax provision (benefit) resulted from the following (in thousands):

	December 31,		September 30,
	1987	1988	1989
Deferred tax benefit resulting from application of net operating losses	$ ---	($667)	($1,386)
Deferral of revenue on long-term contracts	262	---	---
Research and development tax credit	(173)	---	---
Expenses currently not deductible for taxes	(17)	---	---
	$72	($667)	($1,386)

The income tax provision (benefit) is different from that computed using the statutory U.S. Federal income tax rate as set forth as follows:

	December 31,		September 30,
	1987	1988	1989
Statutory rate	40.0%	(34.0%)	(34.0%)
State income taxes, net of Federal benefits	4.2	(2.6)	(2.0)
Research credit	(31.6)	---	---
Partnership flow-through losses	13.3	1.2	---
Consolidation costs	---	4.1	---
Intangible amortization	---	7.1	5.1
Losses without current tax benefit	---	20.2	10.6
	25.9%	(9.4%)	(20.3%)

The Company had net tax operating loss carryforwards of approximately $12,500,000 at September 30, 1989, which may be limited as a result of the merger. Additionally, at September 30, 1989, the Company has approximately $1,000,000 of tax credit carryforwards for income tax reporting purposes. These carryforwards may be utilized by the Company through the year 2004 and expire beginning in 2001.

In December 1987, the Financial Accounting Standards Board issued a standard on accounting for income taxes. The Company is required to adopt the new accounting and disclosure rules not later than 1992, although earlier implementation is permitted. Adoption of the new standard will result in a catch-up adjustment that may be reported in the year the standard is implemented or in an earlier year if the Company elects retroactive application. The Company expects to adopt the new standard in 1992. Based on a preliminary review, the Company expects the new standard will not have a material adverse impact on the consolidated financial statements when adopted.

(10) SERIES B EXCHANGEABLE, REDEEMABLE PREFERRED STOCK

Shares of Series B Exchangeable Preferred Stock ("Series B Preferred Stock") are subject to mandatory redemption if a public offering of at least $4,000,000 of the Company's Common Stock occurs prior to December 31, 1989, the Company has the right to exchange a note (the "Note") for the shares of Series B Preferred stock. If the Company does not exercise that right, it shall redeem the stock for $6,000,000, $2,000,000 of which shall be paid at the time of the public offering, with the balance to be paid in quarterly installments of $500,000 for a two-year period thereafter. If the public offering has not occurred before December 31, 1989, the Company shall redeem the shares of Series B Preferred Stock in exchange for the Note effective January 1, 1990. As of December 31, 1989 the Company did not have a public offering and therefore in January, 1990 the Company redeemed the shares in exchange for the Note.

The Note was issued in the principal amount of $6,000,000, provides for quarterly payments of principal of $500,000 plus accrued interest commencing on March 31, 1990. Interest begins to accrue on January 1, 1990 at a rate of 2% over the prime rate for the first year, 3% over the prime rate for the second year, and 4% over the prime rate for the third year. The Company has granted Martin Marietta a security interest in certain TOS program equipment to secure its obligations relating to the Note.

(11) COMMON STOCK OPTIONS

The Company's stockholders adopted an employee stock option plan under which up to 600,000 shares of the Company's Common Stock were reserved for options to be granted to key employees and directors. Outstanding stock options are exercisable in cumulative installments of one-third on each of the first three anniversaries of the grant date, and will expire five to ten years thereafter. In 1988, SSC optionholders exchanged their options for 22,850 options of the Company. (See note 1)

The following summarizes the option activity under the stock option plan since inception.

	Number of Shares	Option Price Per Share
Granted:		
1988	312,350	$ 5.00 - $20.00
1989	190,900	$20.00
Exercised:		
1988	(11,750)	$ 5.00 - $ 6.50
1989	(320)	$ 7.20
Terminated:		
1988	(4,250)	$ 5.00 - $ 6.50
1989	(5,880)	$ 7.20 - $20.00
Outstanding at:		
December 31, 1988	296,350	$ 7.20 - $20.00
September 30, 1989	481,050	$ 7.50 - $20.00
Exercisable at:		
December 31, 1988	6,850	$ 7.20 - $13.25
September 30, 1989	103,383	$ 7.50 - $20.00

No compensation expense related to option grants under the stock plan has been recorded in the financial statements because the stated exercise price was at fair value as determined by the Board of Directors at the time the options were granted.

(12) COMMITMENTS

Lease Commitments

Aggregate minimum rental commitments under noncancellable operating and capital leases (primarily for office space and equipment) as of September 30, 1989, are as follows (in thousands):

	Operating	Capital
1989	$682	$34
1990	2,710	136
1991	2,411	84
1992	1,945	60
1993	1,873	22
1994 & thereafter	26,468	---
	$36,089	336
Less: Interest Portion at 9.4%		59
		277
Less: Current Portion		106
		$171

Partnership Bank Loan

In December 1987, the Partnership borrowed $500,000 from a bank for working capital purposes represented by a term loan at the prime rate. Principal and accrued interest are due when the loan matures on March 31, 1990. The loan is secured by a certificate of deposit owned by the Company.

New Facility

During 1989, the Company purchased land and began construction of a new facility near Phoenix, Arizona. In September 1989, the Company entered into a build-leaseback arrangement for the building and property. This arrangement provided for the completion and sale of the building and subsequent leaseback of the facility by the Company. The Company sold the facility, with a cost of $9,288,000, for $520,000 and the assumption of bank debt of $8,851,000. Deferred gain on the sale was $83,000, to be recognized over the 20 year operating lease term. The facility was completed and occupied subsequent to September 30, 1989.

(13) DEFERRED SALARY PROFIT-SHARING PLANS

As of September 30, 1989, the Company had two Deferred Salary Profit-Sharing Plans (the "Plans") in accordance with Section 401(k) of the Internal Revenue Code. All full-time employees are eligible for participation in the Plans. Contributions to the Plans are made at the discretion of the Board of Directors. In 1987 and 1988, the Company contributed $99,000 and $539,000, respectively, to the Plans and has accrued $647,000 for the 1989 period.

(14) COMMON STOCK

Subsequent to September 30, 1989, the Company approved a 2-for-1 stock split and increased the number of authorized shares of Common Stock to 40,000,000. All share and per share data in the accompanying consolidated financial statements have been restated for the effect of the split.

APPENDIX D

ALEX. BROWN & SONS INCORPORATED LETTER

Alex. Brown & Sons
Incorporated
ESTABLISHED 1800 • AMERICA'S OLDEST NAME IN INVESTMENT BANKING
MEMBERS: NEW YORK STOCK EXCHANGE, INC. AND OTHER LEADING EXCHANGES

REPLY TO: P.O. BOX 515
BALTIMORE, MD 21203

February 22, 1990

Mr. Carlton B. Crenshaw
Vice President, Finance
Chief Financial Officer
Orbital Sciences Corporation
12500 Fair Lakes Circle
Suite 350
Fairfax, Virginia 22033

Dear Mr. Crenshaw:

It is our understanding that you will be filing an application for authorization to construct and operate a communications satellite system with the Federal Communications Commission in the name of Orbital Communications Corporation, a subsidiary of Orbital Sciences Corporation ("OSC"). We further understand that the FCC requires that you demonstrate the financial capability to effectuate your proposal.

As OSC's investment banker, Alex. Brown believes it has a relationship with OSC and a sound understanding of the Company's strategy and prospects. We are acting as managing underwriter of OSC's public offering of securities. In the course of this involvement with OSC, we have developed a very high regard for the Company, its management, capabilities, strategy, and risks.

We believe that OSC's public offering, scheduled for the first quarter of 1990, will be an excellent basis for providing long-term access to the capital markets, both equity and debt, in accordance with the Company's financial requirements.

Very truly yours,

A. Christine Robinson
Principal

ACR:ek
0788I

REQUEST FOR EXPERIMENTAL/DEVELOPMENTAL AUTHORIZATION

Orbital Sciences Corporation ("OSC") seeks an experimental/ developmental authorization to operate a space station and ground stations in the 35.010 MHz to 42.010 MHz range and a ground station at 423.500 MHz for the purpose of testing and verifying the technology and operating advantages of small, low-earth orbiting satellites. As the licensee, OSC will control the space station as well as all ground stations authorized for operation by the FCC.

Briefly, the proposed space segment will consist of a small satellite placed into a 592 kilometers polar earth orbit. The initial ground segment will consist of approximately 100 low power remote data collection stations deployed throughout the Chesapeake Bay watershed and a central control hub station located in Fairfax, Virginia. OSC requests a "blanket" experimental/ developmental authorization for these remote stations and up to 5,000 other low power remote stations, some of which may be mobile, that may be deployed beyond the initial phase of the experiment. OSC will report periodically to the Commission the actual number of fixed and mobile stations that OSC deploys. Separate applications are submitted for the space station, central control hub station, and remote stations.

While OSC has engineered its proposed system on a non-interference basis, it will maintain at its headquarters in Fairfax, Virginia a point of contact who can immediately remedy any interference problems or terminate operations if necessary. OSC will also maintain at its headquarters, and make available to the Commission upon request, records that will enable identification of all remote station locations, as well as logs of any alleged incidences of interference, the station(s) involved, and the outcome of the incident.

II. Objectives of the Program

OSC will use DataSat-X to develop and evaluate alternate communications protocols and subscriber equipment. It also will be used to develop software and hardware for position determination. The effects of propagation on signal reliability particularly in the low VHF band will be determined as it effects the proposed ORBCOMM service. ORBCOMM has not proposed that so-called "Low Band" frequencies be assigned for the operational service because extensive analysis completed subsequent to the experimental application indicates that those frequencies will not provide the high reliability and system availability required to meet ORBCOMM specifications.

OSC also will use the DataSat-X program as a working demonstration and development vehicle for involving major potential users. The objective is to obtain user involvement early in the system design so that ORBCOMM can be engineered to meet known performance, durability, and cost requirements. At the same time, these relationships provide the opportunity to define the market size and price elasticities far better than studies alone can do.

Finally, OSC will use the DataSat-X program to gain actual operating experience with respect to ephemeris tracking, TT&C functions, and network operations. DataSat-X will have a GPS receiver on board to test for tracking accuracy and for use in position determination development.

III. Program Status

At the time of this filing, the DataSat-X satellite has completed assembly and is in test. Following launch on Pegasus later this year, the satellite and ground system will undergo a two month check-out period and then the initial experimental installations will begin operation. Remote user terminals will be fabricated by OSC and three other organizations planning to join in the test and evaluation program.

OSC has entered into DataSat-X Joint Research Agreements with Sea-Land Service, Inc., the National Park Service, and Dalhousie University and is either negotiating agreements or has invited the participation by six other entities.

The DataSat-X program is experimental, and there are risks that the satellite may not achieve orbit or operate in accordance with plan. Such events will in no way impact or preclude the ORBCOMM from proceeding with the proposed system design and construction. While DataSat-X will provide useful information for ORBCOMM system design, the program demonstrates OSC's commitment to innovative use of the low-earth orbit for communications.

12500 Fair Lakes Circle, Fairfax, Virginia 22033

EXHIBIT 1
(20 pages)

United States of America
FEDERAL COMMUNICATIONS COMMISSION
EXPERIMENTAL
RADIO STATION CONSTRUCTION PERMIT
AND LICENSE

EXPERIMENTAL
(Nature of Service)

K E 2 X E S
(Call Sign)

XR FX
(Class of station)

1191-EX-PL-89
(File number)

NAME ORBITAL SCIENCES CORPORATION

Earth station, Fairfax, Virginia Lat. 38 51 42 N.; Long. 77 22 42 W.
(Location of station)

Subject to the provisions of the Communications Act of 1934, subsequent acts, and treaties, and all regulations heretofore or hereafter made by this Commission, and further subject to the conditions and requirements set forth in this license, the licensee hereof is hereby authorized to use and operate the radio transmitting facilities hereinafter described for radio communications.

Frequency MHz	Authorized Power (watts)	Emission Designator
35.010	1585 (ERP)	12K0F1D
35.995	1585 (ERP)	12K0F1D
37.010	1585 (ERP)	12K0F1D
38.000	1585 (ERP)	12K0F1D
39.000	1585 (ERP)	12K0F1D

Frequency Tolerance: ± 0.005%

Operation: In accordance with Sec. 5.202(d) of the Commission's Rules.

Special Conditions:

1. This license is subject to the understanding that equipment will not be developed for operational use in this band.

2. The satellite can be shut-down with commands from the ground station.

3. Satellite Apogee: 592 Km; Perigee: 592 Km; Period: 96.5 minutes; Inclination: 90 degrees.

4. Point of communications: DATASAT (Callsign KE2XER).

This authorization effective July 10, 1989 and will expire 3:00 A.M. EST August 1, 1991

FEDERAL
COMMUNICATIONS
COMMISSION

12500 Fair Lakes Circle, Fairfax, Virginia 22033
United States of America
FEDERAL COMMUNICATIONS COMMISSION
EXPERIMENTAL
RADIO STATION CONSTRUCTION PERMIT
AND LICENSE

EXPERIMENTAL
(Nature of Service)

K E 2 X E Y
(Call Sign)

XR FX
(Class of station)

1276-EX-PL-89
(File number)

NAME ORBITAL SCIENCES CORPORATION

Earth station, Boulder, Colorado Lat. 40 02 05 N.; Long. 105 15 07 W.
(Location of station)

Subject to the provisions of the Communications Act of 1934, subsequent acts, and treaties, and all regulations heretofore or hereafter made by this Commission, and further subject to the conditions and requirements set forth in this license, the licensee hereof is hereby authorized to use and operate the radio transmitting facilities hereinafter described for radio communications.

Frequency MHz	Authorized Power (watts)	Emission Designator
35.010	1585 (ERP)	12K0F1D
35.995	1585 (ERP)	12K0F1D
37.010	1585 (ERP)	12K0F1D
38.000	1585 (ERP)	12K0F1D
39.000	1585 (ERP)	12K0F1D

Frequency Tolerance: $\pm$ 0.005%

Operation: In accordance with Sec. 5.202(d) of the Commission's Rules.

Special Conditions:

1. This license is subject to the understanding that equipment will not be developed for operational use in this band.

2. The satellite can be shut-down with commands from the ground station.

3. Satellite Apogee: 592 Km; Perigee: 592 Km; Period: 96.5 minutes; Inclination: 90 degrees.

4. Point of communications: DATASAT (Callsign KE2XER).

This authorization effective January 5, 1990 and will expire 3:00 A.M. EST August 1, 1991

FEDERAL
COMMUNICATIONS
COMMISSION

12500 Fair Lakes Circle, Fairfax, Virginia 22033

United States of America
FEDERAL COMMUNICATIONS COMMISSION
EXPERIMENTAL
RADIO STATION CONSTRUCTION PERMIT
AND LICENSE

EXPERIMENTAL
(Nature of Service)

K E 2 X E T
(Call Sign)

XR FX
(Class of station)

1192-EX-PL-89
(File number)

NAME ORBITAL SCIENCES CORPORATION

Remote units in the Chesapeake Bay
(Location of station)

Subject to the provisions of the Communications Act of 1934, subsequent acts, and treaties, and all regulations heretofore or hereafter made by this Commission, and further subject to the conditions and requirements set forth in this license, the licensee hereof is hereby authorized to use and operate the radio transmitting facilities hereinafter described for radio communications.

Frequency MHz	Authorized Power (watts)	Emission Designator
35.010	1 (ERP)	12K0F1D
35.995	1 (ERP)	12K0F1D
37.010	1 (ERP)	12K0F1D
38.000	1 (ERP)	12K0F1D
39.000	1 (ERP)	12K0F1D

Frequency Tolerance: $\pm$ 0.005%

Operation: In accordance with Sec. 5.202(d) of the Commission's Rules.

Special Conditions:

1. This license is subject to the understanding that equipment will not be developed for operational use in this band.

2. The satellite can be shut-down with commands from the ground station.

3. Satellite Apogee: 592 Km; Perigee: 592 Km; Period: 96.5 minutes; Inclination: 90 degrees.

4. Point of communications: DATASAT (Callsign KE2XER).

This authorization effective July 10, 1989 and will expire 3:00 A.M. EST August 1, 1991

FEDERAL
COMMUNICATIONS
COMMISSION

United States of America
FEDERAL COMMUNICATIONS COMMISSION
EXPERIMENTAL
RADIO STATION CONSTRUCTION PERMIT
AND LICENSE

EXPERIMENTAL
(Nature of Service)

K E 2 X E R
(Call Sign)

XR MO
(Class of station)

1190-EX-PL-89
(File number)

NAME ORBITAL SCIENCES CORPORATION

Spacecraft in a circular polar orbit
(Location of station)

Subject to the provisions of the Communications Act of 1934, subsequent acts, and treaties, and all regulations heretofore or hereafter made by this Commission, and further subject to the conditions and requirements set forth in this license, the licensee hereof is hereby authorized to use and operate the radio transmitting facilities hereinafter described for radio communications.

Frequency MHz	Authorized Power (watts)	Emission Designator
42.010	20 (ERP)	12K0F1D
423.500	2 (ERP)	100KF1D

Frequency Tolerance: ± 0.005%

Operation: In accordance with Sec. 5.202(d) of the Commission's Rules.

Special Conditions:

1. This license is subject to the understanding that equipment will not be developed for operational use in this band.

2. The satellite can be shut-down with commands from the ground station.

3. Satellite Apogee: 592 Km; Perigee: 592 Km; Period: 96.5 minutes; Inclination: 90 degrees.

This authorization effective July 10, 1989 and will expire 3:00 A.M. EST August 1, 1991

FEDERAL
COMMUNICATIONS
COMMISSION

APPENDIX F

SATELLITE RADIO CONSTRUCTION APPLICATIONS

FCC Use Only
Antenna No.

33. Table MOB-2 ANTENNAS, RADIATION AND POINTS OF COMMUNICATION.

1. One Table MOB-2 is to be completed for each new or modified antenna system at each site, including the addition or modification of transmitters which will change power output from a transmitter, or effective radiated power or emissions.
2. Attach separate Table MOB-2 if authorization of more than one antenna system is requested.
3. Supplementary Explanations of Certain Items:

   d – Directions of Maximum Gain. The maximum number of directions to be shown is 4. Specify bearings of directions of maximum gain, in degrees from true north. If omnidirectional, specify "Omni."

   e – Maximum Antenna Gain. Maximum power gain over reference half-wave dipole, in decibels.

   h – Beam Width of Major Lobe of Antenna Pattern. Defined as the arc, in degrees, including only points on the polar diagram which are within 3 decibels (half power points) of the point of maximum gain. For omnidirectional antennas, the beam width is defined as 360 degrees.

   j(2) – Class of Station. Use the following codes:

BS – Base Station	TS – Test	SB – Subscriber Station
CT – Control Station	DI – Dispatch	RX – Relay Station
RP – Repeater	SI – Signaling	IO – Inter-Office
ST – Standby	CO – Central Office	

Table MOB-2

There are 22 Table MOB-2's with this Schedule B. This is Table MOB-2 number 4 of Schedule B number 22.

a. Antenna Status	b. Make of Antenna	c. Type No. of Antenna
1. ☐ Existing 2. ☒ Proposed	See Satellite System Filing Part V	

d. Directions of Maximum Gain	e. Maximum Antenna Gain	f. Maximum Effective Radiated Power	g. Height of Antenna Tip Above Ground Level
See (b)	See (b) Decibels	See (b) Watts	Feet

h. Beam Width of Major Lobe of Antenna Pattern	i. Polarization *(Mark "X" One)*
Degrees	1. ☐ Vertical 2. ☐ Horizontal 3. ☒ Circular 4. ☐ Elliptical

j. Transmitters

(Same line numbers apply to same transmitters)

FCC Use Only Transmitter No.	*Line No.*	(1) Frequency ~~XXXXXX~~ (KHz)	(2) Class of Station (Enter Code)	(3) Emission Designators	(4) Transmitter Output Power (Watts)
	1	137.0-137.27	Space	27K00F9D	10 *
	2		Station		
	3				
	4	137.3-137.4	Space	90K00G9D	10
	5		Station		
	6				
	7	400.075-400.125	Space	40K00G9D	20
	8		Station		

Transmitters, continued * Per Channel

Line No.	(5) Points of Communication	(6) Azimuth of Radio Path (Degrees From True North)	(7) Length of Radio Path (Miles)
1	Contiguous United States		
2	Alaska		
3	Hawaii		
4	Puerto Rico		
5			
6			
7			
8			

FCC Use Only Antenna No.

33. Table MOB-2 ANTENNAS, RADIATION AND POINTS OF COMMUNICATION.

1. One Table MOB-2 is to be completed for each new or modified antenna system at each site, including the addition or modification of transmitters which will change power output from a transmitter, or effective radiated power or emissions.
2. Attach separate Table MOB-2 if authorization of more than one antenna system is requested.
3. Supplementary Explanations of Certain Items:

   d – Directions of Maximum Gain. The maximum number of directions to be shown is 4. Specify bearings of directions of maximum gain, in degrees from true north. If omnidirectional, specify "Omni."

   e – Maximum Antenna Gain. Maximum power gain over reference half-wave dipole, in decibels.

   h – Beam Width of Major Lobe of Antenna Pattern. Defined as the arc, in degrees, including only points on the polar diagram which are within 3 decibels (half power points) of the point of maximum gain. For omnidirectional antennas, the beam width is defined as 360 degrees.

   j(2) – Class of Station. Use the following codes:

BS – Base Station	TS – Test	SB – Subscriber Station
CT – Control Station	DI – Dispatch	RX – Relay Station
RP – Repeater	SI – Signaling	IO – Inter-Office
ST – Standby	CO – Central Office	

Table MOB-2

There are 22 Table MOB-2's with this Schedule B. This is Table MOB-2 number 5 of Schedule B number 22.

a. Antenna Status	b. Make of Antenna	c. Type No. of Antenna
1. ☐ Existing 2. ☒ Proposed	See Satellite System Filing Part V	

d. Directions of Maximum Gain	e. Maximum Antenna Gain	f. Maximum Effective Radiated Power	g. Height of Antenna Tip Above Ground Level
See (b)	See (b) Decibels	See (b) Watts	Feet

h. Beam Width of Major Lobe of Antenna Pattern	i. Polarization *(Mark "X" One)*
Degrees	1. ☐ Vertical 2. ☐ Horizontal 3. ☒ Circular 4. ☐ Elliptical

j. Transmitters
(Same line numbers apply to same transmitters)

FCC Use Only Transmitter No.	*Line No.*	(1) Frequency ~~XXXXX~~ (KHz)	(2) Class of Station (Enter Code)	(3) Emission Designators	(4) Transmitter Output Power (Watts)
	1	137.0-137.27	Space	27K00F9D	10 *
	2		Station		
	3				
	4	137.3-137.4	Space	90K00G9D	10
	5		Station		
	6				
	7	400.075-400.125	Space	40K00G9D	20
	8		Station		

Transmitters, continued * Per Channel

Line No.	(5) Points of Communication	(6) Azimuth of Radio Path (Degrees From True North)	(7) Length of Radio Path (Miles)
1	Contiguous United States		
2	Alaska		
3	Hawaii		
4	Puerto Rico		
5			
6			
7			
8			

FCC Use Only Antenna No.

33. Table MOB-2 ANTENNAS, RADIATION AND POINTS OF COMMUNICATION.

1. One Table MOB-2 is to be completed for each new or modified antenna system at each site, including the addition or modification of transmitters which will change power output from a transmitter, or effective radiated power or emissions.
2. Attach separate Table MOB-2 if authorization of more than one antenna system is requested.
3. Supplementary Explanations of Certain Items:

d – Directions of Maximum Gain. The maximum number of directions to be shown is 4. Specify bearings of directions of maximum gain, in degrees from true north. If omnidirectional, specify "Omni."

e – Maximum Antenna Gain. Maximum power gain over reference half-wave dipole, in decibels.

h – Beam Width of Major Lobe of Antenna Pattern. Defined as the arc, in degrees, including only points on the polar diagram which are within 3 decibels (half power points) of the point of maximum gain. For omnidirectional antennas, the beam width is defined as 360 degrees.

j(2) – Class of Station. Use the following codes:

BS – Base Station
CT – Control Station
RP – Repeater
ST – Standby
TS – Test
DI – Dispatch
SI – Signaling
CO – Central Office
SB – Subscriber Station
RX – Relay Station
IO – Inter-Office

Table MOB-2

There are 22 Table MOB-2's with this Schedule B. This is Table MOB-2 number 6 of Schedule B number 22.

a. Antenna Status	b. Make of Antenna	c. Type No. of Antenna
1. ☐ Existing 2. ☒ Proposed	See Satellite System Filing Part V	

d. Directions of Maximum Gain	e. Maximum Antenna Gain	f. Maximum Effective Radiated Power	g. Height of Antenna Tip Above Ground Level
See (b)	See (b) Decibels	See (b) Watts	Feet

h. Beam Width of Major Lobe of Antenna Pattern	i. Polarization (*Mark "X" One*)
Degrees	1. ☐ Vertical 2. ☐ Horizontal 3. ☒ Circular 4. ☐ Elliptical

j. Transmitters
(Same line numbers apply to same transmitters)

FCC Use Only Transmitter No.	*Line No.*	(1) Frequency ~~XXXXX~~ (KHz)	(2) Class of Station (Enter Code)	(3) Emission Designators	(4) Transmitter Output Power (Watts)
	1	137.0-137.27	Space	27K00F9D	10 *
	2		Station		
	3				
	4	137.3-137.4	Space	90K00G9D	10
	5		Station		
	6				
	7	400.075-400.125	Space	40K00G9D	20
	8		Station		

Transmitters, continued * Per Channel

Line No.	(5) Points of Communication	(6) Azimuth of Radio Path (Degrees From True North)	(7) Length of Radio Path (Miles)
1	Contiguous United States		
2	Alaska		
3	Hawaii		
4	Puerto Rico		
5			
6			
7			
8			

FCC Use Only
Antenna No.

33. Table MOB-2 ANTENNAS, RADIATION AND POINTS OF COMMUNICATION.

1. One Table MOB-2 is to be completed for each new or modified antenna system at each site, including the addition or modification of transmitters which will change power output from a transmitter, or effective radiated power or emissions.
2. Attach separate Table MOB-2 if authorization of more than one antenna system is requested.
3. Supplementary Explanations of Certain Items:

   d – Directions of Maximum Gain. The maximum number of directions to be shown is 4. Specify bearings of directions of maximum gain, in degrees from true north. If omnidirectional, specify "Omni."

   e – Maximum Antenna Gain. Maximum power gain over reference half-wave dipole, in decibels.

   h – Beam Width of Major Lobe of Antenna Pattern. Defined as the arc, in degrees, including only points on the polar diagram which are within 3 decibels (half power points) of the point of maximum gain. For omnidirectional antennas, the beam width is defined as 360 degrees.

   j(2) – Class of Station. Use the following codes:

BS – Base Station	TS – Test	SB – Subscriber Station
CT – Control Station	DI – Dispatch	RX – Relay Station
RP – Repeater	SI – Signaling	IO – Inter-Office
ST – Standby	CO – Central Office	

Table MOB-2

There are 22 Table MOB-2's with this Schedule B. This is Table MOB-2 number 7 of Schedule B number 22.

a. Antenna Status	b. Make of Antenna	c. Type No. of Antenna
1. ☐ Existing 2. ☒ Proposed	See Satellite System Filing Part V	

d. Directions of Maximum Gain	e. Maximum Antenna Gain	f. Maximum Effective Radiated Power	g. Height of Antenna Tip Above Ground Level
See (b)	See (b) Decibels	See (b) Watts	Feet

h. Beam Width of Major Lobe of Antenna Pattern	i. Polarization *(Mark "X" One)*
Degrees	1. ☐ Vertical 2. ☐ Horizontal 3. ☒ Circular 4. ☐ Elliptical

j. Transmitters
(Same line numbers apply to same transmitters)

FCC Use Only Transmitter No.	*Line No.*	(1) Frequency ~~XXXXX~~ (KHz)	(2) Class of Station (Enter Code)	(3) Emission Designators	(4) Transmitter Output Power (Watts)
	1	137.0-137.27	Space	27K00F9D	10 *
	2		Station		
	3				
	4	137.3-137.4	Space	90K00G9D	10
	5		Station		
	6				
	7	400.075-400.125	Space	40K00G9D	20
	8		Station		

Transmitters, continued * Per Channel

Line No.	(5) Points of Communication	(6) Azimuth of Radio Path (Degrees From True North)	(7) Length of Radio Path (Miles)
1	Contiguous United States		
2	Alaska		
3	Hawaii		
4	Puerto Rico		
5			
6			
7			
8			

FCC Use Only Antenna No.

33. Table MOB-2 ANTENNAS, RADIATION AND POINTS OF COMMUNICATION.

1. One Table MOB-2 is to be completed for each new or modified antenna system at each site, including the addition or modification of transmitters which will change power output from a transmitter, or effective radiated power or emissions.
2. Attach separate Table MOB-2 if authorization of more than one antenna system is requested.
3. Supplementary Explanations of Certain Items:

d – Directions of Maximum Gain. The maximum number of directions to be shown is 4. Specify bearings of directions of maximum gain, in degrees from true north. If omnidirectional, specify "Omni."

e – Maximum Antenna Gain. Maximum power gain over reference half-wave dipole, in decibels.

h – Beam Width of Major Lobe of Antenna Pattern. Defined as the arc, in degrees, including only points on the polar diagram which are within 3 decibels (half power points) of the point of maximum gain. For omnidirectional antennas, the beam width is defined as 360 degrees.

j(2) – Class of Station. Use the following codes:

BS – Base Station
CT – Control Station
RP – Repeater
ST – Standby
TS – Test
DI – Dispatch
SI – Signaling
CO – Central Office
SB – Subscriber Station
RX – Relay Station
IO – Inter-Office

Table MOB-2

There are 22 Table MOB-2's with this Schedule B. This is Table MOB-2 number 8 of Schedule B number 22.

a. Antenna Status	b. Make of Antenna	c. Type No. of Antenna
1. ☐ Existing 2. ☒ Proposed	See Satellite System Filing Part V	

d. Directions of Maximum Gain	e. Maximum Antenna Gain	f. Maximum Effective Radiated Power	g. Height of Antenna Tip Above Ground Level
See (b)	See (b) Decibels	See (b) Watts	Feet

h. Beam Width of Major Lobe of Antenna Pattern	i. Polarization (*Mark "X" One*)
Degrees	1. ☐ Vertical 2. ☐ Horizontal 3. ☒ Circular 4. ☐ Elliptical

j. Transmitters
(Same line numbers apply to same transmitters)

FCC Use Only Transmitter No.	*Line No.*	(1) Frequency ~~XXXXX~~ (KHz)	(2) Class of Station (Enter Code)	(3) Emission Designators	(4) Transmitter Output Power (Watts)
	1	137.0-137.27	Space	27K00F9D	10 *
	2		Station		
	3				
	4	137.3-137.4	Space	90K00G9D	10
	5		Station		
	6				
	7	400.075-400.125	Space	40K00G9D	20
	8		Station		

Transmitters, continued * Per Channel

Line No.	(5) Points of Communication	(6) Azimuth of Radio Path (Degrees From True North)	(7) Length of Radio Path (Miles)
1	Contiguous United States		
2	Alaska		
3	Hawaii		
4	Puerto Rico		
5			
6			
7			
8			

FCC Use Only
Antenna No.

33. Table MOB-2 ANTENNAS, RADIATION AND POINTS OF COMMUNICATION.

1. One Table MOB-2 is to be completed for each new or modified antenna system at each site, including the addition or modification of transmitters which will change power output from a transmitter, or effective radiated power or emissions.
2. Attach separate Table MOB-2 if authorization of more than one antenna system is requested.
3. Supplementary Explanations of Certain Items:
   - d – Directions of Maximum Gain. The maximum number of directions to be shown is 4. Specify bearings of directions of maximum gain, in degrees from true north. If omnidirectional, specify "Omni."
   - e – Maximum Antenna Gain. Maximum power gain over reference half-wave dipole, in decibels.
   - h – Beam Width of Major Lobe of Antenna Pattern. Defined as the arc, in degrees, including only points on the polar diagram which are within 3 decibels (half power points) of the point of maximum gain. For omnidirectional antennas, the beam width is defined as 360 degrees.
   - j(2) – Class of Station. Use the following codes:

BS – Base Station	TS – Test	SB – Subscriber Station
CT – Control Station	DI – Dispatch	RX – Relay Station
RP – Repeater	SI – Signaling	IO – Inter-Office
ST – Standby	CO – Central Office	

Table MOB-2

There are 22 Table MOB-2's with this Schedule B. This is Table MOB-2 number 9 of Schedule B number 22.

a. Antenna Status
1. ☐ Existing 2. ☒ Proposed

b. Make of Antenna
See Satellite System Filing Part V

c. Type No. of Antenna

d. Directions of Maximum Gain
See (b)

e. Maximum Antenna Gain
See (b) Decibels

f. Maximum Effective Radiated Power
See (b) Watts

g. Height of Antenna Tip Above Ground Level
Feet

h. Beam Width of Major Lobe of Antenna Pattern
Degrees

i. Polarization *(Mark "X" One)*
1. ☐ Vertical 2. ☐ Horizontal 3. ☒ Circular 4. ☐ Elliptical

j. Transmitters
(Same line numbers apply to same transmitters)

FCC Use Only Transmitter No.	*Line No.*	(1) Frequency ~~XXXXXX~~ (KHz)	(2) Class of Station (Enter Code)	(3) Emission Designators	(4) Transmitter Output Power (Watts)
	1	137.0-137.27	Space	27K00F9D	10 *
	2		Station		
	3				
	4	137.3-137.4	Space	90K00G9D	10
	5		Station		
	6				
	7	400.075-400.125	Space	40K00G9D	20
	8		Station		

Transmitters, continued * Per Channel

Line No.	(5) Points of Communication	(6) Azimuth of Radio Path (Degrees From True North)	(7) Length of Radio Path (Miles)
1	Contiguous United States		
2	Alaska		
3	Hawaii		
4	Puerto Rico		
5			
6			
7			
8			

FCC Use Only
Antenna No.

33. Table MOB-2 ANTENNAS, RADIATION AND POINTS OF COMMUNICATION.

1. One Table MOB-2 is to be completed for each new or modified antenna system at each site, including the addition or modification of transmitters which will change power output from a transmitter, or effective radiated power or emissions.
2. Attach separate Table MOB-2 if authorization of more than one antenna system is requested.
3. Supplementary Explanations of Certain Items:

d – Directions of Maximum Gain. The maximum number of directions to be shown is 4. Specify bearings of directions of maximum gain, in degrees from true north. If omnidirectional, specify "Omni."

e – Maximum Antenna Gain. Maximum power gain over reference half-wave dipole, in decibels.

h – Beam Width of Major Lobe of Antenna Pattern. Defined as the arc, in degrees, including only points on the polar diagram which are within 3 decibels (half power points) of the point of maximum gain. For omnidirectional antennas, the beam width is defined as 360 degrees.

j(2) – Class of Station. Use the following codes:

BS – Base Station
CT – Control Station
RP – Repeater
ST – Standby
TS – Test
DI – Dispatch
SI – Signaling
CO – Central Office
SB – Subscriber Station
RX – Relay Station
IO – Inter-Office

Table MOB-2

There are 22 Table MOB-2's with this Schedule B. This is Table MOB-2 number 10 of Schedule B number 22.

a. Antenna Status
1. ☐ Existing 2. ☒ Proposed

b. Make of Antenna
See Satellite System Filing Part V

c. Type No. of Antenna

d. Directions of Maximum Gain
See (b)

e. Maximum Antenna Gain
See (b) Decibels

f. Maximum Effective Radiated Power
See (b) Watts

g. Height of Antenna Tip Above Ground Level
Feet

h. Beam Width of Major Lobe of Antenna Pattern
Degrees

i. Polarization *(Mark "X" One)*
1. ☐ Vertical 2. ☐ Horizontal 3. ☒ Circular 4. ☐ Elliptical

j. Transmitters
(Same line numbers apply to same transmitters)

FCC Use Only Transmitter No.	*Line No.*	(1) Frequency ~~XMHz~~ (KHz)	(2) Class of Station (Enter Code)	(3) Emission Designators	(4) Transmitter Output Power (Watts)
	1	137.0-137.27	Space	27K00F9D	10 *
	2		Station		
	3				
	4	137.3-137.4	Space	90K00G9D	10
	5		Station		
	6				
	7	400.075-400.125	Space	40K00G9D	20
	8		Station		

Transmitters, continued * Per Channel

Line No.	(5) Points of Communication	(6) Azimuth of Radio Path (Degrees From True North)	(7) Length of Radio Path (Miles)
1	Contiguous United States		
2	Alaska		
3	Hawaii		
4	Puerto Rico		
5			
6			
7			
8			

FCC Use Only
Antenna No.

33. Table MOB-2 ANTENNAS, RADIATION AND POINTS OF COMMUNICATION.

1. One Table MOB-2 is to be completed for each new or modified antenna system at each site, including the addition or modification of transmitters which will change power output from a transmitter, or effective radiated power or emissions.
2. Attach separate Table MOB-2 if authorization of more than one antenna system is requested.
3. Supplementary Explanations of Certain Items:

d – Directions of Maximum Gain. The maximum number of directions to be shown is 4. Specify bearings of directions of maximum gain, in degrees from true north. If omnidirectional, specify "Omni."

e – Maximum Antenna Gain. Maximum power gain over reference half-wave dipole, in decibels.

h – Beam Width of Major Lobe of Antenna Pattern. Defined as the arc, in degrees, including only points on the polar diagram which are within 3 decibels (half power points) of the point of maximum gain. For omnidirectional antennas, the beam width is defined as 360 degrees.

j(2) – Class of Station. Use the following codes:

BS – Base Station	TS – Test	SB – Subscriber Station
CT – Control Station	DI – Dispatch	RX – Relay Station
RP – Repeater	SI – Signaling	IO – Inter-Office
ST – Standby	CO – Central Office	

Table MOB-2

There are 22 Table MOB-2's with this Schedule B. This is Table MOB-2 number 11 of Schedule B number 22.

a. Antenna Status	b. Make of Antenna	c. Type No. of Antenna
1. ☐ Existing 2. ☒ Proposed	See Satellite System Filing Part V	

d. Directions of Maximum Gain	e. Maximum Antenna Gain (Decibels)	f. Maximum Effective Radiated Power (Watts)	g. Height of Antenna Tip Above Ground Level (Feet)
See (b)	See (b)	See (b)	

h. Beam Width of Major Lobe of Antenna Pattern (Degrees)	i. Polarization (*Mark "X" One*)
	1. ☐ Vertical 2. ☐ Horizontal 3. ☒ Circular 4. ☐ Elliptical

j. Transmitters
(Same line numbers apply to same transmitters)

FCC Use Only Transmitter No.	*Line No.*	(1) Frequency ~~XXXXX~~ (KHz)	(2) Class of Station (Enter Code)	(3) Emission Designators	(4) Transmitter Output Power (Watts)
	1	137.0-137.27	Space	27K00F9D	10 *
	2		Station		
	3				
	4	137.3-137.4	Space	90K00G9D	10
	5		Station		
	6				
	7	400.075-400.125	Space	40K00G9D	20
	8		Station		

Transmitters, continued * Per Channel

Line No.	(5) Points of Communication	(6) Azimuth of Radio Path (Degrees From True North)	(7) Length of Radio Path (Miles)
1	Contiguous United States		
2	Alaska		
3	Hawaii		
4	Puerto Rico		
5			
6			
7			
8			

FCC Use Only
Antenna No.

33. Table MOB-2 ANTENNAS, RADIATION AND POINTS OF COMMUNICATION.

1. One Table MOB-2 is to be completed for each new or modified antenna system at each site, including the addition or modification of transmitters which will change power output from a transmitter, or effective radiated power or emissions.
2. Attach separate Table MOB-2 if authorization of more than one antenna system is requested.
3. Supplementary Explanations of Certain Items:

d – Directions of Maximum Gain. The maximum number of directions to be shown is 4. Specify bearings of directions of maximum gain, in degrees from true north. If omnidirectional, specify "Omni."

e – Maximum Antenna Gain. Maximum power gain over reference half-wave dipole, in decibels.

h – Beam Width of Major Lobe of Antenna Pattern. Defined as the arc, in degrees, including only points on the polar diagram which are within 3 decibels (half power points) of the point of maximum gain. For omnidirectional antennas, the beam width is defined as 360 degrees.

j(2) – Class of Station. Use the following codes:

BS – Base Station	TS – Test	SB – Subscriber Station
CT – Control Station	DI – Dispatch	RX – Relay Station
RP – Repeater	SI – Signaling	IO – Inter-Office
ST – Standby	CO – Central Office	

Table MOB-2

There are 22 Table MOB-2's with this Schedule B. This is Table MOB-2 number 12 of Schedule B number 22.

a. Antenna Status 1. ☐ Existing 2. ☒ Proposed	b. Make of Antenna See Satellite System Filing Part V	c. Type No. of Antenna

d. Directions of Maximum Gain See (b)	e. Maximum Antenna Gain See (b) Decibels	f. Maximum Effective Radiated Power See (b) Watts	g. Height of Antenna Tip Above Ground Level Feet

h. Beam Width of Major Lobe of Antenna Pattern Degrees	i. Polarization (*Mark "X" One*) 1. ☐ Vertical 2. ☐ Horizontal 3. ☒ Circular 4. ☐ Elliptical

j. Transmitters
(Same line numbers apply to same transmitters)

FCC Use Only Transmitter No.	*Line No.*	(1) Frequency ~~XXXXX~~ (KHz)	(2) Class of Station (Enter Code)	(3) Emission Designators	(4) Transmitter Output Power (Watts)
	1	137.0-137.27	Space	27K00F9D	10 *
	2		Station		
	3				
	4	137.3-137.4	Space	90K00G9D	10
	5		Station		
	6				
	7	400.075-400.125	Space	40K00G9D	20
	8		Station		

Transmitters, continued * Per Channel

Line No.	(5) Points of Communication	(6) Azimuth of Radio Path (Degrees From True North)	(7) Length of Radio Path (Miles)
1	Contiguous United States		
2	Alaska		
3	Hawaii		
4	Puerto Rico		
5			
6			
7			
8			

FCC Use Only
Antenna No.

33. Table MOB-2 ANTENNAS, RADIATION AND POINTS OF COMMUNICATION.

1. One Table MOB-2 is to be completed for each new or modified antenna system at each site, including the addition or modification of transmitters which will change power output from a transmitter, or effective radiated power or emissions.
2. Attach separate Table MOB-2 if authorization of more than one antenna system is requested.
3. Supplementary Explanations of Certain Items:

d – Directions of Maximum Gain. The maximum number of directions to be shown is 4. Specify bearings of directions of maximum gain, in degrees from true north. If omnidirectional, specify "Omni."

e – Maximum Antenna Gain. Maximum power gain over reference half-wave dipole, in decibels.

h – Beam Width of Major Lobe of Antenna Pattern. Defined as the arc, in degrees, including only points on the polar diagram which are within 3 decibels (half power points) of the point of maximum gain. For omnidirectional antennas, the beam width is defined as 360 degrees.

j(2) – Class of Station. Use the following codes:

BS – Base Station	TS – Test	SB – Subscriber Station
CT – Control Station	DI – Dispatch	RX – Relay Station
RP – Repeater	SI – Signaling	IO – Inter-Office
ST – Standby	CO – Central Office	

Table MOB-2

There are 22 Table MOB-2's with this Schedule B. This is Table MOB-2 number 13 of Schedule B number 22.

a. Antenna Status: 1. ☐ Existing 2. ☒ Proposed

b. Make of Antenna: See Satellite System Filing Part V

c. Type No. of Antenna:

d. Directions of Maximum Gain: See (b)

e. Maximum Antenna Gain: See (b) Decibels

f. Maximum Effective Radiated Power: See (b) Watts

g. Height of Antenna Tip Above Ground Level: Feet

h. Beam Width of Major Lobe of Antenna Pattern: Degrees

i. Polarization *(Mark "X" One)*: 1. ☐ Vertical 2. ☐ Horizontal 3. ☒ Circular 4. ☐ Elliptical

j. Transmitters
(Same line numbers apply to same transmitters)

FCC Use Only Transmitter No.	*Line No.*	(1) Frequency ~~XXXXX~~ (KHz)	(2) Class of Station (Enter Code)	(3) Emission Designators	(4) Transmitter Output Power (Watts)
	1	137.0-137.27	Space	27K00F9D	10 *
	2		Station		
	3				
	4	137.3-137.4	Space	90K00G9D	10
	5		Station		
	6				
	7	400.075-400.125	Space	40K00G9D	20
	8		Station		

Transmitters, continued * Per Channel

Line No.	(5) Points of Communication	(6) Azimuth of Radio Path (Degrees From True North)	(7) Length of Radio Path (Miles)
1	Contiguous United States		
2	Alaska		
3	Hawaii		
4	Puerto Rico		
5			
6			
7			
8			

FCC Use Only
Antenna No.

33. Table MOB-2 ANTENNAS, RADIATION AND POINTS OF COMMUNICATION.

1. One Table MOB-2 is to be completed for each new or modified antenna system at each site, including the addition or modification of transmitters which will change power output from a transmitter, or effective radiated power or emissions.
2. Attach separate Table MOB-2 if authorization of more than one antenna system is requested.
3. Supplementary Explanations of Certain Items:

d – Directions of Maximum Gain. The maximum number of directions to be shown is 4. Specify bearings of directions of maximum gain, in degrees from true north. If omnidirectional, specify "Omni."

e – Maximum Antenna Gain. Maximum power gain over reference half-wave dipole, in decibels.

h – Beam Width of Major Lobe of Antenna Pattern. Defined as the arc, in degrees, including only points on the polar diagram which are within 3 decibels (half power points) of the point of maximum gain. For omnidirectional antennas, the beam width is defined as 360 degrees.

j(2) – Class of Station. Use the following codes:

BS – Base Station	TS – Test	SB – Subscriber Station
CT – Control Station	DI – Dispatch	RX – Relay Station
RP – Repeater	SI – Signaling	IO – Inter-Office
ST – Standby	CO – Central Office	

Table MOB-2

There are 22 Table MOB-2's with this Schedule B. This is Table MOB-2 number 14 of Schedule B number 22.

a. Antenna Status	b. Make of Antenna	c. Type No. of Antenna
1. ☐ Existing 2. ☒ Proposed	See Satellite System Filing Part V	

d. Directions of Maximum Gain	e. Maximum Antenna Gain	f. Maximum Effective Radiated Power	g. Height of Antenna Tip Above Ground Level
See (b)	See (b) Decibels	See (b) Watts	Feet

h. Beam Width of Major Lobe of Antenna Pattern	i. Polarization *(Mark "X" One)*
Degrees	1. ☐ Vertical 2. ☐ Horizontal 3. ☒ Circular 4. ☐ Elliptical

j. Transmitters
(Same line numbers apply to same transmitters)

FCC Use Only Transmitter No.	*Line No.*	(1) Frequency ~~XXXXX~~ (KHz)	(2) Class of Station (Enter Code)	(3) Emission Designators	(4) Transmitter Output Power (Watts)
	1	137.0-137.27	Space	27K00F9D	10 *
	2		Station		
	3				
	4	137.3-137.4	Space	90K00G9D	10
	5		Station		
	6				
	7	400.075-400.125	Space	40K00G9D	20
	8		Station		

Transmitters, continued * Per Channel

Line No.	(5) Points of Communication	(6) Azimuth of Radio Path (Degrees From True North)	(7) Length of Radio Path (Miles)
1	Contiguous United States		
2	Alaska		
3	Hawaii		
4	Puerto Rico		
5			
6			
7			
8			

FCC Use Only
Antenna No.

33. Table MOB-2 ANTENNAS, RADIATION AND POINTS OF COMMUNICATION.

1. One Table MOB-2 is to be completed for each new or modified antenna system at each site, including the addition or modification of transmitters which will change power output from a transmitter, or effective radiated power or emissions.
2. Attach separate Table MOB-2 if authorization of more than one antenna system is requested.
3. Supplementary Explanations of Certain Items:

d – Directions of Maximum Gain. The maximum number of directions to be shown is 4. Specify bearings of directions of maximum gain, in degrees from true north. If omnidirectional, specify "Omni."

e – Maximum Antenna Gain. Maximum power gain over reference half-wave dipole, in decibels.

h – Beam Width of Major Lobe of Antenna Pattern. Defined as the arc, in degrees, including only points on the polar diagram which are within 3 decibels (half power points) of the point of maximum gain. For omnidirectional antennas, the beam width is defined as 360 degrees.

j(2) – Class of Station. Use the following codes:

BS – Base Station	TS – Test	SB – Subscriber Station
CT – Control Station	DI – Dispatch	RX – Relay Station
RP – Repeater	SI – Signaling	IO – Inter-Office
ST – Standby	CO – Central Office	

Table MOB-2

There are 22 Table MOB-2's with this Schedule B. This is Table MOB-2 number 15 of Schedule B number 22.

a. Antenna Status	b. Make of Antenna	c. Type No. of Antenna
1. ☐ Existing 2. ☒ Proposed	See Satellite System Filing Part V	

d. Directions of Maximum Gain	e. Maximum Antenna Gain	f. Maximum Effective Radiated Power	g. Height of Antenna Tip Above Ground Level
See (b)	See (b) Decibels	See (b) Watts	Feet

h. Beam Width of Major Lobe of Antenna Pattern	i. Polarization *(Mark "X" One)*
Degrees	1. ☐ Vertical 2. ☐ Horizontal 3. ☒ Circular 4. ☐ Elliptical

j. Transmitters
(Same line numbers apply to same transmitters)

FCC Use Only Transmitter No.	*Line No.*	(1) Frequency ~~XXXXXX~~ (KHz)	(2) Class of Station (Enter Code)	(3) Emission Designators	(4) Transmitter Output Power (Watts)
	1	137.0-137.27	Space	27K00F9D	10 *
	2		Station		
	3				
	4	137.3-137.4	Space	90K00G9D	10
	5		Station		
	6				
	7	400.075-400.125	Space	40K00G9D	20
	8		Station		

Transmitters, continued * Per Channel

Line No.	(5) Points of Communication	(6) Azimuth of Radio Path (Degrees From True North)	(7) Length of Radio Path (Miles)
1	Contiguous United States		
2	Alaska		
3	Hawaii		
4	Puerto Rico		
5			
6			
7			
8			

FCC Use Only Antenna No.

33. Table MOB-2 ANTENNAS, RADIATION AND POINTS OF COMMUNICATION.

1. One Table MOB-2 is to be completed for each new or modified antenna system at each site, including the addition or modification of transmitters which will change power output from a transmitter, or effective radiated power or emissions.
2. Attach separate Table MOB-2 if authorization of more than one antenna system is requested.
3. Supplementary Explanations of Certain Items:

d – Directions of Maximum Gain. The maximum number of directions to be shown is 4. Specify bearings of directions of maximum gain, in degrees from true north. If omnidirectional, specify "Omni."

e – Maximum Antenna Gain. Maximum power gain over reference half-wave dipole, in decibels.

h – Beam Width of Major Lobe of Antenna Pattern. Defined as the arc, in degrees, including only points on the polar diagram which are within 3 decibels (half power points) of the point of maximum gain. For omnidirectional antennas, the beam width is defined as 360 degrees.

j(2) – Class of Station. Use the following codes:

BS – Base Station
CT – Control Station
RP – Repeater
ST – Standby
TS – Test
DI – Dispatch
SI – Signaling
CO – Central Office
SB – Subscriber Station
RX – Relay Station
IO – Inter-Office

Table MOB-2

There are 22 Table MOB-2's with this Schedule B. This is Table MOB-2 number 16 of Schedule B number 22.

a. Antenna Status	b. Make of Antenna	c. Type No. of Antenna
1. ☐ Existing 2. ☒ Proposed	See Satellite System Filing Part V	

d. Directions of Maximum Gain	e. Maximum Antenna Gain (Decibels)	f. Maximum Effective Radiated Power (Watts)	g. Height of Antenna Tip Above Ground Level (Feet)
See (b)	See (b)	See (b)	

h. Beam Width of Major Lobe of Antenna Pattern (Degrees)	i. Polarization *(Mark "X" One)*
	1. ☐ Vertical 2. ☐ Horizontal 3. ☒ Circular 4. ☐ Elliptical

j. Transmitters
(Same line numbers apply to same transmitters)

FCC Use Only Transmitter No.	*Line No.*	(1) Frequency ~~XXXXX~~ (KHz)	(2) Class of Station (Enter Code)	(3) Emission Designators	(4) Transmitter Output Power (Watts)
	1	137.0-137.27	Space	27K00F9D	10 *
	2		Station		
	3				
	4	137.3-137.4	Space	90K00G9D	10
	5		Station		
	6				
	7	400.075-400.125	Space	40K00G9D	20
	8		Station		

Transmitters, continued * Per Channel

Line No.	(5) Points of Communication	(6) Azimuth of Radio Path (Degrees From True North)	(7) Length of Radio Path (Miles)
1	Contiguous United States		
2	Alaska		
3	Hawaii		
4	Puerto Rico		
5			
6			
7			
8			

FCC Use Only
Antenna No.

33. Table MOB-2 ANTENNAS, RADIATION AND POINTS OF COMMUNICATION.

1. One Table MOB-2 is to be completed for each new or modified antenna system at each site, including the addition or modification of transmitters which will change power output from a transmitter, or effective radiated power or emissions.
2. Attach separate Table MOB-2 if authorization of more than one antenna system is requested.
3. Supplementary Explanations of Certain Items:

d – Directions of Maximum Gain. The maximum number of directions to be shown is 4. Specify bearings of directions of maximum gain, in degrees from true north. If omnidirectional, specify "Omni."

e – Maximum Antenna Gain. Maximum power gain over reference half-wave dipole, in decibels.

h – Beam Width of Major Lobe of Antenna Pattern. Defined as the arc, in degrees, including only points on the polar diagram which are within 3 decibels (half power points) of the point of maximum gain. For omnidirectional antennas, the beam width is defined as 360 degrees.

j(2) – Class of Station. Use the following codes:

BS – Base Station	TS – Test	SB – Subscriber Station
CT – Control Station	DI – Dispatch	RX – Relay Station
RP – Repeater	SI – Signaling	IO – Inter-Office
ST – Standby	CO – Central Office	

Table MOB-2

There are 22 Table MOB-2's with this Schedule B. This is Table MOB-2 number 17 of Schedule B number 22.

a. Antenna Status
1. ☐ Existing 2. ☒ Proposed

b. Make of Antenna
See Satellite System Filing Part V

c. Type No. of Antenna

d. Directions of Maximum Gain
See (b)

e. Maximum Antenna Gain
See (b) Decibels

f. Maximum Effective Radiated Power
See (b) Watts

g. Height of Antenna Tip Above Ground Level
Feet

h. Beam Width of Major Lobe of Antenna Pattern
Degrees

i. Polarization *(Mark "X" One)*
1. ☐ Vertical 2. ☐ Horizontal 3. ☒ Circular 4. ☐ Elliptical

j. Transmitters
(Same line numbers apply to same transmitters)

FCC Use Only Transmitter No.	*Line No.*	(1) Frequency ~~XXXXX~~ (KHz)	(2) Class of Station (Enter Code)	(3) Emission Designators	(4) Transmitter Output Power (Watts)
	1	137.0-137.27	Space	27K00F9D	10 *
	2		Station		
	3				
	4	137.3-137.4	Space	90K00G9D	10
	5		Station		
	6				
	7	400.075-400.125	Space	40K00G9D	20
	8		Station		

Transmitters, continued * Per Channel

Line No.	(5) Points of Communication	(6) Azimuth of Radio Path (Degrees From True North)	(7) Length of Radio Path (Miles)
1	Contiguous United States		
2	Alaska		
3	Hawaii		
4	Puerto Rico		
5			
6			
7			
8			

FCC Use Only
Antenna No.

33. Table MOB-2 ANTENNAS, RADIATION AND POINTS OF COMMUNICATION.

1. One Table MOB-2 is to be completed for each new or modified antenna system at each site, including the addition or modification of transmitters which will change power output from a transmitter, or effective radiated power or emissions.
2. Attach separate Table MOB-2 if authorization of more than one antenna system is requested.
3. Supplementary Explanations of Certain Items:

d – Directions of Maximum Gain. The maximum number of directions to be shown is 4. Specify bearings of directions of maximum gain, in degrees from true north. If omnidirectional, specify "Omni."

e – Maximum Antenna Gain. Maximum power gain over reference half-wave dipole, in decibels.

h – Beam Width of Major Lobe of Antenna Pattern. Defined as the arc, in degrees, including only points on the polar diagram which are within 3 decibels (half power points) of the point of maximum gain. For omnidirectional antennas, the beam width is defined as 360 degrees.

j(2) – Class of Station. Use the following codes:

BS – Base Station	TS – Test	SB – Subscriber Station
CT – Control Station	DI – Dispatch	RX – Relay Station
RP – Repeater	SI – Signaling	IO – Inter-Office
ST – Standby	CO – Central Office	

Table MOB-2

There are 22 Table MOB-2's with this Schedule B. This is Table MOB-2 number 18 of Schedule B number 22.

a. Antenna Status 1. ☐ Existing 2. ☒ Proposed

b. Make of Antenna: See Satellite System Filing Part V

c. Type No. of Antenna

d. Directions of Maximum Gain: See (b)

e. Maximum Antenna Gain: See (b) Decibels

f. Maximum Effective Radiated Power: See (b) Watts

g. Height of Antenna Tip Above Ground Level: Feet

h. Beam Width of Major Lobe of Antenna Pattern: Degrees

i. Polarization *(Mark "X" One)* 1. ☐ Vertical 2. ☐ Horizontal 3. ☒ Circular 4. ☐ Elliptical

j. Transmitters
(Same line numbers apply to same transmitters)

FCC Use Only Transmitter No.	*Line No.*	(1) Frequency ~~XXXXX~~ (KHz)	(2) Class of Station (Enter Code)	(3) Emission Designators	(4) Transmitter Output Power (Watts)
	1	137.0-137.27	Space	27K00F9D	10 *
	2		Station		
	3				
	4	137.3-137.4	Space	90K00G9D	10
	5		Station		
	6				
	7	400.075-400.125	Space	40K00G9D	20
	8		Station		

Transmitters, continued * Per Channel

Line No.	(5) Points of Communication	(6) Azimuth of Radio Path (Degrees From True North)	(7) Length of Radio Path (Miles)
1	Contiguous United States		
2	Alaska		
3	Hawaii		
4	Puerto Rico		
5			
6			
7			
8			

FCC Use Only
Antenna No.

33. Table MOB-2 ANTENNAS, RADIATION AND POINTS OF COMMUNICATION.

1. One Table MOB-2 is to be completed for each new or modified antenna system at each site, including the addition or modification of transmitters which will change power output from a transmitter, or effective radiated power or emissions.
2. Attach separate Table MOB-2 if authorization of more than one antenna system is requested.
3. Supplementary Explanations of Certain Items:

   d – Directions of Maximum Gain. The maximum number of directions to be shown is 4. Specify bearings of directions of maximum gain, in degrees from true north. If omnidirectional, specify "Omni."

   e – Maximum Antenna Gain. Maximum power gain over reference half-wave dipole, in decibels.

   h – Beam Width of Major Lobe of Antenna Pattern. Defined as the arc, in degrees, including only points on the polar diagram which are within 3 decibels (half power points) of the point of maximum gain. For omnidirectional antennas, the beam width is defined as 360 degrees.

   j(2) – Class of Station. Use the following codes:

   BS – Base Station
   CT – Control Station
   RP – Repeater
   ST – Standby
   TS – Test
   DI – Dispatch
   SI – Signaling
   CO – Central Office
   SB – Subscriber Station
   RX – Relay Station
   IO – Inter-Office

Table MOB-2

There are 22 Table MOB-2's with this Schedule B. This is Table MOB-2 number 19 of Schedule B number 22.

a. Antenna Status
1. ☐ Existing 2. ☒ Proposed

b. Make of Antenna
See Satellite System Filing Part V

c. Type No. of Antenna

d. Directions of Maximum Gain
See (b)

e. Maximum Antenna Gain
See (b) Decibels

f. Maximum Effective Radiated Power
See (b) Watts

g. Height of Antenna Tip Above Ground Level
Feet

h. Beam Width of Major Lobe of Antenna Pattern
Degrees

i. Polarization *(Mark "X" One)*
1. ☐ Vertical 2. ☐ Horizontal 3. ☒ Circular 4. ☐ Elliptical

j. Transmitters
(Same line numbers apply to same transmitters)

FCC Use Only Transmitter No.	*Line No.*	(1) Frequency ~~XXXXX~~ (KHz)	(2) Class of Station (Enter Code)	(3) Emission Designators	(4) Transmitter Output Power (Watts)
	1	137.0-137.27	Space	27K00F9D	10 *
	2		Station		
	3				
	4	137.3-137.4	Space	90K00G9D	10
	5		Station		
	6				
	7	400.075-400.125	Space	40K00G9D	20
	8		Station		

Transmitters, continued * Per Channel

Line No.	(5) Points of Communication	(6) Azimuth of Radio Path (Degrees From True North)	(7) Length of Radio Path (Miles)
1	Contiguous United States		
2	Alaska		
3	Hawaii		
4	Puerto Rico		
5			
6			
7			
8			

FCC Use Only
Antenna No.

33. Table MOB-2 ANTENNAS, RADIATION AND POINTS OF COMMUNICATION.

1. One Table MOB-2 is to be completed for each new or modified antenna system at each site, including the addition or modification of transmitters which will change power output from a transmitter, or effective radiated power or emissions.
2. Attach separate Table MOB-2 if authorization of more than one antenna system is requested.
3. Supplementary Explanations of Certain Items:

d – Directions of Maximum Gain. The maximum number of directions to be shown is 4. Specify bearings of directions of maximum gain, in degrees from true north. If omnidirectional, specify "Omni."

e – Maximum Antenna Gain. Maximum power gain over reference half-wave dipole, in decibels.

h – Beam Width of Major Lobe of Antenna Pattern. Defined as the arc, in degrees, including only points on the polar diagram which are within 3 decibels (half power points) of the point of maximum gain. For omnidirectional antennas, the beam width is defined as 360 degrees.

j(2) – Class of Station. Use the following codes:

BS – Base Station	TS – Test	SB – Subscriber Station
CT – Control Station	DI – Dispatch	RX – Relay Station
RP – Repeater	SI – Signaling	IO – Inter-Office
ST – Standby	CO – Central Office	

Table MOB-2

There are 22 Table MOB-2's with this Schedule B. This is Table MOB-2 number 20 of Schedule B number 22.

a. Antenna Status	b. Make of Antenna	c. Type No. of Antenna
1. ☐ Existing 2. ☒ Proposed	See Satellite System Filing Part V	

d. Directions of Maximum Gain	e. Maximum Antenna Gain (Decibels)	f. Maximum Effective Radiated Power (Watts)	g. Height of Antenna Tip Above Ground Level (Feet)
See (b)	See (b)	See (b)	

h. Beam Width of Major Lobe of Antenna Pattern (Degrees)	i. Polarization *(Mark "X" One)*
	1. ☐ Vertical 2. ☐ Horizontal 3. ☒ Circular 4. ☐ Elliptical

j. Transmitters
(Same line numbers apply to same transmitters)

FCC Use Only Transmitter No.	*Line No.*	(1) Frequency ~~XXXXX~~ (KHz)	(2) Class of Station (Enter Code)	(3) Emission Designators	(4) Transmitter Output Power (Watts)
	1	137.0-137.27	Space	27K00F9D	10 *
	2		Station		
	3				
	4	137.3-137.4	Space	90K00G9D	10
	5		Station		
	6				
	7	400.075-400.125	Space	40K00G9D	20
	8		Station		

Transmitters, continued * Per Channel

Line No.	(5) Points of Communication	(6) Azimuth of Radio Path (Degrees From True North)	(7) Length of Radio Path (Miles)
1	Contiguous United States		
2	Alaska		
3	Hawaii		
4	Puerto Rico		
5			
6			
7			
8			

FCC Use Only Antenna No.

33. Table MOB-2 ANTENNAS, RADIATION AND POINTS OF COMMUNICATION.

1. One Table MOB-2 is to be completed for each new or modified antenna system at each site, including the addition or modification of transmitters which will change power output from a transmitter, or effective radiated power or emissions.
2. Attach separate Table MOB-2 if authorization of more than one antenna system is requested.
3. Supplementary Explanations of Certain Items:

d – Directions of Maximum Gain. The maximum number of directions to be shown is 4. Specify bearings of directions of maximum gain, in degrees from true north. If omnidirectional, specify "Omni."

e – Maximum Antenna Gain. Maximum power gain over reference half-wave dipole, in decibels.

h – Beam Width of Major Lobe of Antenna Pattern. Defined as the arc, in degrees, including only points on the polar diagram which are within 3 decibels (half power points) of the point of maximum gain. For omnidirectional antennas, the beam width is defined as 360 degrees.

j(2) – Class of Station. Use the following codes:

BS – Base Station	TS – Test	SB – Subscriber Station
CT – Control Station	DI – Dispatch	RX – Relay Station
RP – Repeater	SI – Signaling	IO – Inter-Office
ST – Standby	CO – Central Office	

Table MOB-2

There are 22 Table MOB-2's with this Schedule B. This is Table MOB-2 number 21 of Schedule B number 22.

a. Antenna Status: 1. ☐ Existing 2. ☒ Proposed

b. Make of Antenna: See Satellite System Filing Part V

c. Type No. of Antenna:

d. Directions of Maximum Gain: See (b)

e. Maximum Antenna Gain: See (b) Decibels

f. Maximum Effective Radiated Power: See (b) Watts

g. Height of Antenna Tip Above Ground Level: Feet

h. Beam Width of Major Lobe of Antenna Pattern: Degrees

i. Polarization (*Mark "X" One*): 1. ☐ Vertical 2. ☐ Horizontal 3. ☒ Circular 4. ☐ Elliptical

j. Transmitters
(Same line numbers apply to same transmitters)

FCC Use Only Transmitter No.	*Line No.*	(1) Frequency ~~XXXXX~~ (KHz)	(2) Class of Station (Enter Code)	(3) Emission Designators	(4) Transmitter Output Power (Watts)
	1	137.0-137.27	Space	27K00F9D	10 *
	2		Station		
	3				
	4	137.3-137.4	Space	90K00G9D	10
	5		Station		
	6				
	7	400.075-400.125	Space	40K00G9D	20
	8		Station		

Transmitters, continued * Per Channel

Line No.	(5) Points of Communication	(6) Azimuth of Radio Path (Degrees From True North)	(7) Length of Radio Path (Miles)
1	Contiguous United States		
2	Alaska		
3	Hawaii		
4	Puerto Rico		
5			
6			
7			
8			

FCC Use Only
Antenna No.

33. Table MOB-2 ANTENNAS, RADIATION AND POINTS OF COMMUNICATION.

1. One Table MOB-2 is to be completed for each new or modified antenna system at each site, including the addition or modification of transmitters which will change power output from a transmitter, or effective radiated power or emissions.
2. Attach separate Table MOB-2 if authorization of more than one antenna system is requested.
3. Supplementary Explanations of Certain Items:

d – Directions of Maximum Gain. The maximum number of directions to be shown is 4. Specify bearings of directions of maximum gain, in degrees from true north. If omnidirectional, specify "Omni."

e – Maximum Antenna Gain. Maximum power gain over reference half-wave dipole, in decibels.

h – Beam Width of Major Lobe of Antenna Pattern. Defined as the arc, in degrees, including only points on the polar diagram which are within 3 decibels (half power points) of the point of maximum gain. For omnidirectional antennas, the beam width is defined as 360 degrees.

j(2) – Class of Station. Use the following codes:

BS – Base Station	TS – Test	SB – Subscriber Station
CT – Control Station	DI – Dispatch	RX – Relay Station
RP – Repeater	SI – Signaling	IO – Inter-Office
ST – Standby	CO – Central Office	

Table MOB-2

There are 22 Table MOB-2's with this Schedule B. This is Table MOB-2 number 22 of Schedule B number 22.

a. Antenna Status 1. ☐ Existing 2. ☒ Proposed	b. Make of Antenna See Satellite System Filing Part V	c. Type No. of Antenna

d. Directions of Maximum Gain See (b)	e. Maximum Antenna Gain See (b) Decibels	f. Maximum Effective Radiated Power See (b) Watts	g. Height of Antenna Tip Above Ground Level Feet

h. Beam Width of Major Lobe of Antenna Pattern Degrees	i. Polarization *(Mark "X" One)* 1. ☐ Vertical 2. ☐ Horizontal 3. ☒ Circular 4. ☐ Elliptical

j. Transmitters
(Same line numbers apply to same transmitters)

FCC Use Only Transmitter No.	*Line No.*	(1) Frequency ~~XXXXX~~ (KHz)	(2) Class of Station (Enter Code)	(3) Emission Designators	(4) Transmitter Output Power (Watts)
	1	137.0-137.27	Space	27K00F9D	10 *
	2		Station		
	3				
	4	137.3-137.4	Space	90K00G9D	10
	5		Station		
	6				
	7	400.075-400.125	Space	40K00G9D	20
	8		Station		

Transmitters, continued * Per Channel

Line No.	(5) Points of Communication	(6) Azimuth of Radio Path (Degrees From True North)	(7) Length of Radio Path (Miles)
1	Contiguous United States		
2	Alaska		
3	Hawaii		
4	Puerto Rico		
5			
6			
7			
8			

Applicant's Name	FCC Use Only:
ORBITAL COMMUNICATIONS CORPORATION	File No.

34. Has the applicant obtained reasonable assurance that it can use the proposed site?

☐ Yes ☐ No N/A

35. Antenna Structure Statement

(a) Status of Structure *(Mark "X" One)*

1. ☒ New Structure
2. ☐ Existing Structure, Height Not Increased
3. ☐ Existing Structure, Height Increased

(b) Overall Heights of Antenna Structure (Feet) *(Heights should include obstruction light, if required, and any other surmounting appurtenance.)*

Above Ground Level		Site Elevation		Above Mean Sea Level
______	+	N/A	=	______

(c) Will proposed transmitting antenna be supported by the antenna structure of any other radio station?

☐ Yes XX No If "YES," give Call Sign: ______

(d) Distance from transmitting antenna structure to nearest runway of nearest aircraft landing area (Miles):

N/A

(e) Is the antenna mounted on an existing structure or building which currently bears lighting and markings prescribed by FCC Rules Part 17?

☐ Yes XX No If "YES," give FCC Antenna Tower No. or FAA Aeronautical Study No. if known: ______

(f) Has FAA been notified?

☐ Yes XX No If "YES," answer items (f)1-3.

1. Date Filed *(Month-Day-Year)*
2. Name Under Which Filed
3. Regional Office Where Filed *(City, State)*

(g) Aeronautical Hazards. List any natural formation or existing man-made structure (hills, trees, water tanks, tower, etc.) that applicant believes would tend to shield the antenna structure from aircraft and thereby minimize the aeronautical hazard of the antenna structure.

36. **Vertical Profile Sketch of Antenna Structure.** In the space below draw a vertical profile sketch.
DO NOT attach a separate Exhibit. Use *only* the space provided below.

37. Table MOB-3 HEIGHT AND POWER ENGINEERING DATA

1. One Table MOB-3 must be completed for each antenna. DO NOT SUBSTITUTE A SEPARATE EXHIBIT FOR THIS TABLE.
2. All distances specified in feet in this Table are to be rounded to the nearest whole number.
3. Supplementary engineering information may be included in an Exhibit ______.

Table MOB-3

There are 1 Table MOB-3's with this Schedule B. This is Table MOB-3 number 1 of Schedule B number 1.

List here the frequencies which have identical Column (c) and Column (d) values.	(a) Radial Bearing (Degrees From True North)	(b) Average Elevation Along Radial (2–10 mi.) Above Mean Sea Level (Feet)	(c) Height of Antenna Radiation Center Above Average Elevation of Radial (2–10 mi.) (Feet)	(d) Effective Radiated Power in Radial Direction (Watts)	(e) Distance to Reliable Service Area Contour (Miles)
1.	0°				
2.	45°				
3.	90°	N/A			
4.	135°				
5.	180°				
6.	225°				
7.	270°				
8.	315°				
	*				
	*				
	*				
	(f) Average Terrain Elevation (Feet)		(g) Antenna Radiation Center Height Above Average Terrain (Feet)		

*Show radials and associated data in direction of each co-channel station as prescribed by Rule Section 22.115(a). If more space is needed for additional radials, attach as Exhibit ______.

(h) If the values in Table MOB-3, column (b) above have been computer generated, identify the file (data base) used to obtain the values:

(i) Is antenna omnidirectional and mounted at the top of the antenna structure? ☐ Yes ☒ No
If "NO," attach as Exhibit ______ a directional antenna pattern (polar diagram) showing power distribution (expressed in decibels of power gain over a reference half-wave dipole antenna) of signal radiated in the horizonal plane, as well as any engineering drawings required by Section 22.15(j)(4) of FCC Rules and Regulations.

(j) Are there any co-channel facilities within the mileage standards specified in Section 22.15(b)(1) of FCC Rules and Regulations? ☐ Yes ☒ No
If "YES," attach as Exhibit ______ interference studies required by Rule Section 22.15(b)(2).

38. Table MOB-4 LOCATIONS OF FIXED ANTENNAS REGULARLY RECEIVING SIGNALS OF THE STATION
(All frequencies associated with each fixed antenna are to be grouped together. List each location once.)

(a) Location *(City or Town, County and State)*	(b) Latitude *(Deg-Min-Sec)*	(c) Longitude *(Deg-Min-Sec)*	(d) Call Sign	(e) Frequency *(MHz)*
To Be Determined				

NEED FOR EXPEDITED TREATMENT

A unique opportunity to launch the proposed space segment as a secondary payload on the first launch of OSC's Pegasus™ air-launched space booster recently became available. It should be noted that the Pegasus space booster could significantly alter the future structure of commercial space communications by dramatically reducing the initial investment required to launch a major payload into a useful orbit. The first Pegasus launch is currently scheduled for 22 August 1989. Because a launch opportunity as a secondary payload on Pegasus may not be available for at least another 18 months after the first Pegasus launch, OSC requests that the evaluation of this request for experimental/developmental operating authority be conducted as expeditiously as possible.

As set forth more fully below, OSC plans several important technical as well as operational experiments using the system and technology proposed herein. OSC will report to the Commission periodically on the results of these trials. Through these experiments, OSC hopes to demonstrate the feasibility and utility of small, inexpensive low-earth orbiting satellites. These satellites and related technology may reduce entry barriers to the satellite-based communications industry, and lower costs for end users.

Finally, OSC believes that, because the system that it proposes relies on low-cost technology and a space segment with a life span shorter than that of conventional satellites, a grant of the experimental authorization requested herein is particularly appropriate and consistent with Commission policy.

INTRODUCTION TO THE DATASAT™ PROGRAM

OSC, in cooperation with the Commonwealth of Virginia's Center for Innovative Technology ("CIT"), plans to initiate an experimental satellite-based data collection and relay program ("DataSat"). DataSat will determine the technical, operational, and economic feasibility of employing a small, inexpensive, low-earth orbiting satellite to collect environmental and other data from a number of widely disbursed remote stations.

Environmental information collected by these remote stations, such as the salinity, dissolved oxygen or contamination levels of the Chesapeake Bay, will be stored and then transmitted to the satellite in short-bursts at very low data rates using an ordered access polling sequence controlled by the satellite. The satellite will receive, store and then forward the data collected to a master control hub station for distribution to researchers for analysis.

Environmental data collected in the DataSat program is expected to offer several advantages over traditional data collection methods. In addition to lower costs, the increased temporal and spacial resolution of data collected from the DataSat program may enable researchers to determine the causes of and the solutions to the deteriorating conditions of America's marine environments.

A successful demonstration of the utility of inexpensive satellites in low-earth orbit may also have a significant impact on the future of the satellite communications industry. By reducing the initial capital investment required to create a satellite-based communications business, a variety of firms may be able to enter the communications industry and offer new, innovative, low-cost communications services to a broad spectrum of consumers.

Because the DataSat satellite will be capable of receiving random access transmissions broadcast in an Aloha format, a search and rescue service that is not restricted to marine and aviation emergencies also is proposed.

INTRODUCTION TO ORBITAL SCIENCES CORPORATION

OSC was formed in 1982 to develop and operate space transportation systems and to engage in other space-related businesses in commercial and government markets. Over the past seven years, OSC has developed several major advanced transportation products including the Transfer Orbit Stage® (TOS®) orbit transfer vehicle and the Pegasus air-launched space booster that are now being produced for customers such as the National Aeronautics and Space Administration ("NASA") and the Department of Defense ("DoD"). In addition, in late 1988 OSC acquired Space Data Corporation, a leading developer and manufacturer of suborbital rockets, launch facilities, space payloads, and associated electronics and data systems for customers such as the U.S. Air Force, Army, Navy, NASA, National Oceanic and Atmospheric Administration and the Strategic Defense Initiative Office.

Experience - OSC's experience includes systems engineering and program management for the TOS vehicle, the largest commercial space project ever carried out apart from traditional communications satellites. The company also conceived and designed Pegasus, the first all-new space booster to be introduced in the United States in over 20 years. Since its founding in 1963, Space Data's launch vehicle experience has included design, manufacturing and launch of over 600 large single- and multi-stage suborbital boosters. Space Data has also produced and launched up to 1,000 meteorological sounding rockets each year and has installed and activated launch facilities at 12 sites around the world. The company has developed, integrated and flown two major Space Shuttle payloads and has designed and built numerous major reentry vehicle experiments. In addition, it has assembled and installed over 60 large satellite, rocket and balloon tracking and telemetry stations in 10 countries.

Facilities - OSC is headquartered in Fairfax, Virginia near Washington, D.C.; its fully-integrated hardware design, fabrication, assembly and test facilities at Space Data are located in Tempe, Arizona, a suburb of Phoenix; and other operations offices are maintained in Houston, Texas; Denver, Colorado; Los Angeles, Mohave and Lompoc, California; and Northfield, Minnesota. These facilities encompass over 150,000 square feet of office, laboratory, manufacturing and assembly/test space and house computers, tooling, test equipment, support equipment and inventory. Groundbreaking on a new 250,000 square feet manufacturing, integration and test facility in Arizona was initiated on 6 March 1989.

Personnel - OSC has over 400 employees, of which approximately 225 are graduate engineers experienced in systems engineering, guidance and control, aerodynamics propulsion, electronics and software, communications systems, structures and mechanisms, thermal control and related space disciplines. The company has over 125 technicians and manufacturing workers trained to the highest NASA and DoD space hardware assembly standards.

Financial Status - OSC had revenues of approximately $60 million and year-end backlog of over $150 million for 1988, and projects about 50% growth in both during 1989. OSC was the second fastest-growing private company in America, according to Inc. magazine's 1988 listing of the top 500 high-growth domestic corporations.

INTRODUCTION TO THE CENTER FOR INNOVATIVE TECHNOLOGY

Since its inception in 1984, CIT has actively supported space business and technology development. CIT has joined with industry in support of more than fifteen projects in space-related research valued at approximately $1 million at the University of Virginia,

Virginia Polytechnic Institute and State University, and The College of William and Mary. These projects range from improving satellite communications to developing special space materials.

Headquartered near Dulles International Airport, CIT invests in high-quality industrially relevant research at state colleges and universities, assists in commercializing that research, and aids in the creation and support of technology companies throughout the state.

The space industry has become a focus for the leadership of Virginia because of its importance as an educational, economic, and symbolic tool. Through CIT, Virginia is making $500,000 available for commercial space research and development in joint university-industry projects.

DataSat Program Objectives - The DataSat program is designed to fit into the overall strategy of CIT to develop technology infrastructure, improve university-industry technology transfer, and foster the development of new technological commercial products and processes which result in economic well-being.

Specifically, CIT has several objectives for participating in the DataSat program:

1. Demonstrate the utility of small satellites to provide useful services to the Commonwealth of Virginia in the area of environmental monitoring.

2. Encourage development of commercial communications and space launch services.

3. Provide a tangible asset to the university community for research, development, and education that has direct application to the private sector.

4. Provide a mechanism for private industry to conduct applied research in commercial space projects.

5. Demonstrate Virginia is in a leadership position in developing the potential of commercial space activities.

POTENTIAL ADVANTAGES OF LOW-EARTH ORBITING SATELLITE SYSTEMS

The advent of the Pegasus air-launched space booster could significantly alter the future structure of the commercial satellite communications industry. Capable of placing between 600 and 900 pounds into omni-inclination low-earth orbits for the low cost of approximately $6 million, the Pegasus vehicle has dramatically reduced the initial investment required to launch a significant payload into a useful orbit. Pegasus may be the enabling technology that permits non-traditional communications organizations to develop and launch a new class of small satellites that create a variety of innovative, low-cost communications and earth observation services.

In addition to lower launch costs, communications systems based on small, inexpensive, low-earth orbiting satellites may offer several other advantages over traditional large, geosynchronous satellite systems:

Space Segment Advantages

Such small satellites are:

- o Designed to lower significantly the capital investment required (satellite production costs are a fraction of geosynchronous systems, insurance is available at marginal rates)
- o Developed with less complicated technology and therefore inherently more reliable

- Replaced quickly and inexpensively in the event of launch or on-orbit failure
- Modified easily to compensate for changes in technology or market conditions
- Uniquely capable of providing operational service to high latitude and polar areas

Ground Segment Advantages

Ground segments associated with small satellites are:

- Produced for significantly lower cost
- Operated with lower power requirements (interference minimized and frequency reuse possible)
- Transported easily (facilitates rapid response to changing economic conditions or consumer needs)

PROPOSED DATASAT PROGRAM

OSC, acting as the licensee as well as the systems engineering and program management organization, proposes to design, develop, produce, integrate, launch and operate an experimental space-based data collection and relay system capable of monitoring environmental conditions and collecting other data from remote locations. The DataSat program will be funded by OSC with significant financial support provided by CIT. CIT will contribute $250,000 toward the construction of the satellite and will also co-sponsor with OSC up to an additional $250,000 of research and development activities at Virginia universities and government-sponsored environmental research organizations. This research and development will be directed toward remote data collection station and low-cost radio frequency component technology. The cost for the entire DataSat system is estimated to be approximately $1.1 million.

The DataSat satellite is currently scheduled for launch on 22 August 1989 into a 592 kilometers polar orbit as a secondary payload on the first Pegasus mission. The satellite is designed for a minimum operating lifetime of one year, although it is anticipated that the satellite will be functional for approximately three years. The DataSat program will be funded and experiments are planned for the duration of the satellite's operating life.

DATASAT RESEARCH OBJECTIVES

Technical Experiments

Several important technical experiments are planned for the initial phases of the DataSat program. Efficient operating protocols are critical to the success of the low-earth orbiting satellite method of collecting widely distributed data. The only manner to verify the design of an operating protocol, demonstrate its reliability and reduce the cost of remote ground stations will be through experiments using a fully operational system.

Several space-to-ground protocols for activating and interrogating the remote stations will be investigated including the technique of time sequenced polling along "iso-doppler" lines of position. To OSC's knowledge, the technique of iso-doppler polling has never yet been demonstrated in practice. Several mixes of such ordered access polling and Aloha ground-to-space protocols will be tested to determine the optimum protocol structure that ensures that all remote stations are activated and have the opportunity to transmit data.

Additional communications experiments will be conducted such as determining the parameters that influence the acquisition and loss of signal to and from the low-power remote stations.

Low VHF frequencies are known to be absorbed less by foliage and man-made structures then are the microwave frequencies typically used by traditional communications satellites. Specific experiments to test the relative blockage of satellite signals by intervening structures at low VHF are proposed. Also, the elevation and azimuth of remote station antennas relative to local topography and the satellite's ground track may be important for evaluating the potential performance of widely dispersed collection stations within a specific geographic area.

Operating the DataSat system using low-frequency transmitters during the upcoming period of solar maximum should also provide insight into the propagation losses experienced during periods of intense solar radiation. During periods near solar maximum, the ionospheric maximum usable frequency is often above the frequencies proposed for the uplink and downlink to the remote terminals. When this condition prevails, the performance of the system is likely to be effected in several ways:

- Propagation of signals to and from the satellite may exceed line-of-sight conditions, increasing the satellite's effective range.

- Line-of-sight signals to and from the satellite will be more severely attenuated.

- Additional phase noise and multipath dispersive effects are likely to be introduced on the signals to and from the satellite.

Frequencies in this region of the radio spectrum have seldom been used by spacecraft, particularly in conjunction with phase modulation techniques. DataSat will investigate and report on these phenomena.

Operational Experiments

Primary Objective -- The DataSat program will attempt to validate the concept of employing a low-earth orbiting satellite as an effective, low-cost approach to obtaining valuable environmental data.

Specifically, the initial purpose of the DataSat program is to obtain environmental information about the Chesapeake Bay and its watershed through the use of a space-based data collection and relay system. By dispersing data-relay buoys throughout Virginia's rivers, bays and estuaries, important information about the salinity, temperature, dissolved oxygen and contamination levels of the Chesapeake Bay can be monitored and evaluated. The increased spatial and temporal resolution obtained from a space-based data collection system will provide a unique insight into the processes contributing to the complex ecology of the Chesapeake Bay. Once processed, this information may be useful in determining the causes of and solutions to the changes in marine conditions which have such a significant impact on Virginia's fishing, sporting and recreational economies.

DataSat will complement and augment current methods for obtaining information about the condition of the Chesapeake Bay. However, because it can provide continuous coverage of a larger number of sampling stations dispersed over a wider geographic area than existing data collection systems, investigators will experience a substantial increase in the amount of data collected. They will also now be able to measure the effects that intermittent and transient factors such as the tides, rainfall and illegal disposal of waste products have on the Chesapeake Bay's environment.

DataSat will attempt to demonstrate that low-earth orbiting satellites are valuable to researchers by providing a substantial reduction in the cost of obtaining data. With abundant sampling data available at low cost, an opportunity is available for widespread testing and analysis of the growing threats to the environment.

Secondary Objectives -- Other potential applications of the DataSat program will evaluated, such as:

- Search and Rescue (i.e. Locating individuals lost or injured while hiking and camping in remote wilderness areas.)

- Polar Messaging and Data Collection (i.e. Providing individuals or research stations in the Arctic or Antarctica with a means to send and receive high-priority messages and information.)

- Remote Data Collection (i.e. Measuring rainfall, humidity and temperature over a wide geographic area to aid in harvest and other forecasts.)

- Hazardous Cargo Monitoring (i.e. Determining the disposition of solid, chemical or other industrial waste dumped into oceans or landfills.)

- Stolen Property Notification (i.e. Providing alarm to individuals or law enforcement agencies that a valuable asset such as automobile or boat is being stolen.)

Economic Experiments

Many of the possible applications of inexpensive, low-earth orbiting satellites will be alternatives to existing terrestrial-based services. As a means of verifying the potential usefulness of a DataSat service and to estimate the elasticity of demand for such applications, OSC proposes to collect revenues for some services offered to potential users on a limited basis.

Without the opportunity to compare the actual costs and benefits of using DataSat technology with existing data collection services, potential users of low-earth orbiting satellites will not be able to make a valid evaluation of the relative worth of this new service.

DATASAT SYSTEM ARCHITECTURE

The DataSat system is comprised of three primary components: a small, low-earth orbiting satellite, a master control hub located in Fairfax, Virginia, and a number of widely disbursed remote data collection stations.

Space Segment

The DataSat space segment will consist of a small (approximately 35 pounds) satellite placed into a 592 kilometers polar earth-orbit as a secondary payload on the first launch of the Pegasus space booster in August 1989. The satellite's function is to broadcast a time-sequenced coded signal, which activates and interrogates the remote data collection stations, and then to receive, store and forward the data transmitted from these stations to the master control hub station. The satellite will be designed for a minimum of one year of on-orbit life and will have the following characteristics:

- Receivers:
  - Five Channels in the 35.010 MHz to 39.000 MHz Band
  - FSK demodulation at 1200 bps
  - System G/T consistent with .25W to 1.0W uplink transmitter power from remote stations

- CPU/Mass Storage:

  - 80 NC 186 CPU
  - 4-8 MB Mass Memory
  - Processor capable of processing 4 simultaneous uplink channels
  - All spacecraft software written in C

- Transmitters:

  <u>42.010 MHz (Satellite to Remote Stations)</u>

  - 10W power output
  - 4800 bps maximum data rate
  - Modulation format: FSK
  - Single transmitter design

  <u>423.500 MHz (Satellite to Central Control Hub Station)</u>

  - 4W power output
  - 38400 bps maximum data rate
  - Modulation format: FSK

- Power Subsystem:

  - 20W orbit average power using convention Si solar cells
  - 14V, 6A-H NiCd batteries
  - Battery charge regulation provided by single unit controlled by CPU.

Ground Segment

The initial DataSat ground segment will consist of approximately 100 remote data collection stations (marine buoys) deployed throughout the Chesapeake Bay watershed in Virginia and a central control hub station located in Fairfax, Virginia.

The buoys will be capable of long-duration exposure to the marine environment and be outfitted with miniaturized recording devices and an radio frequency transmitter to uplink the data obtained from scientific instruments integrated with the buoys.

The scientific instruments on the buoys will collect data at pre-determined periodic sample rates and then store the information. The remote stations' transmitters will remain dormant until activated and polled by the DataSat satellite passing overhead. Data will be uplinked at very low rates and then be stored by the satellite. The transmitters will be approximately 10 cubic inches in volume, have omni directional antennas, be battery powered with 100 milliwatts of peak output, and transmit in a short burst using modified x.25 packets. Short-term oscillator stability is estimated to be 200 Hz. Long-term bias will be measured and corrected over multiple passes of the satellite.

The satellite stores and then relays the uplinked data to the master control hub station where the information is formatted and presented to the principal investigators. The purpose of the master control hub station is to provide telemetry, tracking, and command to the satellite. The satellite's software can be reconfigured, if necessary, using protected commanding from the master control hub station.

The master control hub station will be located adjacent to OSC's corporate headquarters in Fairfax, Virginia.

Central Control Hub Station Description

- Receiver
  - Antenna Gain: 15-17 dBiC
  - Frequency: 423.500 MHz
  - System Noise Temperature: Approximately 200K
  - System G/T: Greater than or equal to -7.0 dB/k
  - 9.6 kbps to 56 kbps receiver/demodulator
  - Downlink packets are data and telemetry

- Transmitters
  - Antenna Gain: 2 dBiC (Omni)
  - Frequency: 35.010 Mhz to 42.010 MHz
  - Transmitter power: 1000W
  - Uplink data rate: 1200 bps
  - Modulation format: FSK

CONCLUSION

OSC believes that the technology and uses proposed for its experimental DataSat system could directly benefit the public by demonstrating the technical and economic advantages of a spectrum efficient, low-earth orbit system that is capable of collecting widely distributed data. The opportunity now exists for launch of the proposed space segment on the first launch of the Pegasus air-launched space booster, currently scheduled for 22 August 1989. As demonstrated above, another launch opportunity on Pegasus, the use of which itself reduces system costs, many not be available for at least another 18 months after the initial launch. OSC therefore asks that the Commission consider its application for experimental/developmental authorization with as much speed as is reasonably feasible, understanding the Commission's extensive caseload and limited resources.